Cardiff Metropolitan University

Prifysgol Metropolitan Caerdydd

B.Sc. (Hons) Psychology

Final Year Project

The effects of mood state and emotional content on the deviant sound effect

xxxxx

xxxxx

2017

Dissertation submitted in partial fulfilment of the requirements of Cardiff Metropolitan University for the degree of Bachelor of Science


**Declaration**

I hereby declare that this dissertation is the result of my own independent investigation under the supervision of my tutor. The various sources to which I am indebted are clearly indicated. This dissertation has not been accepted in substance for any other degree, and is not being submitted concurrently for any other degree.

xxxxx……………………………………………………………………………………………………………


Acknowledgments

I have to start by acknowledging the contribution my parents have made to my education; I wouldn’t be here without you and I certainly wouldn’t have managed to finish this, so thank you so much for all you do for me. I would then of course, like to thank my little brother, whom without I would have had much worse break downs and probably thrown my laptop at a wall. A massive thank you has to go to my amazing aunt India for putting up with me in the final dissertation weeks, and supplying food and laughs the whole time. And to my grandmother, Nanan, you have always encouraged me, believed in me, and taken me out for Mexican food, what more could I ask for?

I then have to thank my housemates; Tia for encouraging me not to work, and Meg for encouraging me to work. And a thank you to my ‘psychology crew’, the original team Kim, Jon, Toni and Joe. The library would not have been the same without you. Kayleigh, new to my group but the most helpful person ever and of course so fun, many thanks to you. Thanks to my partner in crime, Will, for his wonderful proof reading and being way too kind to a very stressed me.

And obviously, I would not have managed any of this without the help of my supervisor Nick Perham, I am so grateful for you and I could not have asked for a more calming influence throughout this process.

And finally, a huge thank you to everyone who took part in my study. I know it was a long questionnaire, but thank you to the forty-five people that stuck with it and made my study possible.
Abstract

Research surrounding auditory distraction has led to reports of a new effect; the effect a deviant word has in an otherwise repeated sequence (Escera, Alho, Winkler & Naatanen, 1998). Past studies have looked into this deviance effect and have provided cognitive and neurological reasoning for it (Hughes, 2014; Nostl, 2015). However, research regarding the emotional content of the deviant word, as well as the emotional state of an individual have not been researched, even though both variables are known to have an effect on distraction and an interaction (Buchner, Rothermund, Wentura & Mehl, 2004; Jensen, 1965). Therefore, leading to this research which aims to explore the relationship behind emotion and the effect of deviant words. The study hypothesises that the Positive mood condition will do the worst, Negative second worst, the positive mood will be most distracted by positive deviant words, the negative mood condition will be most affected by negative deviant words, and that neutral words and the quiet control will produce the best scores. The study used 45 participants which were separated into three initial conditions; negative, positive and neutral mood states. This was done twice however, once using participants scores on a mood questionnaire, and once by the music mood condition they were placed in; where the mood was induced using different styles of music (Rigg, 1940). The participants then carried out a serial recall task with forty tasks comprising of ten tasks with irrelevant speech, ten with a negative deviant word, ten with a positive deviant word and ten acted as a quiet control. The serial recall task displayed a single digit (1-9) this was then repeated 9 times for each task, after which the participant was given 30 seconds to write down the answers they could remember in order. The study found no significant three way interactions (F(48)=1.032, MSE=0.017, η²=0.047, p>0.05) and failed to support any of the hypotheses surrounding the deviant effect, and surprisingly showed the opposite to expected as the quiet condition often provided the worst results and the deviant provided some of the best. Overall, more research needs to be carried out proper measures towards counterbalancing need to be considered, as they were not in this study, implications and the use for further research is discussed.
Table of Contents

1.0 Title Page .......................................................... 1
2.0 Declaration .................................................................. 1
3.0 Acknowledgements ....................................................... 2
4.0 Abstract ................................................................... 3
5.0 Introduction .................................................................. 5
6.0 Method ......................................................................
   6.1 Participants ........................................................... 11
   6.2 Design .................................................................. 12
   6.3 Materials ............................................................... 13
   6.4 Procedure ................................................................ 14
   6.5 Ethics ................................................................... 15
   6.6 Method of Analysis ................................................ 16
7.0 Results .................................................................... 17
8.0 Discussion ................................................................... 23
9.0 References ................................................................... 28
10.0 Appendices ............................................................... 31
11.0 Word Count ............................................................. 38
Introduction

Cognitive psychology emerged as a branch of research over fifty years ago and with the subsequent technological advances has evolved into one of the most widely researched areas of modern psychology (Anderson, 1990). One of the most active areas of cognitive psychology, is understandably the research into distraction; as cognition is the study of an individual’s cognitive functions and processes; learning, attention, perception and memory (Anderson, 1990). Cognitive research within psychology varies greatly; not only in subject but in method; many studies use an assortment of questionnaires and experiments relevant to the numerous areas of cognitive ability; reading, memory, or even drawing tasks (Schraagen, Chipman, & Shalin, 2000). Common distraction studies may encapsulate any of the aforementioned experimental techniques whilst simultaneously requiring participants to attend to a seemingly irrelevant stimulus. An example is the Stroop task, one of the most well known in the area. The Stroop task came into prominence when it was first used in 1935 and required participants to state the colour of words rather than the word itself, thus requiring multiple processing facets (Berti & Schroger, 2003). However, this only focused on visual distraction, even if requiring attention to lexical processing. Latter studies have researched the effect of distraction using music, irrelevant sound (Jones & Macken, 1993) and more specifically distinct (Hunt & Worthen, 2003) and deviant (Schroger, 1997) sounds; leading to this research.

Auditory distractions are not an uncommon area of research within cognitive psychology; studies into the area span over recent decades and highlight our reliance on external queues to stay focused and on task (Banbury, Macken, Tremblay & Jones, 2001; Berti & Schroger, 2001). Primarily research focuses on the area due to them being a common cause of complaint in the work environment (Banbury, Macken, Tremblay, & Jones, 2001; Beaman, 2005) and therefore the effects are now studied in controlled environments, to isolate and consolidate causes of distractions. A number of experiments have displayed the negative effects auditory distractions have on cognitive performance. These studies explored the variances of different audio formats such as music, speech and background noise whilst also exploring the effect of semantics and content (Salame & Baddeley, 1982).

The irrelevant sound effect (Colle & Welsh, 1976; Jones & Macken, 1993) is a primary example of popular cognitive research concerned with distraction. As its name would suggest it considers the effect irrelevant sounds (which have been recorded) have on cognitive performance. Studies have demonstrated that it significantly reduces performance on serial recall tasks (Beaman & Jones, 1998). Research into the area therefore states that a working environment would be improved by it being silent. Studies into this area do show on average that silence is the best environment for cognitive tasks as it allows for more concentration without having to attend to background noise (Cassidy & MacDonald, 2007).
Background noise however may be considered an inevitability in the average work place so efforts to reduce the ISE have also been researched; the idea that people will pay more attention to comprehensible speech (Jones & Macken, 2003) and music with lyrics (Huan & Shih, 2011). This is suggested to be due to the changing-state of information associated with speech (Jones & Macken, 2003). However, as for accounting for the irrelevant sound effect, most people will become habituated to working with it; to the extent that background noise in the work place has a much less noticeable impact upon the individual's ability to work (Tremblay, Nicholls, Alford & Jones, 2000). One study even suggested that individuals with a higher working memory are able to better avoid the effects of the ISE (Sörqvist, 2010). This could be due to the fact the ISE is not directly considered due to attention, but rather the effect that conflicting information has on processing information. Work by Buchner also showed that this ‘irrelevant sound effect’ was affected by emotive dialect, and the valence of distractor words significantly impaired serial recall (Buchner, Rothermund, Wentura & Mehl, 2004).

Research surrounding the ISE studies was frequently based in Baddeley’s research concerning the working memory model; the short-term memory system comprising of the visuo-spatial sketch pad, episodic buffer and, most imperative to this study, the phonological loop (1968). However, more recent research may prefer the concept of interference by process, which assumes a process rather than structure based method of attentional selection (Marsh, Hughes & Jones, 2009). Studies into auditory distraction have displayed the effect that they possess over visual and auditory processing within cognitive tasks. Research became oriented to explaining this; one attempt at explaining this phenomenon is the ‘cognitive bottleneck’ suggesting the human mind works similarly to a bottleneck and only limited information can pass through at once (Borst, Taatgen & van Rijn, 2010). Studies have demonstrated that working memory exerts a certain level of control over involuntary attention. This relates directly to the concepts surrounding auditory distraction and that working memory is, to an extent, able to control levels of distractibility in order to stay focused (Berti & Schroger, 2003).

Potentially, words that stand out on an emotional basis are more likely to be remembered or cause a distraction (attended to) as they captivate the participant on a potentially evolutionary scale. For example, a study using spider phobics displayed the relevance of emotion, to an extent, by showing that spider phobics would recall the fourth stimulus in a recall task when the stimulus was simultaneously being associated with the word ‘spider’. The researchers suggest this is down to an evolutionary characteristic that prepares them, to be more alert (Kulas, Conger & Smolin, 2003). However, this could be argued to be down to distinctiveness. If a word stands out more it may be of greater distraction or more likely to be attended to. Therefore, the use of distinctive words would illicit poorer recall within a memory task (Hunt & Worthen, 2003).
The distinctiveness effect is a well-established hypothesis; distinct items are more likely to be recalled over less distinctive stimuli (Calkin, 1986), and therefore are likely to affect memory or attention. Other explanations for the distinctiveness effect include the ‘camatosis’ effect where the mind is performing in a ‘comatose like’ state and only becomes reactive when submitted to a new stimulus (Backamn & Nyberg, 2009).

A novel attentional capture effect is reported in ISE studies where visual-verbal serial recall is disrupted if a single deviation is within the regular irrelevant sounds, highlighting the difference between the ISE and deviant sound effect (Hughes, Vachon & Jones, 2005). This should not be mistaken for the ‘Changing State Effect’ which has been shown to be an independent function acting separately to the deviant effect (Hugh, Vachon & Jones, 2007). The deviant sound effect is a comparatively new area of research within the field of auditory distraction; the deviant effect occurs when changes in an otherwise repetitive auditory stream capture the listener’s attention and therefore impair performance in another cognitive task (Parmentier, 2016). The deviant effect is where there is a unique deviant stimulus in an otherwise sequential stream; differing from changing state where no initial pattern arises.

The deviant effect infers that individuals are distracted, to a greater degree, by a new and perceivably deviant stimulus (Escera, Alho, Winkler & Naatanen, 1998). The effect of a deviant stimulus has a greater prevalence further into a serial recall task as it allows for the individual to become adjusted to the stimulus. However, Bendixen’s and Schroger’s findings suggest new tasks can be picked up after a second stimulus, 2008. Yet some of the first evidence of attention switching, which led to the deviant effect was collected by Cherry in the early 1950’s. Cherry (1953) found that reaction time (RT) was prolonged whenever participants were subject to an unexpected stimulus. This was demonstrated in his research on dichotic listening tasks. Cherry had participants listen to two recordings at the same time but only attend to one. He described this as akin to a person engaging with one conversation at a cocktail party and not another. The studies highlighted the lack of attention paid to one conversation when an individual is focused on another.

Studies often demonstrate the effect of deviant stimuli by requiring the individual to complete a serial recall task, whilst attempting to ignore a string of sound. The effect may be due to acoustic variance, pitch or volume change in potentially any sound type (Escera, Alho, Winkler & Naatanen, 1998) or due to semantic changes in spoken word lists; often categorical lists with one outlier (Parmentier, 2008). However, for the deviant sound to implement any effect, the individual must acknowledge whether consciously, or subconsciously, that the sound is deviant.

Multiple theories as to the mechanisms used to create the deviant effect have been explored. Some researchers suggest that a ‘new-afferent-elements-activation’ model
occurs, where an individual detects deviance through an alternate state of refractoriness to frequently presented stimulus (Pacheco-Unguetti, Parmentier, 2015). Therefore, it may also be perceived as being due to a purely memory-related mismatch mechanism, which is what Schröger theorises (1997; 2000). Schröger’s model for deviance theorises that the individual encodes information and a comparison is then made between the previous and current sound. The information is then either integrated or the mismatch is significant enough to cross a variable threshold. The individual then becomes consciously aware of the deviant detection and an involuntary attention shift occurs (1997). However, these models remain to date only theories. Another explanation is the duplex-mechanism account. This comprises two types of auditory distraction; interference-by-process, where an irrelevant sound disrupts a cognitive task and attentional capture; which can either be specific or aspecific. Attentional capture is of particular relevance to the deviant sound effect as it could explain emotional effects, providing using emotional content greater effects attention (Hughes, 2014; Vachon, Hughes & Jones, 2012).

Cognitive studies frequently overlap with neuroscience and many attempts as to explain such effects have been made on physiological levels. Neuroscience has been able to display the neuroactive responses to ‘mismatch negativity’ (MMN). MMN is the term used to describe the change in neural activity demonstrated after a change in stimulus (Naatanen et al., 1978; 2007), suggesting a physiological basis for the deviant sound effect using more rigorous scientific methods. Such studies suggest a change in the ‘event-related potential’ (ERP; electrophysiological response to a stimulus) depicted by electroencephalogram recordings (Nostl, 2015). Alongside this, pupillary responses have been recorded as reactions to deviant stimuli, and such responses have even been recorded in individuals as young as thirty months (Liao, Yoneyo, Kidani, Kashino & Furukawa, 2016; Fritzche & Hohle, 2015).

These findings prove the deviant effect on a more objective scientific level; if MMN reactions to the central nervous system are able to respond before individuals are even fully aware then more questions concerning the deviant effect arise. Its relation to evolutionary psychology, whether or not it is learnt, and whether or not individuals can learn to ignore the distraction (Roer, Bell, Dentale & Buchner, 2011). A majority of deviant sound studies neglect to recognise the effect that mood state and content has on performance. It assumes all participants are in a neutral mood state, and not exploring any effect of mood inducement or manipulation.

Individual differences can alter performance both positively and negatively in regard to cognitive performance. When taking age into account this is to be expected, as deterioration in cognitive functioning and ageing go hand in hand (Bell, Buchner & Mund, 2008). Another key individual difference is mood state or emotion of the participant; emotions in general impact upon all areas of cognitive performance (Seibert & Ellis, 1991). Emotional content has been shown to have a significant
effect on recall (Bourassa & Besner, 1994). The ‘emotional state’ or ‘mood state’ that a person is in is thought to greatly influence their perception and this influence comprises the majority of cognitive skills. For example, in a study using the Stroop task (where words are displayed in colour and the participant is meant to name the colour the word is written in (Jensen, 1965)) performance was shown to be better in participants with anxiety and this could be because they are tenser and thus more attentive (Hainaut & Bolmont, 2005).

Many studies merely look at content in regard to semantics and varying from repetition. They do not look at the potential emotional content of deviant words. Commonly research focuses on acoustic deviation (Roer, Bell & Buchner, 2014), and large novel sounds (Cowan, Winkler, Tedev & Naatanen, 1993). Research into the area of emotion concerning the deviant sound effect should be expanded upon as studies have not only displayed that auditory distractions may be effected by emotion (Seibert & Ellis, 1991), but also that mood state can increase the deviant sound effect (Pacheo-Unguetti & Parmentier, 2015).

Amir and colleagues found that when using an emotional Stroop task anxious individuals perform slower. However, changing the level of anxiety by placing them in a high pressure, fear inducing situation, interestingly causes them to suppress this anxiety interference and then attend less to the socially threatening words (Amir, Mcnally, Riemann, Burns, Lorenz & Mullen, 1996). Studies such as this allow efforts to be made to improve individuals’ cognitive performance through reducing anxiety inducing situations. Richards and Gross showed the importance of keeping calm to improve cognitive performance in work situations (2000).

Emotion and mood state are impacted upon by emotional content as individuals are most likely to attend to information pertaining to their mood state (Teasdale & Russell, 1983; Mather & Carstensen, 2005). The information that correlates with their mood state would then cause a greater distraction and in a recall task a greater distraction leads to poorer performance. Studies have manipulated mood in order to demonstrate correlations between emotion and auditory distraction (Cassidy & Macdonald, 2007).

As music is so incorporated in our daily lives with new technological advances (Nowak, 2016) it is unsurprisingly the interest of many psychological studies, and has resulted in being depicted as one of the most effective ways to manipulate mood (Rigg, 1940). Music related studies vary as greatly as research concerning music as a form of communication within special needs groups (Gattino, Riesgo, Longo, Leite, & Faccini, 2011) to its possible effects on cognitive performance (Seibert & Ellis, 1991). Studies have used mood-inducing music to counterbalance challenging behaviours (Durand & Mapstone, 1997), and this method is even used within marketing to illicit interest and buying behaviour’s (Alpert & Alpert, 1990). One study asked 144 participants to listen to different genres of music for 15 minutes and carry
out questionnaires pertaining to their mood, tension and mental clarity before and after listening to the music. This study found that rock music induced negative mood states and reduced positive traits (McCraty, Barrios-Choplin, Atkinson, & Tomasino, 1998).

Past research studies into deviant sounds often overlook the initial mood state of participants, and to an extent, appears to ignore individual differences on an emotional level. Therefore, this study will actively manipulate individuals’ mood state using music and it will then test their performance and susceptibility to deviant emotive words whilst participants carry out a serial recall task. Whilst proposing that inducing a positive mood will induce a greater deviance effect toward positive material than a neutral mood would and that people with a negative mood will also show a greater response to the deviance effect with any negative material.

Due to the findings of past research the hypotheses of this study are firstly, that the control condition of quiet will score the highest overall; for all participants, as silence is suggested to be the best environment for cognitive performance (Cassidy & MacDonald, 2007). Then the neutral word condition, as the irrelevant sound effect, will be the only influencing factor. Poorer serial recall performance is also expected when there is a negative word within the negative mood state group as they are likely to attend more to the negative deviant word. Just as the positive mood state group will respond more to the positive deviant word (Mather & Carstensen, 2005) and will therefore will score the lowest, due to the highest levels of distraction.

It can be assumed the negative mood state condition will have a particularly low score as past research suggests people in a negative mood state adhere greater to emotional biases (McCabe & Gotlib, 1995). However, happiness has been shown to increase the deviant sound effect (Pacheco-Unguetti & Parmentier, 2015) so it is assumed the positive people will perform the worst overall. Finally, it is also assumed that the serial recall curve (recall being better towards the beginning and end of a task) will to some extent be observed, even if in the deviant sound tasks it becomes violated (Murdock, 1962).
Method

6.1 Participants

The participants for this study were collected using opportunity and snowball sampling techniques; primarily from within a University in South Wales. Therefore, a majority of the participants are students or within the students' family and friendship groups.

Forty-five participants were collected overall. Due to the between variable of mood of the participants, this study attempted to separate them into three mood groups; positive, negative and neutral. However, as there were two measures of mood, PoMs score and music mood condition, the participants were in fact separated twice.

Initially the 45 participants were to be separated using the PoMs score and separating the possible scores into thirds; however, this did not provide any negative participants, so the actual PoMs scores were separated into thirds; with the lowest scores (-31 to -10) being positive, the average scores (-9 to 12) being neutral and the highest scores (14 to 54) being negative, providing fifteen in each condition.

The music mood was the second way to separate participants; with fifteen in positive, fourteen in negative and sixteen in the neutral condition. Age and gender were not of particular concern when recruiting participants. However, all participants were adults, above eighteen, and all were below sixty. In order to account for deteriorating cognitive ability (Hänninen & Soininen, 1997) age was not recorded, however the study sample gathered was 44.4% male and 55.6% female. The participants worked in a voluntary capacity and received no payment for taking part.

<table>
<thead>
<tr>
<th>Mood State</th>
<th>Music Mood</th>
<th>PoMs Mood</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive</td>
<td>15</td>
<td>15</td>
</tr>
<tr>
<td>Neutral</td>
<td>16</td>
<td>15</td>
</tr>
<tr>
<td>Negative</td>
<td>14</td>
<td>15</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>No. of Participants</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>20</td>
</tr>
<tr>
<td>Female</td>
<td>25</td>
</tr>
</tbody>
</table>
6.2 Design

The study used a mixed design, the first independent variable (IV) was mood; which comprised of three levels; positive, negative and neutral. The second IV was sound; whether the neutral word list with a positive deviant was played, the neutral word list with a negative deviant, the all neutral word list or the quiet condition. The third IV was position of the word within the word list (1-9). The test shall be measuring score on the memory test; the dependent variable (DV) therefore is the score of digits recalled for each task (1-9).
6.3 Materials

The study required music for the positive and negative mood state conditions; music is one of the highest rated mood manipulators and the study will use music such as upbeat, fast tempo music to improve or slow, minimal note variation to decrease positivity (Rigg, 1940; Sloboda, 1991). More recent studies looking into ‘pop’ music suggest Queen’s ‘Don’t Stop Me Now’ is one of the most effective songs for improving mood (Jolij, 2015). Therefore this song as well as the ‘saddest pop song’, ‘The Drugs Don’t Work’ by The Verve (Witchel, 2011) were played at 70dB to influence mood states.

The Abbreviated Profile of Mood States (PoMS) questionnaire (McNair, Lorr & Droppelman, 1971; Grove & Prapavessis, 2016) will be used. It is a forty-point measure of mood state with six emotional subscales (tension, anger, depression, vigour, fatigue, confusion and esteem-related effect), the questionnaire uses a Likert scale of 0-4 on how much a participant is feeling a characteristic at that exact time (i.e. weary) the negative subscales are then added and the positives are subtracted to provide a Total Mood Disturbance (TMD) score; which range from -44 to 116.

Word lists were used within a serial recall task, created from the Affective Norms for English Words (ANEW; Bradley, Cuthbert & Lang, 1998), the ANEW provides word scores from which the positivity of a word can be gauged; using a one-way ANOVA, with SPSS, positive (i.e. cheer and champion), negative (i.e. betrayal and funeral) and neutral (i.e. cabinet and egg) word lists were created, Levene’s test demonstrated variance between the three sub-groups as it was violated and insignificant F(2, 157)=0.2261, p>0.05 (p=0.108). These words were then recorded using a laptop microphone to be played back during the serial recall task, all recordings were of the same woman’s voice with attempts to maintain similar tone, neutral emotion and volume.

The serial recall task was created using PowerPoint (Microsoft Office Plus Professional, 2010), the PowerPoint was comprised of forty, eighteen slide tasks; a one digit number appearing on every other slide for a second, between blank white slides. Each numbered slide had a white background with a single centered digit in the same size black font (Calibri Light, font size 44). The numbers were in a pseudo-random order with attempts to avoid date-like patterns and over repetition within each task. The tasks were also pseudo-random as no pattern in terms of background noise was used, and they were never consecutively repeated.
6.4 Procedure

After participants were collected they took part in the study at their earliest convenience; during practical hours (8am – 8pm) within controlled laboratory style environments; without further auditory or visual distractions. The study began with participants reading the information sheet and then filling out the consent form.

Participants were pseudo-randomly placed into either the positive, negative or neutral (control) conditions and played music relevant to a certain mood state to influence their mood (Rigg, 1940; Sloboda, 1991). If placed into the positive condition participants were played two minutes of Queen’s ‘Don’t Stop Me Now’ (Jolij, 2016) and all were played the same version from thirty seconds into the track.

The same was done for the negative condition using The Verve’s ‘The Drugs Don’t Work’ (Witchel, 2011). Participants assigned to the neutral condition were played no music before beginning the cognitive tasks. Then to guarantee the participant’s mood states had been influenced and that they were within the parameters of the mood state condition to which they were assigned they were all given the Abbreviated PoMs questionnaire (McNair, Lorr & Droppelman, 1971; Grove & Prapavessis, 2016) and asked to circle each answer on the forty-point scale. Their total mood disturbance (TMD) was calculated after the study.

After completing the questionnaire, the participants were ready to carry out the serial recall task. The PowerPoint comprising of forty, nine-digit recall tasks; ten for each condition (completing the task in silence, completing the task to all neutral words, to neutral words with a negative deviant and to neutral words with a positive deviant). Participants were given thirty seconds at the end of each task to write down all the numbers they could recall in order using the answer sheet provided. The number orders were pseudo-randomly selected; the researcher attempted to avoid ‘date-like’ patterns and over use of repetition was also avoided.

The participants were given over ear headphones, which cancelled out a great amount of any potential surrounding sound, so they would just hear the audio feedback of the wordlists which played simultaneously to the presentation of digits within a PowerPoint. The recordings attempted to maintain a similar tone and volume and were all recorded using the same female voice. Overall the study took half an hour for each participant to complete, and afterwards the participant was debriefed.
6.5 Ethics

This study was approved by the Cardiff Metropolitan Ethics Board, and only used adults who are in a state to provide consent for themselves. Each participant filled out a consent form provided by the university (see appendix). Participants were informed that the music might be upsetting and that some emotional content may come up in the study and they could withdraw from the study at any point.

They were also informed that their performance had no reflection upon their intelligence but if they were interested they could request to find out how well they did. Participants were also debriefed and the aim of the study was explained.

Participants were all allocated a random reference number to avoid any bias marking and to maintain a certain level of anonymity and confidentiality should anyone else come across the data. The data was also kept in secure files and was only to be seen by the researchers. All data would be deleted or destroyed after the study was complete.
6.6 Method of Analysis

A 3x5x9 mixed analysis of variance (ANOVA) using the Statistical Package for the Social Sciences (IBM SPSS Statistics for Windows, Version 23) was used to show any possible interactions between mood state, word emotion and placement. A three-way ANOVA was used as the study uses only one DV and multiple IV’s and works with interval and normal data (Coolican, 2014).
Results

Due to the two possible methods that ‘mood’ could be measured (participants PoMs scores and the mood state that was induced via music) the analysis was carried out twice. The first three-way ANOVA was carried out using the music mood conditions as the measure of mood. The analysis of the within subject effects found no significant main effect of sound on score $F(3, 126)=1.349$, $MSE=0.077$, $\eta^2=0.031$ $p>0.05$ or of mood on score $F(2, 42)=0.494$, $MSE=0.368$, $\eta^2=0.023$ $P>0.05$.

However, there was a significant effect for the position on score $F(8, 336)=53.964$, $MSE=3.342$, $\eta^2=0.562$ $p<0.01$, but this could be explained by primacy and recency effects evident in the study, rather than the deviant sound effect. Additionally, there was a significant interaction between sound and position, $F(24. 1008)=1.616$, $MSE=0.026$, $\eta^2=0.037$, $p<0.05$, but again, the pairwise comparisons suggest this was can be assumedly due to primacy and recency effect rather than the deviant effect, and Greenhouse-Geisser was violated $F(13.623)=1.616$, $MSE=0.045$, $\eta^2=0.037$ $p>0.05$. There was also no statistically significant relationship between music mood and position, $F(16, 336)=1.48$, $MSE=0.92$, $\eta^2=0.066$ $p>0.05$, or music mood and sound $F(6, 126)=0.791$, $MSE=0.045$, $\eta^2=0.036$ $p>0.05$.

The three-way interaction between sound, position and music mood was also statistically insignificant $F(48)=1.241$, $MSE=0.20$, $\eta^2=0.056$, $p>0.05$. The mean scores for music mood had no significant differences between them ($p>0.05$), but overall the positive scored the best ($M=0.560$), then neutral scored second best ($M=0.538$) and negative had the worst scores ($M=0.507$).

With regards to the sound condition mean scores, there was again no significant difference between them ($p>0.05$) and unexpectedly the quiet condition did the worst, with the negative condition scoring the best, then positive, then neutral. When looking at position, the primacy and recency curve are evident as the first position scored the best ($M=0.80$) and fell towards the sixth, to then again significantly rise from seventh to eighth ($p<0.05$). Within the negative music mood condition, negative and quiet sound conditions scored the best ($M=0.512$), with positive scoring the worst ($M=0.498$). In the neutral music mood condition, positive sound scored the best ($M=5.60$) then negative ($M=0.558$), with neutral ($M=0.540$) and quiet scoring the worst ($M=0.495$). In the positive condition, negative scored the best ($M=0.584$) then neutral ($M=0.555$), positive ($M=0.554$) and then quiet ($M=0.546$), although these music and sound interactions were not significant, they were interestingly unexpected.

Overall the negative music mood conditions seventh and eighth position scores were notably lower than other scores and were significantly lower than the neutral and positive scores ($p<0.05$).
Fig. 1, Line graph showing the Average Scores of each condition in the Positive Music condition.

The primacy and recency effects are once again evident within the chart, with negative unexpectedly appearing to score highest overall, but drop most notably after the sixth word.

Fig. 2, Line graph showing the Average Scores of each condition in the Negative Music condition.

Within the negative condition the quiet condition plummets the most visibly, however begins with the highest scores.
Within the neutral music condition the participants seem to do most poorly within the quiet sound condition, and the primacy recency curve is demonstrated for all sound conditions.

The second mixed-ANOVA looked at the effects that the participants’ PoMs scores had on results; the within results showed that there was no significant main effect of sound on score $F(3, 126)=1.575$, $MSE=0.085$, $\eta^2=0.036$, $p>0.05$. There was however, a significant main effect of position on score $F(8, 336)=52.218$, $MSE=3.320$, $\eta^2=0.554$, $p<0.01$, but this was due to the primacy and recency effect rather than the position of the deviant word. The between results showed there was no significant effect of PoMs mood on score $F(2, 42)=3.749$, $MSE=2.423$, $\eta^2=0.151$, $P>0.05$. There was a statistically significant interaction between sound and position $F(24)=1.628$, $MSE=0.026$, $\eta^2=0.037$, $p<0.05$, however the pairwise comparisons suggest this was can be assumedly due to primacy and recency effect rather than the deviant effect, and Greenhouse-Geisser was violated $F(13.215)=1.628$, $MSE=0.047$, $\eta^2=0.037$, $p>0.05$. There was no significant relationship between PoMs mood and position $F(16, 336)=0.900$, $MSE=0.057$, $\eta^2=0.041$, $p>0.05$. There was a significant relationship between PoMs mood and sound, $F(6, 126)=2.241$, $MSE=0.120$, $\eta^2=0.096$, $p<0.05$, however, Greenhouse-Geisser was violated $F(4.933, 103.593)=2.241$, $p>0.05$. The three way interaction between sound, position and PoMs mood was statistically insignificant $F(48)=1.032$, $MSE=0.017$, $\eta^2=0.047$, $p>0.05$.

Pairwise comparisons of score success means show a significant difference between the negative and positive PoMs mood conditions ($p<0.05$), with negative scoring better then positive (with a mean difference of 0.133). No significant differences were found in the pairwise comparisons between sound conditions.

**Fig. 3.** Line graph showing the Average Scores of each condition in the Neutral Music condition.
however quiet did the worst overall (M=0.517) then neutral (M=0.535), then positive (M=0.539) then negative (M=0.552). The primacy and recency curve was noted, similarly to the previous analysis. With regards to the PoMs scores within the neutral condition, the negative sound condition scored best (M=0.553), then positive (M=0.552), then neutral (M=0.549) and then quiet (M=0.522). Within the positive mood condition, quiet scored the best (M=0.490), followed by negative (M=0.480), positive (M=0.454) and neutral (M=0.435). Finally, in the negative mood condition negative scored the highest (M=0.624), then neutral (M=0.619), positive (M=0.610) and quiet (M=0.539), however none of these differences were statistically significant (p>0.05). Overall the negative mood condition scored the best (M=0.598) then neutral (M=0.544) then positive (M=0.465).

Fig. 4, Line graph showing the Average Scores of each condition in the Positive PoMs condition.

The graph suggests poorest recall in the quiet condition, and greater recall for the neutral condition until the forth digit where both positive and negative appear to overtake, varying greatly throughout the rest of the task.
Fig. 5, Line graph showing the Average Scores of each condition in the Negative PoMs condition.

The graph shows a large decrease in score in the neutral condition with the ‘negative mood state’ participants, with the quiet condition scoring highly.
Fig. 6, Line graph showing the Average Scores of each condition in the Neutral PoMs condition.

Once again, the primacy and recency effect are evident, however, with the quiet condition scoring quite poorly and a considerably high recall score on the negative word position.
Discussion

The study aimed to explore the links between mood state and emotional content on the deviance effect. Using forty-five participants a musical mood inducement was carried out; followed by the PoMs questionnaire to measure the mood (McNair, Lorr & Droppelman, 1971; Grove & Prapavessis, 2016), rather than just assuming that the inducement was successful.

The participants then undertook a 40-part serial recall task which comprised of 10 quiet and 10 neutral irrelevant speech tasks as controls, and 10 negative, 10 positive deviant word tasks. The mean scores were calculated and the results were analysed using a three-way ANOVA. The mixed three-way ANOVA was carried out twice as there were two ways of considering the participants mood state as the mood inducement and mood recorded via PoMs were not entirely concurrent.

Firstly, the results with regards to music mood state shall be discussed, the first hypothesis ‘that the positive mood state participants will have the poorest recall overall’ was not at all supported by the results. In fact the positive condition scored the best even though these results were not statistically significant the first null hypothesis is accepted.

The second hypothesis that ‘the negative condition would do the second worse’, was not the case. However, the negative participants did do worse than the neutral condition, yet again this was not statistically significant.

The hypothesis suggesting that the positive mood state group would be most distracted by the positive deviant was correct with regards to the other sound conditions. However ‘quiet’ did poorer and these results were again statistically insignificant.

The same was hypothesised for the negative mood state, ‘that it would be most affected by the negative deviant sound tasks, as individuals are assumed to pay the most attention to stimulus most relevant to their emotional state’ (Teasdale & Russell, 1983; Mather & Carstensen, 2005). However the opposite was found with the negative and quiet conditions scoring the best. ‘Quiet’ was expected to induce the best recall, but instead individuals appeared to have better recall when faced with negative deviants, perhaps due to the associations between the negative words inducing better a recall of sorts.

The assumption that neutral words would draw the least attention and therefore the neutral as the neutral sound condition scored second worse overall, with the mean accuracy only scoring better than the quiet condition. Which leads to the sixth prediction of the study; that quiet would do best overall. However, this was evidently not the case within this study and although there was no significant difference between sound conditions, the fact ‘quiet’ did the worst is extremely controversial as there is so much past research to the contrary (Cassidy & MacDonald, 2007).
It may be inferred that this was instead due to the quiet condition going against what was expected; participants expected distracting sounds and therefore the quiet became a deviant. Overall, the recall curve displaying primacy and recency was demonstrated in all conditions as was expected (Murdock, 1962), and explains away most of the results which were shown to be significant, and interactions with position.

The second analysis used PoMs as the measure of mood and results supported the first hypothesis; ‘that the positive mood condition would score the poorest’. Although this was the case these results were not statistically significant. The negative mood condition however, leads the second hypothesis to be rejected, with the negative mood state scoring highest, rather than the assumed second lowest. The third hypothesis, that suggests the positive participants, in this case the participants with the lowest PoMs scores would be most distracted by the positive deviant sound condition, however the neutral sound condition scored the most poorly, with positive second to last.

The similar hypothesis concerning the negative PoMs group, was shown to be null, as the negative word tasks scored the best within the negative mood condition, even if insignificantly. The fifth hypothesis suggesting the neutral word tasks would provide the best scores out of the sound conditions, due to the lack of emotional importance capturing attention, and the quiet condition were the same between conditions and therefore is still not supported. Overall, none of the hypotheses are fully accepted as little of the relations are significant and most of the position data can be explained by the recall curve (Murdock, 1962) rather than any presence of the deviant effect.

The lack of hypotheses met could be due to a reasonably weak methodology; the study failed to use the correct counterbalancing measures, the effects of practice and order are both well researched and supported (Mandler & Dean, 1969). Yet, minimal counterbalancing was set in place to account for these; all participants carried out the tasks in the same order, and although the order was random, and all tasks were repeated, order effects are not accounted for, and thus practice effects; as participant’s were able to carry out the serial recall for three sound conditions before the first quiet task. In effect, the lack of counterbalancing undermined the validity and reliability of the study. To account for it forty-five random PowerPoints should have been made, using the same words in each task, but all PowerPoints would be made up of unique task orders. The participants may have also benefitted from a controlled practice round before beginning, to understand how to correctly carry out the task.

As well as the flaw in counterbalancing, the measures used for other variables were less than ideal. The PoMs score upon the initial data analysis would have provided the study with no negative participants if using the possible scores as a comparison. PoMs is also regularly used to measure different aspects of mood rather than just grouping together positive, negative and neutral mood groups (Parmentier, 2008). The questionnaire is more commonly used in athletes and looking at different feelings, however some of the terminology used in PoMs is questionable in itself;
some of the terms confused participants, who were generally of a younger generation and were not familiar with words like ‘bushed’.

Some of the emotions deemed as negative were also open to interpretation, restless for example could have also been associated with positive energy. Of course, the issue can be expanded to state that many moods and emotions are not universal, and undoubtedly and questionnaire would struggle to function in a multitude of cultures.

This alongside the matter that the PoMs scores did not correlate with the music mood score suggests not only was PoMs a questionable method with regards to validity but the music mood inducement techniques were also flawed. This could be due to a number of issues with regards to music mood inducement; preference of music could have influenced individuals’ mood, the research behind mood inducement suggests certain songs will induce negative emotional states, but this is reliant on individual differences being virtually non-existent.

Issues concerning words and their context within the study went beyond the potential faults with PoMs. The study used the ANEW (Bradley, Cuthbert & Lang, 1998) to create word lists, allowing the researcher to ensure valence of each sound group. However, the ANEW has only a finite amount of words within each range, making it perceivably impossible to have created thirty sets of words pertaining to the same context. That is, most deviant studies look at obvious semantic differences; using a fruit name in a list of sports, for example, whereas this study merely looked at random, yet strongly emotive words as a deviant, in an otherwise random group of emotionally neutral words. Although the deviance effect should have still taken place as it still contained a deviant, the sequence may have been more difficult to grasp, in part explaining the lack of significant results. And to maintain a high valence words were repeated, as the study comprised of forty tasks, this however, may have caused some confusion to participants. Other issues may have arisen with the word list regarding individual differences once again, certain words may have a particular meaning to an individual; even though the ANEW was used this could have been an issue with the neutral words having emotive meaning to certain individuals. The ANEW is comprised of averages from a large sample, however, these averages could allow for a large variation in how the word is actually viewed.

Often research regarding music inducement looks at rock music and assumes it induces negative feeling in its listeners (McCraty, Barrios-Choplin, Atkinson, & Tomasino, 1998). However, personal preference could affect this, otherwise all individuals who enjoyed rock music would adhere to the same negative archetypal traits. The songs chosen (Don’t Stop Me Now and The Drugs Don’t Work) were both popular songs which undoubtedly most participants had heard and therefore may associate with other situations and emotions rather than the assumed negative and positive connotations of the tunes.
Past research has suggested sad songs may induce happy emotions purely based on the nostalgia behind them (Huron, 2011). As well as in regards to auditory stimulation the effects of the visual aspect of the task; the PowerPoint could have been reviewed, the PowerPoint was controlled in such that timing, colour, font and font size were the same throughout, however certain research suggests that other colours than white background and black font may be seen and potentially attended to better (Halls & Hannah, 2004).

Improvements to the study could include a more varied selection of participants, although this can be said of most studies, the research may have benefitted from a more of a multi-cultural cross section; as culture may have an effect on task success (Bell & Buchner, 2007). As well as a reduction in students, who were more likely to conform to social desirability, which they likely were able to as many of the participants were psychology students which may have picked up on the aims of the study.

If changes to the study had have been made, and then provided significant research it would have had an impact on how the deviant effect is viewed. For instance, with regards to the cognition regarding the deviance effect, an emotional influence would display how, concurrent with other effects that attention can be prioritised to emotional content. This, in principle, could extend to support theories regarding the deviant sound effect, and on a larger scale, theories behind distraction on a whole. If this was the case it could also support past research regarding evolutionary psychology (Kulas, Conger & Smolin, 2003); in that certain words are able to require one’s attention on an uncontrollable basis; perhaps an innate evolutionary throwback allowing people to pay attention to more socially important information. And of course, as with most auditory distraction research would highlight the use of inhibiting emotional language in cognitive work environments, and the effect of mood state on distraction in the work place. Further research and work could be done to reduce the effect of emotional distraction.

Therefore, future research should be carried out to include the suggested changes as well as considering the effects other cultures may have on both music preference, and the views towards mood and emotion. The PoMs questionnaire relies heavily on a subjective view of mood, which may not necessarily be cross-cultural as well as the aforementioned exhaustive knowledge of more colloquial dated British terms.

Different music types may not be translated well to different cultures; not only can the lyrics lose meaning but different styles may be more familiar to different individuals and evoke different moods (Balkwill & Thompson, 1999). Individual differences regarding gender could have been studied as not only have men and women displayed different cognitive abilities (Cosgrove, Malure & Staley, 2007), they may also show differences with music effect on their mood, as well as the words they are more likely to attend to and even the voice they might attend more to.
The voice used was that of a young English woman and this could have impacted upon the words which came across as most prevalent, as well as how each person interpreted the emotional context and whether they paid much attention to them.

The voice used was that of a young English woman and could have been impacted upon the words which came across as most prevalent as well as how each person interpreted the emotional context and whether they paid much attention to them. In society, it is widely acknowledged that men and women are not always viewed equally (Savran, 1998) this may have, by some extension, affected the amount of attention paid by the participants; if a man’s voice was used perhaps the sound effects would have been greater. Also, even though the same recording equipment was used and care was taken, no other forms of moderating the voice was used; as in tone and emotion portrayed could have come across, requiring participants to adhere more to certain words. Ideally a monotone automated voice could have been used for better control, and therefore simple replicability for other studies.

Overall, the research displays the effects flawed methodology can have on findings, even rebuking effects that are widely accepted. ‘Quiet’ should not have done as poorly as it did and although it is previously suggested that this could be due to the changing state or deviant effect from and irrelevant sound to silence, it is more than likely due to the lack of counterbalance measures put in place. As well as that it could stand to further demonstrate how often individual differences are ignored in cognitive studies and that a small student heavy sample may not be the best participant set. However, extraneous and confounding variables are an inevitability in any research. The study still proposes an interesting question concerning the effects of mood and emotional content on the deviant sound effect and highlights the need for more research in the area.
References


Witchel, H. (2011) *You are what you hear*. Algora Publishing; New York, USA.

13 December 2016
ethics /appinprincipal

BSc (Hons) Psychology
Cardiff School of Health Sciences

Dear Applicant

Re: Application for Ethical Approval: The effects of mood state and emotional content on the deviant sound effect

Your Ethics Application, as shown above, was considered by Psychology Ethics Panel on 07/12/2016.

As a result, your application was APPROVED IN PRINCIPLE as being ethically sound. However, full approval was withheld because the Panel/Committee felt that some amendments/further information were required as follows:

1. Include word list to be presented to participants

Please make the amendments to your application, highlighting the changes made, and/or provide the supporting documents as applicable, and submit them to the relevant Panel/Committee for reconsideration.

Please note that this is not final approval.

Do not commence any activity on this project until you receive the final approval confirmation.

Yours sincerely

Dr Nick Perham
Chair
Psychology Research Ethics Committee
Cardiff School of Health Sciences

Tel: 029 20416255
E-mail: nperham@cardiffmet.ac.uk
Title of Project: The effects of mood state and emotional content on the deviant sound effect.

Participant information sheet

The study
The study aims to explore the effects of mood states and emotional content on the deviance effect; the effect emotion plays on distraction.

What would happen if you agree to participate?
If you agree to take part in this study you will be agreeing to take part in memory tasks whilst listening to audio distractions, you may initially be played a small piece of music which may influence your mood state, you will also be asked to fill out a questionnaire describing your mood.

Exclusion criteria
You must be over 18 years of age.

Potential Risk
No obvious risks are anticipated. You may listen to some music and you may hear some negative words such as ‘angry’.

Potential benefits
You may receive credits towards your module, as well as taking part in a unique study furthering the research into auditory distractions.

Withdrawal, anonymity and confidentiality
Your name will not be taken, all data will be securely stored in a password protected PC and only I and my supervisor will see the data. You can withdraw your data at any point up until the end of the testing session.

If you have any questions about the study, please contact: Nick Perham on nperham@cardiffmet.ac.uk
PARTICIPANT CONSENT FORM

Reference Number:
Participant name or Study ID Number:
Title of Project: The effects of mood state and emotional content on the deviant sound effect.
Name of Researcher: xxxxx

Participant to complete this section: Please initial each box.

1. I confirm that I have read and understand the information sheet for the above study. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily.

2. I understand that my participation is voluntary and that I am free to withdraw at any time before leaving the experiment, without giving any reason.

3. I agree to take part in the above study.

_______________________________________   ___________________
Signature of Participant

_______________________  ___________________  ___________________
Name of person taking consent  Date

____________________________________  
Signature of person taking consent
Word List

Negative words; Cancer, Betray, Loneliness, Dead, Killer, Grief, Bomb, Abuse, Funeral, Death.
Positive words; Beauty, Love, Lucky, Baby, Cash, Paradise, Romantic, Champion, Cheer, Delight.
Neutral Words;
Vanity
Vest
Violin
Wagon
Windmill
Window
Table
Tank
Taxi
Tease
Time
Tool
Tower
Truck
Trumpet
Trunk
Umbrella
Vest
Violin
Sphere
Spray
Square
Statue
Stiff
Stomach
Subdued
Quart
Radiator
Rain
Rattle
Reserved
Reverent
Rifle
Rough
Rock
Scissors
Seat
Odd
Office
Paper
Part
Passage
Patent
Patient
Pencil
Phase
Pig
Plain
Poetry
Poster
News
Noisy
Nonchalant
Nun
Iron
Journal
Jug
Kerchief
Kerosene
Item
Kettle
Knot
Lamp
Lawn
Listless
Locker
Machine
Material
Metal
Museum
Door
Egg
Elbow
Elevator
Engine
Excuse
Fabric
Foot
Fork
Frog
Fur
Gender
Glacier
Glass
Habit
Hairpin
Hammer
Hard
Highway
History
Horse
Humble
Icebox
Indifferent
Industry
Chin
Circle
<table>
<thead>
<tr>
<th>Word Count</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Abstract</td>
<td>375</td>
</tr>
<tr>
<td>Introduction</td>
<td>2,777</td>
</tr>
<tr>
<td>Method</td>
<td>1,390</td>
</tr>
<tr>
<td>Results</td>
<td>1,019</td>
</tr>
<tr>
<td>Discussion</td>
<td>2,296</td>
</tr>
<tr>
<td>Total</td>
<td>7,482</td>
</tr>
</tbody>
</table>

Signed;

Date;