Less Stress, Happiness, Cognitive Success: An investigation into sedative music and its ability to increase our attention within cognitive tasks

Evan Murphy
X12115681

Submitted in partial fulfilment of the requirements of the BA (Hons) in Psychology at National College of Ireland, Dublin.

Supervisor: Dr. Rebecca Maguire

March 2015

Department of Psychology
National College of Ireland

Table of Contents

Acknowledgements

I would like to sincerely thank my supervisor Dr Rebecca Maguire for her time and expertise in helping guide me through my research project. I would also like to thank Nigel Vahey for his time and for helping me understand how to use the experimental software used within the study. Additionally I would like to thank all my past and current lectures for their support and help throughout these past 3years. Furthermore a huge thanks to all the participants who took part and who gave up their spare time to help out with a project I thoroughly enjoyed doing.

1. Abstract

This research investigated the effects of sedative music on physiological stress, positive and negative affect and how by positively altering such variables it could influence the attention of the individual within a stressful test. 30 undergraduate participants (40% women, 60% men; mean age of 23.2) were all firstly measured for resting pulse rate and temperature through lab software equipment. Furthermore their baseline measures of positive and negative affect were recorded by the use of the PANAS scale. Afterward, they listened to either sedative, stimulative or no music for 2 minutes prior to and during the Stroop test. The physiological and affective measures were again assessed through the same methods both prior and post Stroop test. These measures were compared within each condition. Lower physiological stress was identified within the sedative condition compared to the stimulative and control conditions. Likewise the sedative condition help better maintain the affective score of individuals compared to the stimulative and control conditions. In addition to these findings no significant impact was found for the conditions impact on Stoop performance of individual's. These findings can suggest a benefit of sedative music for individuals who experience stress during cognitive task however no casual effect can be made for its impact on subsequent performances within the task.

Keywords: music, attention and reaction times, positive affect, negative affect, pulse rate and skin temperature

Submission of Thesis and Dissertation

National College of Ireland

Research Students Declaration Form

(Thesis/Author Declaration Form)

Name: Evan Murphy

Student Number: X12115681

Degree for which thesis is submitted: BA (Hons) Psychology

Material submitted for award

(a) I declare that the work has been composed by myself.

(b) I declare that all verbatim extracts contained in the thesis have been distinguished by quotation marks and the sources of information specifically acknowledged.

(c) My thesis will be included in electronic format in the College Institutional Repository TRAP (thesis reports and projects)

(d) ***Either*** *I declare that no material contained in the thesis has been used in any other submission for an academic award.

Or *I declare that the following material contained in the thesis formed part of a submission for the award of

Level 8 honours psychology degree. Awarding body National College of Ireland.

I declare that the work has been composed by myself .

I declare that all verbatim extracts contained in the thesis have been distinguished by quotation marks and the sources of information specifically acknowledged.

My thesis will be included in electronic format in the College Institutional Repository TRAP (thesis reports and projects)

I declare that no material contained in the thesis has been used in any other submission for an academic award. _____

(State the award and the awarding body and list the material below)

Signature of research student: *Evan Murphy* _____

Date: 29/03/2015

2. Introduction

"Music gives a soul to the universe, wings to the mind, flight to the imagination and life to everything." — Plato

The above quote gives a powerful impression of the role music can have within an individual's life. Equally, recent studies have identified music as ubiquitous within all human cultures, and how various types of music can induce emotions such as relaxation, happiness, fear and even produce feelings conflicting with each other (Honing et al., 2015). Examining music further it can be seen how vast amounts of people utilise music within their lives to help regulate their mood and arousal (Chanda & Levitin, 2013). Likewise music can be identified as being pivotal in many skilled workers and professional's lives and as to how they can use music to improve concentration, attention and motivation (Chanda & Levitin, 2013).

For the above reasons an emergent body of literature has surfaced in seeking answers to how particular types of music affects these individual responses e.g. in terms of physiological (Davis & Thaut, 1989), psychological (Radocy and Boyle, 1998), behavioural (Hallam and Price, 1998), emotional (Juslin and Sloboda, 2001) and cognitive (Blood & Zatorre, 2001) processes. Additionally the style of music can be pivotal in altering the aforementioned processes.

Musical characteristics such as tempo and mode are inherent properties of the structure of music. These characteristics are important, as it has been shown that they can influence individuals affect, physiology and behaviours (Kämpfe, Sedlmeier, & Renkewitz, 2010). When examining the styles of music it can be seen that sedative music would be slow, soft and contain little rhythmic activity while stimulative music is characterized by its fast tempos, loud volume, and larger rhythmic pattern (Jiang et al., 2013). However when delving further into Kämpfe et al., (2010) meta-analysis a null effect of the effects of background music on the individual's behaviour, cognition, physiology and mood was observed. However with more stringent examinations of the studies

reviewed it allowed for the calculation of the effect sizes, which revealed that such a null effect could be due to averaging out particular effects. The studies therefore indicated that background music intrudes on reading processes, has some small harmful effects on memory, but can positively impact on emotional reactions and improves achievement in sports. Likewise the Kuribayashi, & Nittono (2014) findings can suggest from their comparisons of various types of background music that the tempo of the music can impact the tempo of activities that are being performed when exposed to the background music. Therefore it is quite apparent that the current literature on the effects of music is in need of more specific theories about the role and the impact background music can have on aforementioned areas of the individual's life. Likewise such inconclusive findings have further increased clinician's and researcher's curiosities for the ability of using music as a psychological tool for altering individual's arousal, affect and cognition (Chanda & Levitin, 2013).

In the present investigation, the effects of sedative and stimulative music were examined and how they altered (a) the physiology of the individual (b) the listener's affect, and (c) the individual's cognitive performance within stressful tasks. Answering such questions can be significant due to the role music can have within therapeutic settings in elevating anxiety and positively affecting individuals physiology (Tabrizi et al., 2014). Furthermore the use of music can be significant for educational purposes due to its ability in enhancing cognitive abilities (Chobert et al., 2014). This has led the current research to further investigate the power of music and its effect on the above areas while trying to improve on previous methods used.

2.1. Music and Physiology

Various studies evaluate how different music genres have differing effects for reducing stress and have commonly established that any individual's heart rate (HR), respiration and blood pressure usually increased more in response to stimulative music that aroused feelings of tension than to

sedative music that can be seen to calm individuals (Kämpfe et al., 2010). Equally the type of music can be significant in altering the physiology of an individual, due to the music's ability to accelerate the individuals breathing rates as well as, its ability to increase blood pressure and heart rate which can be proportional to the tempo and possibly to the rhythms complexities (Bernardi, Porta, & Sleight, 2006; Larsen & Galletly, 2006). Likewise stimulative music could be seen to increase the breathing rates of the individuals and that in turn could negatively alter the individuals stress levels (Bernardi, Porta, & Sleight, 2006). Moreover Bernardi et al.'s (2006) study would further suggest that the pauses in relaxing music and the subsequent ability to dictate the individuals breathing and in turn relax them would be more significant to reduction of stress compared to the music style or a person's music preference.

Additionally it can be further intimated that the relaxing music may positively affect the physiology of the individual and that in turn affects the individual's affective states. According to Knight and Rickard (2001) relaxing music can supress levels of subjective anxiety, systolic blood pressure, and heart rate which in turn affect's our mood positively. Consequently Gerra et al. (1998) examined the impact techno music could have on several physiological variables and deduced that listening to stimulative music such as techno music would result in significant rises in heart rate, blood pressure, as well as a number of rises in endocrine parameters affecting the individuals mood negatively. Likewise findings on individuals who listened to relaxing music and individuals who sat in silence produced results of increased relaxation compared to individuals who listened to stimulative music (Hasegawa, Uozumi, & Ono, 2003; Iwanaga, Kobayashi, & Kawasaki, 2005; Lingham & Theorell, 2009; Sandstrom & Russo, 2010 as cited in Jiang et al., 2013). Furthermore when choosing a particular style of relaxing music to calm an individual it must be chosen carefully. Lloret et al., (2014) exemplified this by their results indicating how individuals would react differently when listening to different styles of relaxing music. Their results suggested that new age music was the most significant style of music for the

reduction of autonomic responses when compared to classical and romantic music. Intriguingly, the personal feelings and the preferences concerning the style of music had no effect on autonomic responses.

2.2. Music and Affect

The research on the effects of sedative music can suggest that by positively altering an individual's physiology it can increase the positive affect of the individual. However many positive affective states, for example, elation will represent states of arousal, with affiliated increases in cardiovascular activity, particularly the heart rate and blood pressure (Dockray & Steptoe, 2010). Further research would also suggest that fast tempo and major mode are significantly linked with happiness, whereas slow tempo and minor mode are linked with sadness (Ladinig & Schellenberg, 2012). Equally the tempo of the music can be a vital characteristic in the understanding of the modulating effect music has on an individual's affect (Van Der Zwaag, Westerink, & Van Den Broek, 2011).

The valence–arousal model, would suggest that a higher tempo is associated with the energetic arousal dimension (Gabrielsson & Lindström, 2010), while the slow tempos would be associated with low-arousal sad music. Furthermore the fast tempos can be seen to be associated with high-arousal happy music (Van Der Zwaag, Westerink, & Van Den Broek, 2011). Such findings could imply that a song that was stimualtive would be better suited than a sedative song to increase the positive affect within the individual. This makes it quite difficult when trying to interpret the type of music's influence on the physiological changes and how they influence affective states especially when viewing how a similar affective state, like an individual's gratification with their life, can coincide with reductions in cardiovascular reactivity (Dockray & Steptoe, 2010).

Consequently Jiang et al., (2013) further questioned if sedative music was best suited within all individuals to alter affective states and to reduce stress. Their findings demonstrated that the

effects of sedative and stimulative music on stress reduction depended on the individual's preference for the piece of music being played. Equally studies that involved individuals which allowed them to self-select their music prior to stressors also produced significantly reduced cardiovascular responses within the stressful environments (Allen and Blascovich, 1994; Smolen, Topp, & Singer, 2002). Such findings could relate to the self-selected music having a greater impact on the individual's mood (Jeong, 2008 as cited in Jiang et al., 2013), and this in turn could have enhanced the individual's positive affect while in turn protecting against negative cardiovascular responses that can occur if the chosen stimulus produced dislikeable emotions (Fredrickson and Levenson 1998; Fredrickson et al. 2000; Fredrickson, 2001).

The aforementioned findings could suggest that if stimualtive music was favourably perceived by the individual it may in turn negate the negative physiological outcomes accompanying the fast loud music. It could be therefore argued that if either form of music produced positive emotions they could negate the negative physiological outcomes. It could be further argued that for such changes to alter an individual's mood in relation to the style of music being listened to, that it must always transpire in an interaction amongst the listener, the music, and the environment the person finds themselves in (Gabrielsson, 2001; Hargreaves, MacDonald, & Miell, 2005; Juslin & Laukka, 2004). Therefore such reactions that occur due to the music can never be anticipated from the properties of the music alone. That is, different listeners who listen to musical pieces will react differently when presented with the same piece of music, while also reacting diversely in different situations

2.3. *Music and Cognition*

In addition when further examining the properties of stimualtive and sedative music it can be identified how particular styles can influence the cognitive ability of individuals. Subsequently such effects of listening to music on our cognition can be explained by the "arousal-mood hypothesis" (Thompson, Schellenberg, & Husain, 2001). The arousal-mood hypothesis states that the subsequent performance within a cognitive task would coincide with alterations within the individual's arousal and mood affected by the style of music (Hunter and Schellenberg, 2010). Gabrielsson and Lindström (2010) suggest that the listener's arousal and mood would be seemingly determined by the tempo (fast vs. slow) as well as the mode (major vs. minor) contained within each music type. Fast tempo and major mode music tend to increase cognitive performance. Slow tempo and minor mode music would inhibit cognitive ability through their effects on the individual's arousal and mood (e.g., Husain et al., 2002; Hunter and Schellenberg, 2010). Equally effects of the music on our arousal and mood can be further identified by changes in skin conductance, heart rate, finger pulse amplitude, breathing rate, and other measures (Davis & Thaut, 1989; Krumhansl, 1997). However Hallam, Price, & Katsarou (2002) would argue that sedative music would produce better performances within cognitive tasks, compared to music that was perceived as arousing, aggressive and unpleasant which disturbed the performances. Although like the Hunter and Schellenberg (2010) findings, Hallam et al.'s (2002) results highlighted the effects that listening to music can have on task performance and are seemingly mediated by our arousal and mood rather than affecting cognition directly.

When examining further research it can be suggested that some stimulative styles of music can cause negative effects on human performances within various cognitive tasks when the music is fast and loud (Thompson, Schellenberg, & Letnic, 2011). This can relate to the process of listening to music while consuming more of listener's fixed attentional resources when it encompasses a significant number of auditory events per unit time, which can be challenging for the individual to block out due to its intensity (Thompson, Schellenberg, & Letnic, 2011). Such negative

findings could be explained by the "cognitive-capacity hypothesis" (Kahneman, 1973) in which individuals only have a limited pool of resources that are available for cognitive processing during any moment (Baddeley, 2003). Contrastingly, the slow-tempo music can allow for a constant and instinctive recovery within the calming musical interference, comparable to the negative effects attributed with the fast music due to its distracting effects on our cognitive processing (Thompson, Schellenberg, & Letnic, 2011).

However in acknowledging the negative interfering qualities of fast loud music it should be noted within the earlier literature that some abrasive music may be processed differently within different individuals. This could possibly relate to the individual habituating to the particular noisy environment (Basner et al., 2014). Furthermore it can be seen within research that individuals will be significantly affected by the familiarity of the piece of music (Van Den Bosch, Salimpoor, & Zatorre, 2013). Subsequently Miell, MacDonald and Hargreaves (2005) would state that to fully understand the power music has we must analyse the type of music and its interaction between the listener and analyse the context within which the task is taking place.

2.4. Stroop Test

After examining the properties of listening to music and how it can alter an individual's mood, arousal and cognition, the present study set out to investigate if a form of sedative music could influence the aforementioned areas within a stressful task such as the Stroop task to increase performance. When examining further, the impacts of listening to either style of music, and what impact they can have on an individual that is placed in an already stressful environment, it can be identified how their arousal levels can be either heightened or lowered by the music type as discussed earlier. Based on the classic psychological arousal–performance relationship (Yerkes & Dodson, 1908), performance will be greatest when the performer experiences a moderate level of arousal.

Looking at the Stroop test further it can be seen to be quite significant in relation to the matters of attention and perception in cognitive psychology (MacLeod 1992). Examining J. Ridley Stroop (1935) original experiment used within the current study it is seen how it tests the individual's ability for naming the colour of a word within two conditions known as congruent and incongruent conditions. Within the congruent condition the colour and written word will match, contrastingly in the incongruent condition the colour will not match the written word (Stroop 1935/1992). In this classic study it will take longer for the participant to respond if the colour is not matching the written word as individuals inherently read words faster than they will recognize a colour known as the Stroop effect (Lamers, Roelofs, & Rabeling-Keus, 2010). This has led the Stroop test being used in significantly large amounts of experimental research for testing why individual's attention and reaction times are inferior when placed in incongruent conditions (MacLeod, 1991). Therefore many researchers have used the Stroop test as a significant tool within cognitive psychology when investigating an individual's attention and perception with several theories surfacing to explain the Stroop effect (MacLeod 1992).

Further literature on the Stroop test would also suggest its usage as a research tool for understanding changes in our physiology (Brown et al., 2002). The value to our physiology can be seen in the manner of how more stressful cognitive tasks seemingly induce changes in cardiovascular responses reflecting a greater sympathetic activity, with decreased parasympathetic activity (Kalat, 2008). These changes would correlate with cardiovascular responses such as a rise in pulse rate (Pase et al., 2013). What can also be observed are the positive correlations between higher pulse rate and levels of physical stress (Kulkarni , O'Farrell , Erasi , & Kochar MS., 1998). The research seemingly proposes that lowering levels of physical stress could hypothetically decrease the difficulty of the person's ability to process the cognitive task, thus enhancing the performance within the stressful task. Consequently it can be suggested that within a stressful cognitive task such as the Stroop test stimulative music may negatively impact

on the individual arousal levels while a more relaxing form of music may reduce the arousal to optimal levels (Lilley, Oberle, & Thompson, 2014).

This argues for the use of a form of sedative music as opposed to stimualtive music for increasing an individual's attention and thus their score within the Stroop test. Further studies however would argue that a form of stimualtive classical music would be better suited with regard to increasing an individual's affect and in turn positively affecting the individual's cognitive ability. The stimulative music could induce a change within an individual's perception possibly heightening the attraction towards the current learning environment (Hardré, Crowson, DeBacker, & White, 2007; Nijhuis, Segers, & Gijselaers, 2008 as cited in Dosseville, Laborde, & Scelles, 2012). Likewise when examining findings from Dosseville et al., (2012) on how classical music could be used for maintaining positive affect, within learning environments such as lectures, for the purposes of increasing the cognitive performance, it was found that the stimualtive music helped support the positive affect of individuals during stressful tasks compared to individuals who experienced no music. Maintaining PA within the Stroop test can be vital as literature on an individual's attention capacity has identified our mood as being crucial in the manner of the role it can play in our daily functioning. Additionally research would highlight that our positive affect can be theorized as having the ability to expand our attention thus leading to greater flexible cognition (Biss & Hasher, 2011). Furthermore literature within Biss & Hasher (2011) would suggest that such changes within the individual's attention could enhance the priming abilities of the individual and make it easier for the individual to ignore irrelevant information within their environment.

Such positive findings within Dosseville et al., (2012) study could be therefore significant to the Stroop test as it requires the individual to focus on trying to name the colour that a word is printed in, furthermore what also is apparent is how it takes longer if the word is also a color word, but a different colour usually explained by response competition (Lien& Proctor, 2002). Response

Competition occurs when a response to both the colour and the word are formed, but the individual is only able to make one response in the time period. Likewise the response to the word can be seen to be quicker than the individual's response in regard to the colour, and in turn interferes with the attempt of the individual to name the colour. The quicker reaction to the word can be a sign of automaticity, this occurs when some responses within attention tests like the Stroop test are processed automatically side tracking our conscious processing (Marmurek, 2003).

When examining further relaxing techniques, it can be seen how higher performances within cognitive tasks that included categorization, complex decision making and creative problem solving occurred after manipulations that induced positive moods compared to manipulations that were neutral with respect to mood (Isen & Daubman, 1984; Isen, Niedenthal, & Cantor, 1992; Khan & Isen, 1993). Therefore it could be suggested that there are great merits in using stimualtive music to achieve greater performances within the Stroop test due to the findings of the Dosseville, Laborde, & Scelles (2012) study. However within their study they failed to use any other sound condition within their design, such as slow relaxing music. Furthermore within their study it showed a change in affect before and after the lecture, however both the PA and NA did not significantly predict the individual's test scores suggesting the findings were not due to the change in affect induced by music during the lecture.

It can be therefore speculated that if a more calm intervention was used it may have significantly enhanced the individual's affect as well maintaining optimal arousal levels and in turn increasing the test scores. Such a claim could be supported in relation to arguments made earlier within the literature, that when music is fast and loud it can be quite distracting for the individual partaking within the cognitive task (Thompson, Schellenberg, & Letnic, 2011). Using sedative music can in all probability reduce anxiety within the stressful test and could be vital in enhancing the individuals affect within the stressful environments. While by the same token the comprehension and recall would be greater when listening to the sedative music rather than the fast-tempo music

which in contrast could distract the individual within the task (Cassidy & MacDonald, 2007; Furnham & Strbac, 2002).

Furthermore it can be seen that various cognitive tasks such as reading comprehension, free recall, mental arithmetic, and verbal reasoning tasks can be improved when individuals listened to calmer music compared to upbeat music (Thompson, Schellenberg, & Letnic, 2011). Additionally it can be seen from (Gerra et al., 1998) that forms of stimulative music can negatively affect an individual's mood. Relatedly if the music produced NA and combined with elevated arousal it can be suggested to generate rigid thoughts that can direct the individual's attentional focus away from peripheral information and onto the central cues (Rowe, Hirsh, & Anderson, 2007).

When further analysing similar relaxation techniques in comparison to relaxing music it can be identified how such techniques can positively enhance the self- regulation of the individual (Tang et al., 2010). It could be further speculated therefore that the relaxing music could better help the individual regulate their processing of the perceived negative information and hopefully process the negative information within the Stroop test more effectively with the intervention of relaxing music, because of this form of music's ability to relax a person (Allen et al., 2001) and because of the common traits it shares with meditation and other forms of relaxation techniques (Maratos et al., 2010).

Although it seems clear that sedative music can be significant at increasing the attention of an individual within a stressful task, further investigations would highlight other factors such as musical preferences, as mentioned earlier and how they could negate the influence of a selected form of relaxing music with regard to reducing anxiety and the enhancement of performances within the Stroop test. Furthermore Recours, Aussaguel, & Trujillo (2009) results would further support such claims, as they highlighted individual differences in preferences as having a mediating effect on an individual's levels of anxiety. Likewise when examining Chen et al.,

(2013) results it can be seen how the power of any music considered pleasant can be pivotal for increasing visual attention compared with music that was considered unpleasant and white noise, participants assessed their moods as being more positive and their arousal as higher when listening to the pleasant music.

2.5. Purpose of The Study

For these reasons the current study set out to expand on the findings made within Dosseville et al., (2012) and Lilley et al., (2014). In regard to the Dosseville, Laborde, & Scelles study the current research set out by using a similar design in the manner of playing the music during the stressful task. However unlike their study, a form of sedative music will be used. This could relate to the findings within the Lilley, Oberle, & Thompson study as they used calm music prior to the stressful test in the hope of decreasing the arousal of the individual to an optimal level and thus to increase their performance within the cognitive task.

For these reasons the current study hypothesises that a form of sedative music would be best suited for positively altering an individual's performance within the Stroop test. For the purpose of the current research participants will be grouped into 3 conditions. The first condition participants will complete the Stroop test accompanied by sedative music. The second condition will involve abrasive stimulative music within the task. The final condition the participants will complete the Stroop test without any musical interference.

2.6.*Present Study*

The present study used a sedative song with a tempo of 60bpm for the relaxing condition that can be seen as ideal for maintaining a resting heart rate (Hill, 2013). Research highlights the optimal level for background music as 35dB and how music at this level would typically enhance

cognition amongst learners (Hill, 2013). For this reason the music was played at a level of 35dB. Furthermore the piece of sedative music used contained no vocals due to the negative cognitive effects that can be seen to occur when vocals are co-occurring with the piece of music (Furnhamet et al., 1999). Equally the style of sedative music used was a new age song due to recent research suggesting of its greater power over more traditional types of sedative music used for stress reduction (Lloret et al., 2014).

In the second experimental group the music's tempo was 180bpm. The reason for choosing this style was to investigate if heightening the individuals already heightened arousal levels could significantly impact the performance within the Stroop test negatively as research would suggest a bpm over 120 could induce heightened arousal (Hill, 2013). Furthermore no lyrics were used within this song assuring that any effects from the music were due to the bpm of the song.

Subsequently the present study measured affective changes within all conditions by using self-report measures. Furthermore, due to a number of methodological problems that can occur with self-reports, such as the individual answering according to what they may feel is the appropriate response instead of their actual true feelings (Lundqvist, Carlsson, Hilmersson, & Juslin, 2009), the current research also monitored physiological changes within the individuals. Additional questionnaires were completed following completion of the tasks, with the purpose of investigating the environments participants study in and if music is prevalent within such environments.

2.7. Hypotheses

The hypotheses proposed are as follows. Firstly physiological stress should be lower within the sedative music group compared to both the control group and stimulative music group. Likewise higher positive affective scores and lower negative affective scores should be reported within the sedative music group compared to both the control group and stimulative music group.

Furthermore it is predicted that all groups would experience Stroop effects in the manner of slower reaction times and less accuracy within the Stroop test. However it's further predicted that the sedative music group's performance within the Stroop test will be enhanced comparatively to both the control group and the stimulative music group due to its positive effects on maintaining individual's positive affect while also achieving optimal arousal levels.

Additional variables that will be looked at will be music preferences, music habits while studying and testing environment. For the reasons discussed in the research it is suggested that musical preference may have an influence on findings. Furthermore in regard to habitation it is believed individuals who listen to music while studying regularly could be differently affected than individuals who don't. Likewise the style of music listened to by participants in their leisure time may also contribute to the findings.

3. Method

3.1. Participants

The sample included 30 students, 18 males (60%) and 12 females (40%) and these individuals ranged in age from 18 to 36, with a mean age of 23.2 years (SD = .49). The students were randomly assigned

into three groups each containing the same amount of participants, two experimental groups (n = 10) that contained either stimulative or sedative music and one control group that had no music (n = 10).

3.2. Design

The design for the study was experimental in nature that tested how listening to either stimualtive or sedative music during a stressful task effected individual's attention, mood and physiology. The study contained two experimental groups where either sedative or stimulative music was present and one control group where no music stimuli was present. Additionally all participants were randomly assigned to either group. The experimental design used a mixed factorial design using repeated measures of which the independent variables were listening habits while studying, musical preferences and whether the word name and font color were the same or different within the Stroop test. Conversely the independent measures had predictor variables that were stimualtive music, sedative music and silence. The dependent variables within the study were positive physiological responses, negative physiological responses, positive affect change, negative affect change, reaction times and accuracy within Stroop test. The design for the study was experimental in nature that tested how listening to either stimualtive or sedative music during a stressful task effected the individual's attention (as measured by performance in the Stroop test), mood (as measured by the PANAS scale) and physiology (specifically, measures of heart rate and skin temperature). The study contained two experimental groups where either sedative or stimulative music was present and one control group where no music stimuli was present. All participants were randomly assigned to either group. The experimental design used a mixed factorial design with each group acting as the primary between-participants factor, and time (pre or post intervention) as the key within-participants factor. Other independent variables examined were listening habits while studying and musical preferences (both between-participants) and the congruent or incongruent conditions in the Stroop test (within-participants) – this referred to whether the word name and font color were the same (congruent) or different (incongruent). The dependent variables within the study were positive physiological

responses, negative physiological responses, positive affect change, negative affect change, reaction times and accuracy within Stroop test.

3.3. Apparatus

3.3.1. Physiological Measures

Lab Tutor software was used that allowed for physiological measures to be obtained through the software's accompanying finger transducer and skin temperature probe. The software automatically calculated the average heart rate as well as automatically calculating the average temperature for all participants for the allocated time period.

3.4. Materials

3.4.1. Music

The music chosen to increase performance within the Stroop test by inhibiting arousal levels and maintaining positive affect was a form of new age music without lyrics so that individual's attention would not be disturbed. The specific piece of music chosen was a song named "weightless" which holds a strong public consensus as being one of the most relaxing songs (Grossman et al., 2013). Contrastingly the music elicited to adversely influence the individuals performance within the Stroop test and in turn altering the affect and physiology negatively was a fast-tempo abrasive piece of music. The specific song utilized within the participants was a generic techno song at 180bpm. Furthermore the volume of the music was the same for both experimental conditions at a level of 35dB.

3.4.2. Stroop Test

An online alternative version of the classic Stroop test was used containing both incongruent and congruent conditions (Stroop, 1935). The Congruent condition produced 45 words both where the colour word and the colour of the word matched, while the incongruent condition produced 45 words

where the colour word and colour of the word did not match. Each stimulus was displayed in one of four colours (blue, yellow, red, or green) matched with four labelled keys (blue, yellow, red, or green). The order of each condition is random and determined by the experiment with each condition identified before the experiment begins.

3.4.3. Affective States

To measure affect, the approach used by Watson, Clark, and Tellegen (1988) was chosen, which groups discrete emotions into higher order dimensions due to the overlapping properties of the dimensions. The PANAS (Watson et al., 1988b) consists of two 10-item mood scales and was originally developed to allow for the measures of positive affect and negative affect. The items were derived from a principal components analysis of Zevon and Tellegen's (1982) mood checklist that could be argued to being a good representation of the affective lexicon. The scale gets the respondents to rate the extent to which they have experienced each particular emotion within a specified time period, with reference to a 5-point scale. The scale points are: 1 'very slightly or not at all', 2 'a little', 3 'moderately', 4 'quite a bit' and 5 'very much'. A number of different time-frames have been used with the PANAS, but in the current study the time-frame adopted was 'currently experiencing'. Cronbach alpha levels for both positive and negative affect subscales were above .8 (Crawford, & Henry, 2004). Further research would also largely support the construct validity of the PANAS scales (Crawford, & Henry, 2004; Tuccitto, Giacobbi, & Leite, 2010). To see full descriptions of questions used within the questionnaire (see Appendix C).

3.4.4. Revised Stomp Scale

Part 1 of the revised Short Test of Musical Preferences (STOMP) scale contained a section that measured individual's musical preferences to studying and music's influences on studying on a Likert scale ranging from one to seven; 1 being strongly disagree, 4 neither agree nor disagree, and 7 strongly agree. Part 2 of the Revised STOMP scale was a 14-item measure where participants are

asked to rate how much they like certain types of music (e.g., classical, pop, heavy metal and jazz) on a Likert scale ranging from one to seven; 1 being strongly dislike, 4 neither like nor dislike, and 7 strongly like. The 14 items are furthermore scored into four music preference dimensions with scores ranging from 3-28 on any dimension. The music preference dimensions are grouped into reflective and complex, intense and rebellious, upbeat and conventional, and energetic and rhythmic dimensions. Likewise high test-retest reliability for the measures can be seen ranging from .77, .80, .89, and .82 for the Reflective and Complex, Intense and Rebellious, Upbeat and Conventional, and Energetic and Rhythmic dimensions respectively (Rentfrow & Gosling, 2003). Furthermore the confirmatory factor analysis used by the test authors would further ensure of the 4 factor structure and its construct validity (Rentfrow & Gosling, 2003). To see full descriptions of questions used within the questionnaire (see Appendix A).

3.4.5. Reflections on the Task

Following the full completion of the task participants were given a 7 item scale to complete measuring their overall experience within the test and the testing environment. Participants were instructed to circle the appropriate number that was represented on the Likert scale ranging from one to seven; 1 being strongly disagree, 4 neither agree nor dislagree, and 7 strongly agree for how stressful they found the task, how difficult they found the task, how enjoyable they found the task and if the noise was distracting. Likewise they were asked if the noise within the environment enhanced their performance within the Stroop test, furthermore if the experimenter disturbed their performance and if the testing environment was uncomfortable. To see full descriptions of questions used within the questionnaire (see Appendix B).

3.5. Procedure

Participants were made aware of the current study and the very nature of its purpose prior to participation. Participant's participation within the current study was voluntary and they provided

informed consent before commencing the experiment (see Appendix D). Prior to any interventions measurements were taken for participant's current mood using the PANAS scale as well as having their resting heart rate and temperature measured via the Lab Tutor software for a period of two minutes. Likewise all participants filled out a revised version of the Stomp scale measuring study habits with relation to listening to music and the individuals preferences for different genres of music.

Following this both experimental groups listened to either stimulative or sedative music depending on their assigned condition for a time period of 2 minutes limiting the chances of habituating to the musical stimuli. Conversely the control condition received no musical interference however they waited in silence for 2 minutes. During this time frame all groups were again measured for their temperature and pulse allowing comparisons to be made with their baselines. Furthermore after the physiological measurements were recorded the individuals again filled out a self-reported PANAS Scale that analysed their present moods.

Subsequently all individuals participated within the Stroop test which was carried using a laptop, which allowed for the response times to be recorded for each individual trial within all conditions. All responses were made with one of four labelled keys (blue, yellow, red, or green), which retained the same mapping throughout the experiment. Each stimulus consisted of a display of 45-point characters, displayed in one of four colours (blue, yellow, red, or green).

Similarly to earlier within the study all groups were measured for physiological changes within their bio markers and on this occasion the measurements were made during the Stroop test monitoring for changes in levels of physical stress. Furthermore within both experimental groups the Stroop test was accompanied by either stimulative or sedative music depending on participant's condition. Conversely the control groups test environment was not influenced and therefore experienced normal Stroop test conditions. After all groups completed the Stroop test they were again measured for present mood via The PANAS Scale. In addition to filling out the PANAS scale participants were

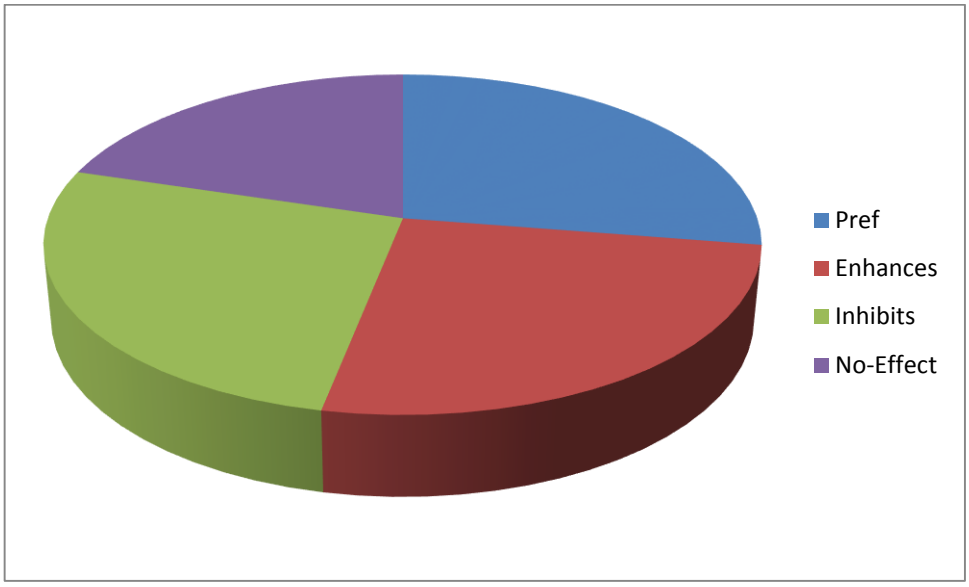
given a quick reflective scale to fill out asking about the overall experience within the test and the testing environments.

4. Results

4.1. Descriptive statistics

Prior to any investigations within the different conditions an analysis of frequency of study habits and the testing environment conditions were conducted and showed that participants preferences for listening to music while studying seemed to be quite even with some stating they had high preferences and others stating they did not have a preference to music listening while studying. Furthermore participants again differed in opinions over the beneficial impact of music with some believing it has no effect or would inhibit them within learning environments (see Figure 1).

Figure 1 Study habits and testing environment



In addition to the above measures participants musical preferences were recorded for and the means, standard deviations and the range of scores can be identified within Table 2.

Table 2 Descriptive statistics for musical preferences

	Reflective/Complex	Intense/Rebellious	Upbeat/Conventional	Energetic/Rhythmic
Mean	15.97	13.57	15.73	14.5
SD	4.40	3.31	3.79	4.01
Range	5-24	8-21	8-22	5-21

Subsequently the different conditions were then investigated for the means for physiological stress baselines, post interventions and post Stroop task (see Figure 2 and Figure 3).

Figure 2 pulse means

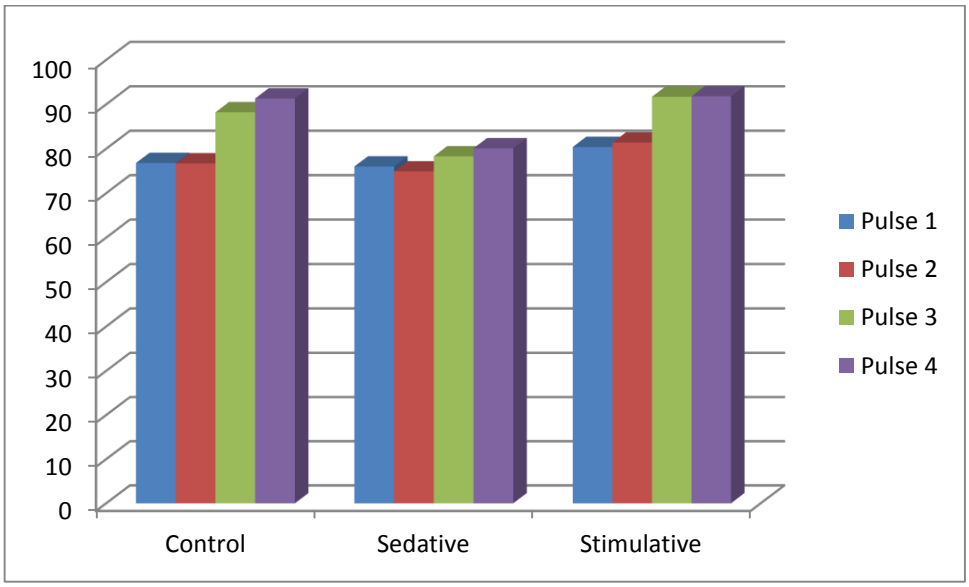
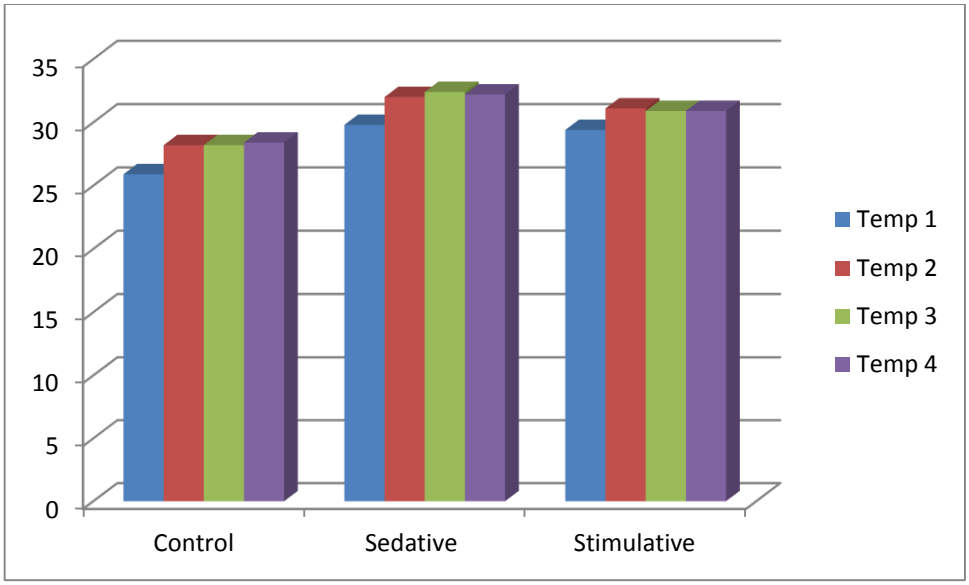


Figure 3 temperature means



What can be seen is how the participants in the sedative group showed reductions in pulse measures before and after the intervention and Stroop task while both the stimulative and control groups showed increases within their pulse levels compared to the sedative group. However the same was not evident within the mean scores for temperature, with the control group recording lower mean scores for their temperature compared to the sedative and stimulative groups.

In addition to this by looking at means for affective states baseline, post interventions and post Stroop task it can be seen how mean scores for positive affect were higher within the sedative group compared to the stimulative and control groups. Additionally the sedative group showed lower mean scores in regard to negative affect (see Figure 4 and Figure 5).

Figure 4 postive affect means

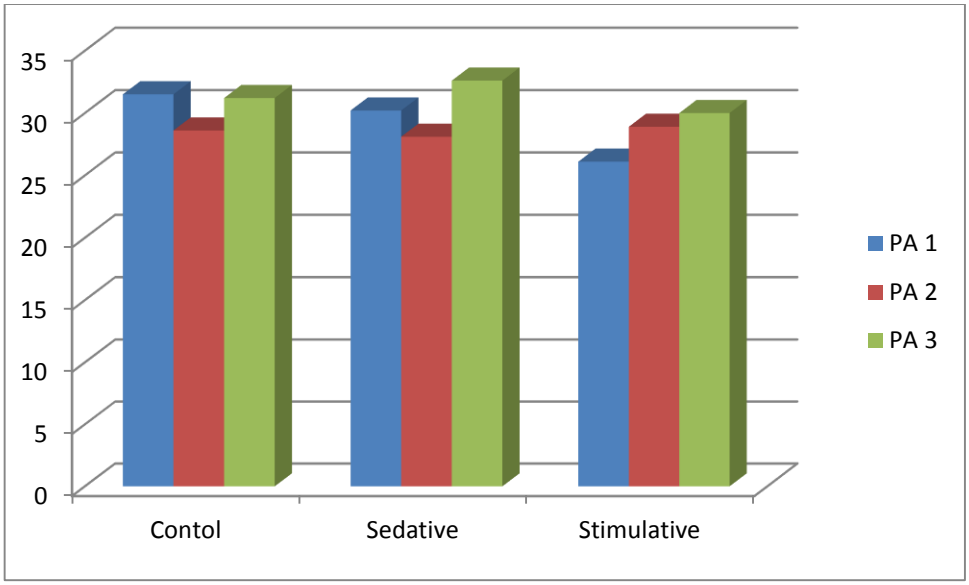
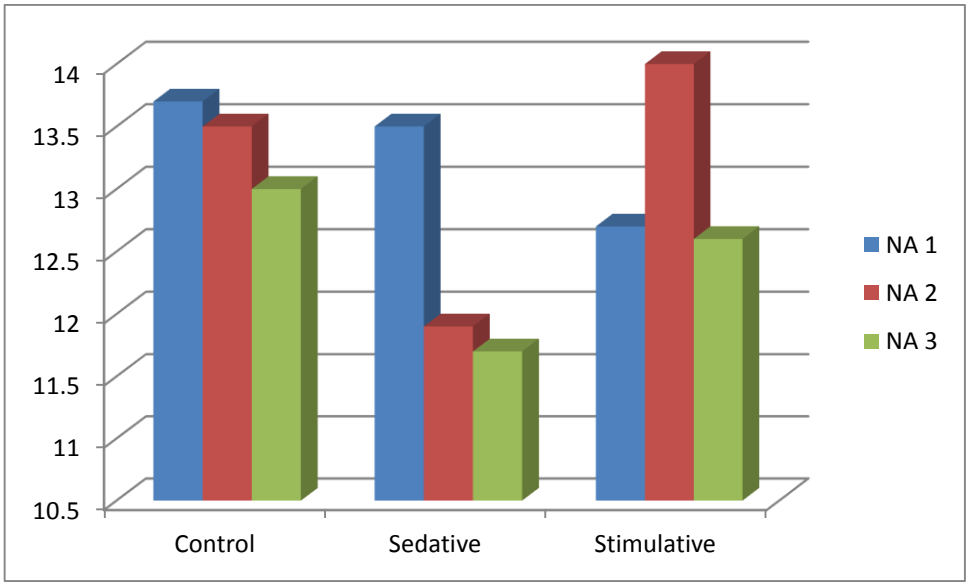


Figure 5 negative affect means



4.2. Stress levels

Following the findings made within the descriptive statistics the first hypotheses was investigated by using mixed between-within subjects analysis of variance to test for any differences relating to the impact of the three different interventions (Sedative Music, Stimulative Music and No Music) on participants temperature and pulse scores across three time periods (pre-intervention, post intervention and following completion of Stroop test). Firstly looking at pulse a non-significant

interaction between the different conditions and time was observed, Wilks' Lambda = .73, F (6, 50) = 1.4, p = . 24, partial eta squared = . 14. There was although a large effect for time, Wilks' Lambda = .41, F (3, 25) = 11.8, p < .001, partial eta squared = . 59. Additionally it could be identified how Time 4 produced the highest mean scores for pulse (see Figure 2). The main effect comparing the three types of conditions was not significant, F (1, 27) = 1.17, p = .33, partial eta squared = .08, suggesting no difference in the effectiveness of these three conditions. However when looking at temperature a significant interaction between the different conditions and time was observed, Wilks' Lambda = .88, F (6, 50) = .54, p = . 001, partial eta squared = . 56. There was also a substantial effect for time Wilks' Lambda = .44, F (3, 25) = 10.7, p < .77, partial eta squared = . 61. Moreover the main effect comparing the three types of conditions was not significant, F (1, 27) = 3.17, p = .058, partial eta squared = .19, suggesting no difference in the effectiveness of these three conditions. Additionally looking at both physiological variables means within the 3 conditions showed increases and decreases within both pulse and temperature scores (see Figure 2 and Figure 3). The findings partially supported the first hypotheses claims in how sedative music could be used for reducing physical stress.

4.3. Affect induction

When looking at the second hypotheses it proposed that higher positive affective scores and lower negative affective scores should be reported within the sedative music group compared to both the control group and stimulative music group. To further investigate time and affect differences within the conditions a mixed between-within subjects analysis of variance was conducted to assess the impact of three different interventions (Sedative Music, Stimulative Music and No Music) on participants positive affect scores across three time periods (pre-intervention, post intervention and following completion of Stroop test). There was no significant interaction between the different conditions and time, Wilks' Lambda = .85, F (4, 52) = 1.13, p = . 352, partial eta squared = . 08. There was however a substantial main effect for time, Wilks' Lambda = .79, F (2, 26) = 3.39, p <

.049, partial eta squared = . 21, with both the control and sedative groups showing increased positive affect from time 1 to time 2 (see Figure 4). The main effect comparing the three types of conditions was not significant, F (2, 27) = .311, p = .74, partial eta squared = .022, suggesting no difference in the effectiveness of these three conditions. A mixed between-within subjects analysis of variance was conducted again, this time to assess the impact of the three different interventions (Sedative Music, Stimulative Music and No Music) on participant's Negative Affect scores across three time periods (pre-intervention, post intervention and following completion of Stroop test). There was a significant interaction between the different conditions and time, Wilks' Lambda = .68, F (4, 52) = 2.8, p = . 035, partial eta squared = . 18. However there was a no effect for time Wilks' Lambda = .82, F (2, 26) = 2.8, p < .081, partial eta squared = . 18, with the 3 conditions means showing both increased negative affect and decreased negative affect. The main effect comparing the three types of conditions was not significant, F (1, 27) = .402, p = .67, partial eta squared = .029, suggesting no difference in the effectiveness of these three conditions. The findings partly supported the second hypotheses claims that sedative music could induce affect and protect against negative affect from occurring. Additionally the mean scores and changes within different time periods and conditions can be witnessed (See Figure 4 and Figure 5).

4.4. Correlations between affective measures and physiological measures

Prior to further investigations correlations were ran to see if any relationship existed within the affective measures and the physiology of the individual. The subsequent correlations showed no significant relationships (See Table 2 and Table 3).

Table 2 NA and Physiology

Variables	1	2	3
1-Baseline NA	1		
2-Baseline Temp	.081	1	
3-Baseline Pulse	-.065	.177	1

Table 3 PA and Physiology

Variables	1	2	3
1-Baseline PA	1		
2-Baseline Temp	-.243	1	
3-Baseline Pulse	-.014	.177	1

Likewise correlations were ran between affective measures, physiological measures and Stoop test scores The second hypotheses proposed that poorer performance within the Stroop test would relate to rises in physiological stress and lower affective states. Likewise it was predicted normal Stroop like effects would be observed between the congruent and incongruent conditions. Moreover a pearson product-moment correlation coefficient was conducted to test the relationship between Stroop performance and for the affective states at time 3, physiological measures at time 4 and scores within the congruent and incongruent reaction scores. There was a moderate, negative correlation between the two variables, $r = -.529$, $n = 30$, $p < .01$, with high levels of pulse associated with lower levels of incongruent attention times. Likewise there was a moderate, negative correlation between the two variables, $r = -.493$, $n = 30$, $p < .01$, with high levels of temperature associated with lower levels of incongruent reaction times. Additionally there was a moderate, negative correlation between the two variables, $r = -.412$, $n = 30$, $p < .05$, with high levels of temperature associated with lower levels of congruent attention times. Following this the relationship between affective states from time 3, physiological states time 3 and congruent and incongruent attention scores was investigated using Pearson product-moment correlation coefficient.

4.5. Efficacy of the stressor

Consequently the fourth hypotheses suggested that higher stress levels would be associated with worse performances within the Stroop test. Prior to any statistical analysis being run outlier reaction time scores were removed to increase the strength and validity of the data. Investigations using paired sample t-tests were performed to evaluate relationships between congruent and incongruent trial variables and to test the hypotheses claims. The results produced a significant rise in the 2 paired sample t-tests. Congruent Reaction Condition (M = 954.30, SD = 119.40) to Incongruent Reaction Condition (M = 1094.27, SD = 21.65), t (29) = -5.1, p = .001 (two-tailed). The Mean increase in Reaction Time scores was -139.96 with a 95% confidence interval ranging from -195.64 To -84.29 the eta squared statistic was (.49) indicated a large effect size. Congruent Attention Condition (M = .9967, SD = .0092) to Incongruent Attention Condition (M= .9800, SD = .0281), t (29) = 3.4, p = .002 (two-tailed). The Mean increase in Attention Scores was .017 with a 95% confidence interval ranging from .0060 To .027 the eta squared statistic was (.29) indicated a large effect size. The findings could highlight the efficacy of the stressor. The findings supported the hypotheses and the efficacy of the stressor.

4.6. Affect and physiology as a predictor of Stroop performance

In addition to the above findings the fifth and main hypotheses of the study was investigated. Moreover it proposed that the Sedative group's performance within the Stroop test would be higher compared to the Stimulative group and Control group. A one-way between-groups analysis of variance was conducted to explore the impact each condition had on reaction times of all participants. Unlike earlier on in the analysis both Congruent and Incongruent reaction time were computed into one singular variable by using Cohens D formula to allow for the calculation of the effect size occurring between the two variables There was a non-significant difference at the $p < .05$ level in reaction times for the three conditions: F (2, 27) = .54, p = .59. Despite producing a

non-significant result the differences in mean scores was quite large (see Table 4). The effect size, calculated using eta squared, was small .03. Subsequently a one-way between-groups analysis was conducted again between all conditions to explore the impact between each condition within congruent and incongruent attention scores. There was a non-significant difference at the $p < .05$ level in congruent attention scores for the three conditions: $F (2, 27) = .61$, $p = .56$. The effect size, calculated using eta squared, was .0. Additionally there was no statistically significant difference at the $p < .05$ level in incongruent attention scores for the three conditions: $F (2, 27) = .52$, $p = .6$. However the effect size, calculated using eta squared, was .04. Additionally mean scores between the three conditions within incongruent and congruent attention scores were small (see Table 4).

Table 4 Means and standard deviations for Stroop scores within conditions

	Control			Sedative			Stimulative		
Task	n	M	SD	n	M	SD	n	M	SD
Congruent attention	10	1	.01	10	.99	.01	10	1	.01
Incongruent attention	10	.97	.03	10	.98	.02	10	.98	.03
Stroop reaction times	10	1.75	.67	10	.68	11.26	10	4	5.7

Table 5 Correlations for musical preferences and Stroop test scores

variable	1	2	3	4	5	6	7
1-Reflective	1						
2-Intense	-.096	1					
3-Upbeat	.416*	.076	1				
4-Energetic	-.126	-.072	-.014	1			
5-StroopReaction	-.195	-.154	-.121	.046	1		
6-Incongruent	-.317	-.100	-.223	.263	-.219	1	
7-Congruent	.048	-.162	-.066	.084	-.116	.292	1

*Note. Statistical significance: *p < .05; **p < .01; ***p < .001*

Following the main findings within the study a pearson product-moment correlation coefficient was conducted to test the relationship between Stroop performance (see Table 5). What could be identified within the above analysis is the non-significant impact the individual's musical preference had within the Stroop test. Likewise all participants recorded reflections on the task and their overall experience within it with the majority of individuals finding the task enjoyable. Subsequently the means, standard deviations, range and possible range can be seen within Table 6.

Table 6 Descriptive statistics for study habit and testing environment continuous variables

Question	M	SD	Range	Possible Range
I Found the task stressful	2.77	1.72	1-6	1-7
I Found the task difficult	2.23	1.48	1-5	1-7
I Found the task enjoyable	5	1.05	3-7	1-7
I Found background noise distracting	2.53	1.7	1-6	1-7
I Found background noise enhanced my performance	3.17	1.77	1-7	1-7
I Found the presence of the experimenter distracting	1.90	1.42	1-5	1-7
I Found the tests environment uncomfortable	1.80	1.13	1-4	1-7

Moreover the full findings within this study can partly support most of the stated hypotheses and will be discussed in detail within the discussion as to the impact such findings can have within individuals learning environments.

5. Discussion

The aim of the current study was to expand on the findings made within Lilley et al., (2014) and Dosseville et al., (2012) research which highlighted how the type of music selected could have a significant impact on the individuals positive affect and optimal arousal levels within stressful cognitive tasks and how they could be significant for greater performances within such tasks. In addition the study also felt the participants musical preferences could have an impact on the subsequent performance due to findings made by Jiang et al., (2013). Equally the study felt that the individual's prior study environment could also impact on their performance as well as their familiarity with using music being crucial, in addition to the overall influence a style of music would have on their performance as indicated by results found by (Basner et al., 2014; Jiang et al., 2013; Van Den Bosch et al., 2013).

Subsequently when examining the results of this study it supported the first hypotheses for the impact of sedative music on reducing physical stress. In particular, compared with those who listened to the stimualtive music, participants who listened to the calm music experienced lower pulse levels, prior to partaking within the Stroop test and during the Stroop test. These findings are consistent with those from other studies showing that calm music reduces stress and promotes relaxation, whereas faster-paced music increases tension levels (Dillman & Potter, 2007; Thoma et al., 2013). Specifically looking at the role sedative music had on the individuals pulse levels it can be identified how it produced lower mean scores compared to the individuals within the control and stimulative groups prior to the Stroop test and post Stroop test. Such findings would not be unusual for the ability of relaxing music in reducing pulse levels within individuals, as similar trends can be identified in vast amounts of research (Bradt, & Dileo, 2009; Han et al., 2010; Holm, & Fitzmaurice, 2008; Moradipanah, Mohammadi, & Mohammadil, 2009; Nilsson, 2009).

In addition to the pulse levels being measured the temperature of the individual was recorded as well. Consequently the individual's temperature rose within the sedative group compared to the control and stimulative groups. Such a finding would be common within research as a significant

portion of music studies using physiological measures have reported increases within participant's skin temperature after listening to relaxing music (Dillman & Potter, 2007). Furthermore the ability of the relaxing music to increase the temperature of the individual could highlight the power of the music's ability for reducing stress levels (Yang et al., 2012). This can be due to the relationship between skin temperature and emotional stress and how research would identify the relaxing music's ability to increase skin temperature that can lower the physical stress of the individual (Yang et al., 2012). Moreover the physiological reactions witnessed within the current study could have related to the soothing ability of the music to cause such reactions (Yang et al., 2012). Consequently such findings would support the claims made within the first hypotheses and could highlight the great strengths for using the new age song "weightless" as the choice of sedative music for stress reduction due to the similarity of the findings made within Lloret et al., (2014). This can be identified as being crucially important for music therapists since it can highlight the strength of using new age music instead of any style of sedative music. However in acknowledging such results it must be noted within the current study that no other choices of relaxing music were used therefore no comparison can be made as seen in prior research (Lloret et al., 2014). What can be further identified within the current findings and why they may have been achieved could relate to the slow tempo, non-lyrical, euphonic melody, and an absence of heavy beats used within the selected song as well as the low volume used. Research would highlight how such methods can be very effective within clinical practices for stress reduction (Yang et al., 2012).

In addition to this, the second hypothesis proposed that both positive affect and negative affect would be positively influenced within the sedative music condition while negatively influenced in the stimualtive music condition and unaffected within the control condition. Despite not producing significant results it is worth noting how the sedative music condition better maintained low NA in individuals and increased PA within individuals, which could be observed by the mean scores. It

could be argued that although these differences were non-significant the mean differences within the groups could have related to the calming nature of the music. Likewise it is possible that the calming nature of the music that helped maintain the optimal arousal levels seen in the aforementioned results within the stressful environment arguably could have maintained the positive affect of the individuals by making the environment more enjoyable (Västfjäll, Juslin, & Hartig, 2012). Conversely considering that the main purpose of the music was to lower tension levels of the individual it may have indirectly influenced the non-significant findings as it was not specifically chosen to increase positive affect (Dosseville et al., 2012). Additionally the song choice may have not been the right choice of musical stimuli to elicit such emotions as shown by research highlighting the greater benefits of a faster tempo and major mode style that establishes a connection between higher arousal and higher positive affect (Thompson et al., 2001). Therefore it is possible to speculate that if a different form of music such as classical music had been utilized within the stressful environment it may have induced stronger effects on the individuals affective measures due to findings made within Dosseville et al., (2012). However in saying this the contrasting findings found within the physiological measures and the affective measures could be due to the individual's levels of affectivity, not relating to the individual's levels of physical arousal which was further supported within the study by the lack of correlations within the variables. Moreover the idea that both these aforementioned variables are independent of each other is supported by results made within similar research findings (e.g. Dockray & Steptoe, 2010). Also the individual's preferences for styles of music leaned towards more stimulative music and this could have also influenced the findings due to the great impact the individuals musical preference can have on their present moods and physiology (Jiang et al., 2013). Furthermore in regard to the self-reported affective scores producing non-significant results, it could have related to the proximity of the individuals and the experimenter, as a social desirability bias may have occurred and in turn may have influenced participants Panas scale responses (Lundqvist, Carlsson,

Hilmersson, & Juslin, 2009). Moreover, given that the Panas scale was filled out three times by participants during the experiment, it is possible that responses on their final two accountings could have entailed a form of bias due to their memories of the responses they used within the initial baseline measurement (Lundqvist, Carlsson, Hilmersson, & Juslin, 2009).

Following this the third hypotheses stated that normal Stroop like effects would occur within all individuals. This was tested by using paired sample t-tests which revealed significantly large differences between congruent and incongruent reaction times. In addition to this a significantly large difference was observed also within the congruent and incongruent attention scores. The findings made within the current study are often referred to as the Stroop effect. This can occur when attention and reaction scores suffer within the incongruent part of the Stroop task (MacLeod, & MacDonald, 2000). Such findings might have materialised because of the cognitive demands placed on the processing involved within the incongruent tasks (Boksem et al., 2005). Likewise the quicker reaction times within the congruent part of the test could have related to a sign of automaticity. This could have occurred as previously mentioned within the subsequent literature as to when an individual responses within the Stroop test are processed automatically, thereby side tracking our conscious processing (Marmurek, 2003). Moreover the current study participant's physiological variables significantly correlated with Stroop test reaction and attention times. This was observed through the significantly strong negative correlation between higher pulse scores and incongruent attention as well as the negative effect lower temperature had on the individual's incongruent reaction times. These results indicated that the more physiological stress individuals experienced the more likely they were to make errors within the Stroop task. Specifically looking at the relationships between the individuals pulse scores and incongruent attention it could be identified that the greater difficulty of the cognitive task could have induced greater HR within the person compared to the congruent task (Simoes et al., 2013). Similarly the results found within incongruent reaction times and the temperature of the individual could have been due to the same

factors. Furthermore a significant negative correlation was noted between the congruent attention scores and the temperature of the individual. Furthermore the stress of the task may have induced directed attentional fatigue within the individuals relating to the cognitive demands placed on the processing of the task (Boksem et al., 2005). Further research would propose that the fatigue could have influenced the higher HR as studies suggest the lower the HR the more attentive the individual is within the Stoop Test (Elsesse, 2006). Equally the results of the present study would be supported by various studies on cognitive difficulty and its relationship to raised HR (Cothran & Larsen, 2008).

Consequently these aforementioned findings led to the testing of the 4th and main hypotheses of the study which claimed that sedative music could positively impact the individual's performance within the Stroop test. What can be highlighted from partaking within a stressful task such as the Stroop test is the probability that it's not a particularly enjoyable task for individuals. This led to the belief that by increasing the individual's positive affect and by lowering their stress levels it could enhance the performance of the individual. However within the current study, although it observed a significant effect for time within both PA and NA, the conditions themselves did not significantly differ in regard to PA and NA scores. Likewise the individual's conditions did not significantly impact on their subsequent Stroop performance possibly highlighting the lack of effect of sedative music on an individual's attention and reactions times within a stressful task. Therefore considering the music did no elicit positive affect it is possible no alterations occurred within the individual capcity to ignore irrelevant information and thus not increasing their processing ability (Rowe et al., 2007). However unlike affect a significant effect for music within the individual's physiological variables was recorded, likewise it was also noted how the majority of individuals enjoyed the task. It is possible to therefore speculate that the task did not sufficiently stress the individual out and although the music lowered the individuals physiological stress it may have reduced it too much due to individuals actually enjoying the task. This in turn could have influenced

the results negatively and could relate to the individual arousal levels and how they were not optimal for the current task (Lilley et al., 2014).

Conversely such non-significant findings could have related to the time period that was allocated to induce affectivity and how it may have not being sufficiently long enough. Research would suggest that the minimum time needed would be 8 minutes long to induce changes within mood (Janssen, van den Broek, & Westerink, 2012). Similarly as the current study only instilled 2minutes of musical stimuli at each sitting this could have reduced the chances for the physiological measures impacting on the affective measures of the individuals which in turn negated the impact for improved Stroop task performance. This could relate to previous research implicating longer time periods for the music stimuli used on the physiological variables that in turn increased the individual's mood (Knight, & Rickard, 2001). It could be therefore speculated that due to the time frame used within the task it may have failed to induce both positive affect and optimal arousal and thus failed to impact the performance within the Stroop task. What could be further speculated is that the choice of music chosen was not as well suited as other types of relaxing styles of music. Several studies claim that classical music is better suited to increase cognition within individuals (Schellenberg, & Weiss, 2013). Likewise as stated earlier due to the high proportion of individuals finding the task enjoyable it could be speculated that the task did not increase their stress levels sufficiently enough for the sedative music to be effective. Therefore a more stimulative relaxing song could have increased the performance more than the sedative song due to the relationship of the arousal-mood hypotheses on cognitive performances (Thompson et al., 2001).

Further investigating the results it could be suggested that the lack of significant findings relating to performances within the Stroop test could relate to the individuals musical preferences. In saying this, the current study did however control for particular musical preferences within individuals by using the STOMP scale and produced findings suggesting such preferences did not influence scores within the Stroop test. Although such findings were evident, as stated earlier there can be great

benefits of self-selected music in positively altering affective and physiological measures (Jiang et al., 2013). It could be therefore highlighted that a self-selected new age music could have had a greater influence compared to the experimenters selected music on the individual's physiology and affective scores and in turn could have produced significant findings within the subsequent performances within the Stroop test. This could be further evident due to the research highlighting the great strengths of having the individual self-select pleasant music for their affect, physiology and cognition (Kushnir et al., 2012).

5.1. Limitations

As mentioned previously, there were certain limitations within the current study. Firstly an imperative issue within the current study was the lack of significant results with the affective measures. As stated earlier the results may have been influenced through the proximity of the researcher, creating a social desirability bias which inhibited the survey responses. Furthermore it was stated that the lack of significant findings could have related to the amount of times the participants had to complete the Panas scales. This could be likely as the participants had to complete the inventory three times throughout the experiment therefore it could be possible that the individuals responses for the final two inventories could have been biased due to their memory of their previous responses. In addition the time period used for the music may have not been sufficiently long enough. Given that participants only listened to the music for a time period of 2minutes it is possible that it was not sufficiently long enough to influence the affect of the individual.

Secondly the study may have not induced the required amount of stress for the sedative music to induce optimal arousal levels within the individuals. Therefore it could be highlighted that the lack of any other type of relaxing music condition could have influenced the lack of significant findings within the current research. This could be evident as a significant portion of studies suggest that

classical music reduce stress and in turn increases the positive affect of the individual to maximise the cognitive performance within stressful tasks.

Thirdly the music was preselected by the experimenter, and although the study partly controlled for individual differences in musical preferences, it did not include a condition specifically related to the individuals preferred music. Therefore it is highly likely due to the research cited within the literature that the participants may have performed to a greater extent within the Stroop test if they had been listening to music they self-selected. This could be the case as some individuals may find sedative music irritating or confusing and this may have in turn actually distract them within the task.

Finally the small sample size used within the current study could have negatively impacted the current findings. Likewise the differences in age and individual differences can be vital when determining the influence of the type of music (Namdar et al., 2014) and therefore this could have been a concern within the current study as the significant proportion of the participants within the current sample were Caucasian young adult males. This may have in turn limited the generalizability of the findings from this study. Despite the limitations of this study, the significant findings seen within the physiology of the individual could be vital for the impact of the use of new age music for music therapists. Equally the small differences observed within the mean scores could further suggest that with a larger sample of more diverse individuals it could have produced significant findings in regard to how sedative music could have influenced the Stroop task performance of the individuals. What this current study does possess is a foundation for the ability of new age music and how it can reduce stress within stressful cognitive tasks however its influence over reaction and attention scores within such tests is not fully understood. In addition to this although the current findings did not possess a significant effect on self-reported affective scores, physiological effects of stress were identified when individuals listened to new age music.

Therefore although not all findings were supported and limitations were identified the strengths are still abundant for the use of new age music to reduce the physiological stress of individuals.

5.2. Conclusion

This study provided valuable insight into the influence for the use of sedative music for reducing an individual's stress levels within a stressful cognitive task. Likewise it partly supported the use of sedative music for maintaining an individual's affective states within the same type of environment. In addition to these findings the results showed no impact for the use of sedative music for increasing performances within the Stroop test. However in saying this, the sample size was quite small and likewise small differences were observed within the participants means scores. Therefore it could be speculated that if the sample size was larger it could have possibly influenced the findings within the current research. Moreover although the main hypotheses was rejected it can be suggested by the positive results found with regard to the music's influence over the individual's physiology that it is possible if the current research was replicated within a larger diverse sample it could produce the positive outcomes proposed by the current research.

Appendix A

STOMP

Part1

For the following items, please rate if you agree or disagree with the statements listed using the scale provided.

1----------2----------3----------4----------5----------6----------7
Strongly disagree neither agree nor disagree
Strongly agree

1. In general I have a preference for listening to music while studying
2. Music enhances My performance within academic tasks (writing, attention, studying etc)
3. Music inhibits my performance within academic tasks (writing, attention, studying etc)
4. Music has no effect on my performance within academic tasks(writing, attention, studying etc)

Part 2

For the following items, please indicate your basic preference level for the genres listed using the scale provided.

1----------2----------3----------4----------5----------6----------7

Strongly dislike — neither like nor dislike — Strongly like

1. _____Classical
2. _____Country
3. _____Blues
4. _____Dance/Electronica
5. _____Folk
6. _____Rap/hip-hop
7. _____Soul/funk
8. _____Religious
9. _____Alternative
10. _____Jazz
11. _____Rock
12. _____Pop
13. _____Heavy Metal
14. _____Soundtracks/theme songs

Appendix B

Reflections on the task

For the following items, please circle the appropriate number representing how strongly you agree or disagree with the statements listed using the scale provided.

1----------2----------3----------4----------5----------6----------7

Strongly disagree *neither agree nor disagree* *Strongly agree*

1- I Found the task stressful	1-------- 2--------3-------- 4-------- 5 --------6 --------7
2- I Found the task difficult	1-------- 2--------3-------- 4-------- 5 --------6 --------7
3- I Found the task enjoyable	1-------- 2--------3-------- 4-------- 5 --------6 --------7
4- I Found background noise distracting	1-------- 2--------3-------- 4-------- 5 --------6 --------7
5- I Found background noise enhanced my performance	1-------- 2--------3-------- 4-------- 5 --------6 --------7
6- I Found the presence of the experimenter distracting	1-------- 2--------3-------- 4-------- 5 --------6 --------7
7- I Found the tests environment uncomfortable	1-------- 2--------3-------- 4-------- 5 --------6 --------7

Appendix C

PANAS

This scale consists of a number of words that describe different feelings and emotions. Read each item and then mark the appropriate answer in the space next to that word. Indicate to what extent you feel this way at the present time.

1	**2**	**3**	**4**	**5**
very slightly or not at all	a little	moderately	quite a bit	extremely

_____ interested

_____ distressed

_____ excited

_____ upset

_____ strong

_____ guilty

_____ scared

_____ hostile

_____ enthusiastic

_____ proud

_____ irritable

_____ alert

_____ ashamed

_____ inspired

_____ nervous

_____ determined

_____ attentive

_____ jittery

_____ active

_____ afraid

Appendix D

CONSENT FORM FOR RESEARCH PARTICIPANTS

Information Sheet

Purpose of the Study. As part of the requirements for my psychology degree at NCI, I have to carry out a research study. The study is concerned with how levels of physical stress can inhibit our attention within cognitive tasks.

What will the study involve? The study will involve participants partaking in a cognitive task known as the Stroop test. Each participant's involvement should take roughly 10-15 minutes. Participants will be assigned randomly to groups and will be given a time slot in regard to their participation time. Participants within all groups will be measured for heart rate prior to partaking within the test, during the test and after the test. Participants will also have their psychological moods measured prior to the test and following the test.

Why have you been asked to take part? You have been asked to take part in the study as you are generally suitable to provide data for the proposed study.

Do you have to take part? Participation is completely voluntary. Signing the consent form allows me the researcher to gather an idea of the participants that are interested in participating but does not oblige you to take part after signing your consent.

Will your participation in the study be kept confidential? Yes your data will be kept with the upmost anonymity as there will be a coding system for all participant's scores.

What will happen to the information which you give? The data will be kept confidential for the duration of the study. On completion of the thesis, they will be retained for a further six months and then destroyed.

What will happen to the results? The results will be presented in the thesis. They will be seen by my supervisor, a second marker and the external examiner. The thesis may be read by future students on the course. The study may be published in a research journal.

What are the possible disadvantages of taking part? It is forseen that there will be little to no disadvantages in taking part in the study.

What if there is a problem? At the end of the procedure, I will discuss with you how you found the experience and how you are feeling. If you subsequently feel distressed, you should contact your local GP.

Who has reviewed this study? National College of Ireland Ethics Committee and approval has to be given by the NCI Research Committee before studies like this can take place.

.Any further queries? For further information, contact me: Evan Murphy, evanmurphy2012@gmail.com If you agree to take part in the study, please sign the consent form overleaf.

Consent Form

I……agree to participate in Evan Murphy's research study.

The purpose and nature of the study has been explained to me in writing.

I am participating voluntarily.

I understand that I can withdraw from the study, without repercussions, at any time, whether before it starts or while I am participating.

I understand that anonymity will be ensured to protect the secrecy of my results.

I understand that my results within this experiment will be used in the thesis and any subsequent publications if I give permission below:

Signed……. Date……..

References

Allen K. et al. Normalization of hypertensive responses during ambulatory surgical stress by perioperative music. *Psychosomatic Medicine*, 63, 487-492.

Allen, K., & Blascovich, J. (1994). Effects of music on cardiovascular reactivity among surgeons. *Jama-journal of The American Medical Association*, 272(11), 882-884. doi:10.1001/jama.272.11.882

Baddeley A. (2003). Working memory: looking back and looking forward. *Nat. Rev. Neurosci*. 4, 829–839. doi:10.1038/nrn1201

Basner, M., Babisch, W., Davis, A., Brink, M., Clark, C., Janssen, S., & Stansfeld,, S. (2014). Auditory and non-auditory effects of noise on health. *The Lancet*, 383(9925), 1325-1332. doi:10.1016/S0140-6736(13)61613-X

Bernardi, L., Porta, C., & Sleight, P. (2006). Cardiovascular, cerebrovascular, and respiratory changes induced by different types of music in musicians and non-musicians: the importance of silence. *Heart*, 92(4), 445-520. doi:10.1136/hrt.2005.064600

Biss, R. K., & Hasher, L. (2011). Delighted and distracted: Positive affect increases priming for irrelevant information. *Emotion*, 11(6), 1474-1478. doi:10.1037/a0023855

Blood, A. J., & Zatorre, R. J. (2001). Intensely pleasurable responses to music correlate with activity in brain regions implicated in reward and emotion. *Proceedings of The National Academy of Sciences*, 98(20), 11818–11823. doi:10.1073/pnas.191355898

Boksem, M., Meijman, T. F., & Lorist, M. M. (2005). Effects of mental fatigue on attention: An ERP study. *Cognitive Brain Research*, 25(1), 107–116. Retrieved from http://dx.doi.org/10.1016/j.cogbrainres.2005.04.011

Bradt, J., & Dileo, C. (2009). Music for stress and anxiety reduction in coronary heart disease patients. *The Cochrane Library*.

Brown, T. L., Gore, C. L., & Carr, T. H. (2002). Visual attention and word recognition in Stroop color naming: Is word recognition 'automatic?'. *Journal of Experimental Psychology: General*, 131(2), 220-240. doi:10.1037/0096-3445.131.2.220

Cassidy, G., & MacDonald, R. (2007). The effect of background music and background noise on the task performance of introverts and extraverts. *Psychology of Music*, 35(3), 517–537. doi: 10.1177/0305735607076444

Chanda, M. L., & Levitinemail, D. J. (2013). The neurochemistry of music. *Trends in cognitive sciences*, 17(4), 179–193. Retrieved from http://dx.doi.org/10.1016/j.tics.2013.02.007

Chen, M. C., Tsai, P. L., Huang, Y. T., & Lin, K. C. (2013). Pleasant music improves visual attention in patients with unilateral neglect after stroke. *Brain Injury*, 27(1), 75-82. doi:10.3109/02699052.2012.722255

Chobert, J., François, C., Velay, J. L., & Besson, M. (2014). Twelve Months of Active Musical Training in 8- to 10-Year-Old Children Enhances the Preattentive Processing of Syllabic Duration and Voice Onset Time. *Cerebral Cortex*, 24(4), 956-967. doi:10.1093/cercor/bhs377

Cothran, L., & Larsen, R. (2008). Comparison of Inhibition in Two Timed Reaction Tasks: The Color and Emotion Stroop Tasks. *J Psychol*, 142(4), 373–385. Retrieved from http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2655309/#!po=13.8889

Crawford, J., & Henry, J. (2004). The positive and negative affect schedule (PANAS): Construct validity, measurement properties and normative data in a large non-clinical

sample. *British Journal of Clinical Psychology*, 43(3), 245-265. doi: 10.1348/0144665031752934

Davis, W. B., & Thaut, M. H. (1989). The influence of preferred relaxing music on measures of state anxiety, relaxation, and physiological Responses. *Journal of Music Therapy*, 26(4), 168-187. doi:10.1093/jmt/26.4.168

Derryberry, D., & Tucker, D. M. (1994). *Motivating the focus of attention.* In P. M. Niedenthal & S. Kitayama (Eds), The heart's eye: Emotional influences in perception and attention (pp.167-196), San Diego, California: Academic Press.

Dillman Carpentier, F. R., & Potter, R. F. (2007). Effects of music on physiological arousal: Explorations into tempo and genre. Media Psychology, 10(3), 339-363.

Dockray, S., & Steptoe, A. (2010). Positive affect and psychobiological processes. *Neuroscience and Biobehavioral Reviews*, 35(1), 69–75.. doi:10.1016/j.neubiorev.2010.01.006

Dosseville, F., Laborde, S., & Scelles, N. (2012). Music during lectures: Will students learn better? *Learning and Individual Differences*, 22(2), 258–262. doi:10.1016/j.lindif.2011.10.004

Easterbrook, J. A. (1959). The effect of emotion on cue utilization and the organization of behavior. *Psychological Review*, 66(3), 183-201. doi:10.1037/h0047707

Elsesser, K. G. (2006). Attentional bias and evoked heart-rate response in specific phobia. *Cognition & Emotion*, 20(8), 1092-1107. Retrived from 10.1080/02699930500375712

Fredrickson B. L., Levenson R. W., (1998). Positive emotions speed recovery from the cardiovascular sequelae of negative emotions. *Cognition and Emotion*. 12(2), 191–220. doi: 10.1080/026999398379718

Fredrickson, B. L. (2001). The role of positive emotions in positive psychology. *American Psychologist*, 56(3), 218 –226. Retrieved from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3122271/

Fredrickson, B. L., Mancuso, R. A., Branigan, C., & Tugade, M. M. (2000). The undoing effect of positive emotions. *Motivation and Emotion*, 24(4), 237–258. doi:10.1023/A:1010796329158

Furnham, A., & Strbac, L. (2002). Music is as distracting as noises: The differential distraction of background music and noise on the cognitive test performance of introverts and extraverts. *Ergonomics*, 45(3), 203–217. Retrieved from: http://www.ncbi.nlm.nih.gov/pubmed/11964204

Furnham, A., Trew, S., & Sneade, I. (1999). The distracting effects of vocal and instrumental music on the cognitive test performance of introverts and extraverts. *Personality and Individual Differences*, 27(2), 581–592. doi:10.1016/S0191-8869(98)00249-9

Gabrielsson, A., & Lindström, E., (2010). *The role of structure in the musical expression of emotions*. In P. N. Juslin & J. A. Sloboda (Eds.), Music and emotion: Theory, research, and applications (pp. 367–400). Oxford: Oxford University Press

Gabrielsson, A. (2001) *Emotions in strong experiences with music*. In: Music and emotion: Theory and research, ed. P. N. Juslin & J. A. Sloboda, pp. 431 – 49. Oxford University Press. [arPNJ]

Gerra, G., Zaimovic, A., Franchini, D., Palladino, M., Guicastro, G., Reali, N., Maestri, D., Caccavari, R., Delsignori, R., Brambilla, F., (1998). Neuroendocrine responses of healthy volunteers to "techno-music": relationships with personality traits and emotional state. *International Journal of Psychophysiology* 28(1), 99 – 111. doi:10.1016/S0167-8760(97)00071-8

Grossman, L., Brock-Abraham, C., Carbone, N., Dodds, E., Kluger, J., Park, A., ... & Webley, K. (2013). The 50 best inventions. Time Magazine.

Hallam, S., Price, J., & Katsarou, G. (2002). The Effects of Background Music on Primary School Pupils' Task Performance. *Educational Studies*, 28(2), 111-122. doi:10.1080/03055690220124551

Han, L., Li, J. P., Sit, J. W., Chung, L., Jiao, Z. Y., & Ma, W. G. (2010). Effects of music intervention on physiological stress response and anxiety level of mechanically ventilated patients in China: a randomised controlled trial. *Journal of clinical nursing*, 19(7-8), 978-987.

Hardré, P. L., Crowson, H. M., DeBacker, T., & White, D. (2007). A multitheory study of high school students' beliefs, perceptions, goals and academic motivation. *Journal of Experimental Education*, 75(4), 247–269. doi:10.3200/JEXE.75.4.247-269

Hargreaves, D. J., MacDonald, R., & Miell, D. (2005). *How do people communicate using music?* In D. Miell, R. MacDonald, & D. J. Hargreaves (Eds.), Musical communication (pp. 1–25). Oxford: Oxford University Press.

Hasegawa, H., Uozumi, T., & Ono, K. (2003). Physiological evaluation of music effect for the mental workload. In *Paper presented at the proceedings of 6th Asian design international conference* Tsukuba, Japan.

Hill, A. J. (2013). Music to our ears: The effect of background music in higher education learning environments. *Journal of the Audio Engineering Society*.

Holm, L., & Fitzmaurice, L. (2008). Emergency department waiting room stress: can music or aromatherapy improve anxiety scores?. *Pediatric emergency care*, 24(12), 836-838.

Honing, H., ten Cate, C., Peretz, I., & Trehub, S. E. (2015). Without it no music: cognition, biology and evolution of musicality. *Philosophical Transactions of the Royal Society of London B: Biological Sciences*,370(1664), 20140088

Hunter P. G., Schellenberg E. G. (2010). *"Music and emotion,"* in Music Perception, eds Jones M. R., Fay R. R., Popper A. N., editors. (New York: Springer;), 129–164

Husain G., Thompson W. F., Shellenberg E. G. (2002). Effects of musical tempo and mode on arousal, mood and spatial abilities. *Music Percept*. 20, 151–171. doi:10.1525/mp.2002.20.2.151

Isen A.M, & Daubman K.A. (1984). The influence of affect on categorization. *Journal of Personality and Social Psychology*. 47(6):1206–1217. doi:10.1037/0022-3514.47.6.1206

Isen, A. M., Niedenthal, P., & Cantor, N. (1992). An influence of positive affect on social categorization. *Motivation and Emotion*, 16(1), 65–78. doi:10.1007/BF00996487

Iwanaga, M., Kobayashi, A., & Kawasaki, C. (2005). Heart rate variability with repetitive exposure to music. *Biological Psychology*, 70(1), 61–66.

Janssen, J. H., van den Broek, E. L., & Westerink, J. H. (2012). Tune in to your emotions: a robust personalized affective music player. User Modeling and User-Adapted Interaction, 22(3), 255-279.

Jeong, H. C. (2008). The effect of music therapy on the physiological and psychological status of women college students based on their preference of music. *Journal of Korean Academy of Adult Nursing*, 20(2), 321–330. Retrieved from: http://www.koreamed.org/SearchBasic.php?RID=0094JKAAN/2008.20.2.321&DT=1

Jianga, J., Zhoub, L., Ricksonc, D., & Jianga, C. (2013). The effects of sedative and stimulative music on stress reduction depend on music preference. *The Arts in Psychotherapy*, 40(2), 201–205. doi:10.1016/j.aip.2013.02.002

Juslin, P. N., & Laukka, P. (2004). Expression, perception, and induction of musical emotions: A review and a questionnaire study of everyday listening. *Journal of New Music Research*, 33(3), 217–238. doi:10.1080/0929821042000317813

Juslin, P.N. and Sloboda, J.A. (eds) (2001) *Music and Emotion: Theory and Research*. London: Oxford University Press.

Kahneman D. (1973). *Attention and Effort*. Englewood Cliffs. NJ: Prentice-Hall

Kalat, J. W. (2008). *Biological psychology* (10th ed.). Belmont, CA: Cengage Learning.

Kämpfe, J., Sedlmeier, P., & Renkewitz, F. (2010). The impact of background music on adult listeners: A meta-analysis. *Psychology of Music*. 39(4), 424-448. doi: 10.1177/0305735610376261

Khan, B. E., & Isen, A. M. (1993). The influence of positive affect on variety-seeking among safe, enjoyable products. *Journal of Consumer Research*, 20(2), 257–270. Retrieved from: http://www.jstor.org/stable/2489273

Knight, W.E.J., Rickard, N.S. (2001). Relaxing music prevents stress-induced increases in subjective anxiety, systolic blood pressure and heart rate in healthy males and females. J. *Music Therapy*, 38 (4), 254-272. doi:10.1093/jmt/38.4.254

Krumhansl, C.L. (1997). An exploratory study of musical emotions and psychophysiology. *Canadian Journal of Experimental Psychology*, 51(4), 336–352. Doi:10.1037/1196-1961.51.4.336

Kulkarni , S., O'Farrell , I., Erasi , M., & Kochar MS., M. S. (1998). *Stress and hypertension.* WMJ, 97(11), 34-8. Retrieved from: http://europepmc.org/abstract/med/9894438

Kuribayashi, R., & Nittono, H. (2014). Speeding up the tempo of background sounds accelerates the pace of behavior. Psychology of Music, 0305735614543216.

Kushnir, J., Friedman, A., Ehrenfeld, M., & Kushnir, T. (2012). Coping with preoperative anxiety in cesarean section: physiological, cognitive, and emotional effects of listening to favorite music. Birth, 39(2), 121-127.

Ladinig, O., & Schellenberg, E. G. (2012). Liking Unfamiliar Music: Effects of Felt Emotion and Individual Differences. *Psychology of Aesthetics Creativity and The Arts*, 6(2), 146 –154. doi:10.1037/a0024671

Lamers, M. JM., Roelofs, A., & Rabeling-Keus, I. M. (2010). "Selective Attention And Response Set In The Stroop Task". *Memory & Cognition* 38 (7): 893–904. doi:10.3758/mc.38.7.893

Larsen, P. D., & Galletly, D. C. (2006). The sound of silence is music to the heart. *Heart*, 92, 433-434. doi:10.1136/hrt.2005.071902

Lilley, J. L., Oberle, C. D., & Thompson, J. G. (2014). Effects of music and grade consequences on test anxiety and performance. *Psychomusicology: Music, Mind, and Brain,* 24(2), 184-190. doi:10.1037/pmu0000038

Lingham, J., & Theorell, T. (2009). Self-selected "favourite" stimulative and sedative music listening – how does familiar and preferred music listening affect the body? *Nordic Journal of Music Therapy,* 18(2), 150–166. doi:10.1080/08098130903062363

Lien, M.-C. & Proctor, R. W. (2002). Stimulus-response compatibility and psychological refractory period effects: Implications for response selection. *Psychonomic Bulletin & Review*, 9(2), 212-238. doi: 10.3758/BF03196277

Lloret, S. P., Diez, J., Domé, M. N., Delvenne, A. A., Braidot, N., Cardinali, D. P., & Vigo, D. E. (2014). Effects of different" relaxing" music styles on the autonomic nervous system. *Noise Health*, 16(72), 279-284. Retrieved from http://www.noiseandhealth.org/text.asp?2014/16/72/279/140507

Lundqvist, L. O., Carlsson, F., Hilmersson, P., & Juslin, P. N. (2009). Emotional responses to music: experience, expression, and physiology. *Psychology of Music*, 37(1), 61–90. doi:10.1177/0305735607086048

MacLeod, C.M. (1991). "Half a century of research on the Stroop effect: an integrative review". *Psychological Bulletin*, 109 (2), 163–203. doi:10.1037/0033-2909.109.2.163

MacLeod, C. M. (1992). The Stroop task: The "gold standard" of attentional measures. *Journal of Experimental Psychology-general*, 121(1), 12-14. doi:10.1037//0096-3445.121.1.12

Maratos, A., Gold, C., Wang, X., & Crawford, M. (2008). Music therapy for depression. *The Cochrane Library*.

Marmurek, H. H. C. (2003). Coloring only a single letter does not eliminate color-word interference in a vocal-response Stroop task: Automaticity revealed. *Journal of General Psychology*, 130(2), 207-224. doi:10.1080/00221300309601285

MacLeod, C. M., & MacDonald, P. A. (2000). Interdimensional interference in the Stroop effect: uncovering the cognitive and neural anatomy of attention. *Trends in Cognitive Sciences*, 4(10), 383–391. doi:10.1016/S1364-6613(00)01530-8

Moradipanah, F., Mohammadi, E., & Mohammadil, A. Z. (2009). Effect of music on anxiety, stress, and depression levels in patients undergoing coronary angiography.

Namdar, H., Sadeghi, M. T., Sabourimoghaddam, H., Sadeghi, B., & Ezzati, D. (2014). Effects of Music on Cardiovascular Responses in Men with Essential Hypertension Compared with Healthy Men Based on Introversion and Extraversion. Journal of cardiovascular and thoracic research, 6(3), 185.

Nijhuis, J., Segers, M., & Gijselaers, W. (2008). The extent of variability in learning strategies and students' perceptions of the learning environment. *Learning & Instruction*, 18(2), 121–134, doi:10.1016/j.learninstruc.2007.01.009.

Nilsson, U. (2009). The effect of music intervention in stress response to cardiac surgery in a randomized clinical trial. *Heart & Lung: The Journal of Acute and Critical Care*, 38(3), 201-207.

Pase, M. P., Stough, C., Grima, N. A., Harris, E., Macpherson, H., Scholey, A. B., & Pipingas, A. (2013). Blood Pressure and Cognitive Function: The Role of Central Aortic and Brachial Pressures. *Psychological Science*, 26(9). doi:10.1177/0956797613488602

Radocy, R.E. and Boyle, J.D. (1998) *Psychological Foundations of Musical Behaviour*. Springfield, IL: Charles Thomas

Recours, R., Aussaguel, F., & Trujillo, N. (2009). Metal music and mental health in France. Culture, *Medicine and Psychiatry*, 33, 473–488. doi:10.1007/s11013-009-9138-2

Rowe, G., Hirsh, J. B., & Anderson, A. K. (2007). Positive affect increases the breadth of attentional selection. Proceedings of the National Academy of Sciences, 104(1), 383-388.

Sandstrom, G. M., & Russo, F. A. (2010). Music hath charms: The effects of valence and arousal on recovery following an acute stressor. *Music and Medicine*, 2(3), 137–143.

Schmitz, T. W., De Rosa, E., & Anderson, A. K. (2009). Opposing influences of affective state valence on visual cortical encoding. *The Journal of Neuroscience*, 29, 7199 –7207. doi:10.1523/JNEUROSCI.5387– 08.2009

Schellenberg, E. G., & Weiss, M. W. (2013). 12 Music and Cognitive Abilities.

Simoes GMS, Campagnaro BP, Tonini CL, Meyrelles SS, Kuniyoshi FHS, Vasquez EC. (2013). Hemodynamic Reactivity to Laboratory Stressors in Healthy Subjects: Influence of Gender and Family History of Cardiovascular Diseases. *Int J Med Sci*, 10(7), 848-856. doi:10.7150/ijms.5967.

Smolen, D., Topp, R., & Singer, L. (2002). The effect of self-selected music during colonoscopy on anxiety, heart rate, and blood pressure. *Applied Nursing Research*, 15(3), 126-136. doi:10.1053/apnr.2002.34140

Stroop (1935) *Online Psychological Laboratory*. Retrieved from http://opl.apa.org/Experiments/Stroop.aspx

Tabrizi, E. M., Rad, S. M., Lak, M., & Hajizadeh, E. (2014). The Effect of Music Therapy on Anxiety and physiological variables in Patients under Spinal Anesthesia. *Journal of Applied Environmental and Biological Sciences,* 4(4), 240-246. Retrieved from

http://www.textroad.com/Old%20Version/pdf/JAEBS/J.%20Appl.%20Environ.%20Biol.%20Sci.,%204(4)240-246,%202014.pdf

Tang, Y., Lu, Q., Geng, X., Stein, E. A., Yang, Y., & Posner, M. I. (2010). Short-term meditation induces white matter changes in the anterior cingulate. *Proceedings of the National Academy of Sciences*, 107(35), 15649–15652. doi:10.1073/pnas.1011043107

Thoma, M. V., La Marca, R., Brönnimann, R., Finkel, L., Ehlert, U., & Nater, U. M. (2013). The Effect of Music on the Human Stress Response. *PLoS ONE*, 8(8), e70156. doi:10.1371/journal.pone.0070156

Thompson, W. F., Schellenberg, E. G., & Husain, G. (2001). Arousal, Mood, and The Mozart Effect. *Psychological Science*, 12(3), 248-251. doi:10.1111/1467-9280.00345

Thompson, W. F., Schellenberg, E. G., & Letnic, A. K. (2011). Fast and loud background music disrupts reading comprehension. *Psychology of Music*, 40(6), 700-708. doi: 10.1177/0305735611400173

Tuccitto, D. E., Giacobbi, P. R., Jr., & Leite, W. L. (2010). The internal structure of positive and negative affect: A confirmatory factor analysis of the PANAS. *Educational and Psychological Measurement*, 70(1), 125-141. doi: 10.1177/0013164409344522

Van Den Bosch, I., Salimpoor, V. N., & Zatorre, R. J. (2013). Familiarity mediates the relationship between emotional arousal and pleasure during music listening. *Front Hum Neurosci*, 7, 534. doi:10.3389/fnhum.2013.00534

Van Der Zwaag, M. D., Westerink, J. H., & Van Den Broek, E. L. (2011). Emotional and psychophysiological responses to tempo, mode, and percussiveness. *Musicae Scientiae*, 15(2), 250–269. doi: 10.1177/1029864911403364

Västfjäll, D., Juslin, P. N., & Hartig, T. (2012). Music, subjective wellbeing, and health: The role of everyday emotions. Music, health and wellbeing, 405-423.

Yang, C. Y., Chen, C. H., Chu, H., Chen, W. C., Lee, T. Y., Chen, S. G., & Chou, K. R. (2012). The Effect of Music Therapy on Hospitalized Psychiatric Patients' Anxiety, Finger Temperature, and Electroencephalography A Randomized Clinical Trial. Biological research for nursing, 14(2), 197-206.

Yerkes, R.M., & Dodson, J.D. (1908). The relation of strength of stimulus to rapidity of habit formation. *Journal of Comparative Neurology and Psychology*, 18, 459–482.