Music for the Mind: A study into musical preferences, personality traits and memory retention

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*Submitted in partial fulfillment of the requirements for the Master of Research at Western Sydney University.
Statement of Authentication

The work presented in this thesis is, to the best of my knowledge and belief, original except as acknowledged in the text. I hereby declare that I have not submitted this material, either in full or in part, for a degree at this or any other institution.

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Abstract

Previous research has demonstrated a link between musical preferences, memory and personality, but has yet to explore them in combination. This thesis reports on two experiments: a pilot study (N=42), which examined the initial premises put forward by the thesis, and a second study (N=100). Statistically insignificant trends were found in the pilot study. No significant results were found when musical preferences were compared to the previous literatures predictions, resulting in a follow up analysis. Previous findings in the literature between personality traits and musical preferences were not replicated. In Study 2, no significant results were found for the first two hypotheses. Multiple correlations were found between the facet levels of the Big Five Aspect Scale and the genres of the Short Test of Musical Preferences. Significant results were found in both studies that warrant further examination, with some future directions discussed in the conclusion of this thesis.
Chapter one: Introduction

Music is a universal phenomenon, transcending cultural and physical barriers with an ease that some researchers have found intriguing (Simmons-Stern, Budson, & Ally, 2010). Music Processing takes place in many parts of the brain, including the auditory cortex and the motor cortex with some overlap in the language centres such as Broca’s and Wernicke’s areas (Johnson et al., 2011). It has been shown to influence the cognitive, emotional, and physiological reactions of people (Proverbio et al., 2015; Samson, Dellacherie, & Platel, 2009; Verrusio et al., 2015; Yang & Li, 2013; Zantinge, van Rijn, Stockmann, & Swaab, 2017).

But to describe it as such, theorists argue, is to ignore a vast aspect of music’s role in human society (Blum, 2013; P. N. Juslin, Barradas, & Eerola, 2015; Koelsch, 2015; Krumhansl, 1991; Paulson, Bharucha, Iyer, Limb, & Tomaino, 2013; Samson et al., 2009). Music changes the dynamic of many situations that it enters; for example, consider any serious or tense movie scene with the music replaced with something more suited to cartoons (ShelleyCraig, 2012, 4, 13). The feeling, both as it was intended and the way it is experienced almost immediately changes. One example of this is the Sega Classic video game ‘Sonic the Hedgehog’ (sonicKAI, 2008, 9, 25). In some parts of the game, the main character of the game (Sonic) is required to traverse areas that are completely underwater. There is a subtle tension as the player must guide the character to a breathable space before they run out of air. However, this tension is greatly increased by the music. The frantic tone, with a quickly accelerating beat, instils a sense of panic that is not achieved by simple silence or by watching a bar (that represents the current level of oxygen ‘Sonic’ has left) slowly empty.

The fact remains, regardless of personal experience with the examples above, that music has the power to evoke some form of reaction, small or large in the listener (Robinson, 2005). Reacting, or not reacting as the case may be, is a response to the music experienced. Even if it does not evoke an emotional or physical response, it has still has entered the conscious mind.
and in doing so will have caused the individual to form a judgement upon it. But why? What is it about music that can transcend language barriers, that can evoke such varied emotions regardless of whether an individual may wish them to?

Some attempts have been made to understand this concept, such as a study by Juslin and Västfjäll (2008). These authors developed a seven-item model, describing these mechanisms, known as the BRECVE (Brain stem reflex, Rhythmic entrainment, Evaluative conditioning, Emotional contagion, Visual imagery, Episodic Memory). The Brain Stem Reflex refers to a process where emotion is evoked by music because some of the fundamental acoustics of the music are mistaken for an important or urgent event (Such as sudden loud noises). When music that is particularly dissonant, or feature quickening beats, as described in the Sonic example above, the listener can often become uneasy or stimulated(Patrik N. Juslin & Västfjäll, 2008). Rhythmic Entrainment occurs when an emotion is evoked by a piece or section of music, due to a powerful rhythm of the music influencing the internal bodily rhythm of the listener. Such as certain beats mimicking a quicker heartbeat than the listener has, this can occasionally induce the heart rate of the listener to increase as well (within reason), to match this beat. As a result, the body confuses this for the experience of an emotion and thus, to correct itself, induces that emotion. Evaluative conditioning refers to a process where music is paired with a stimulus respectively, thus colouring the music with the emotion normally associated with that stimuli. Such as selecting a song for a morning alarm. If one is a late riser and has difficulty waking, then that alarm clock becomes a negative stimulus. Which when paired with the song, induces a negative emotional reaction in the listener even when the stimuli are not paired (i.e., when the song comes on the radio in the car). Emotional contagion, however, is the most commonly understood aspect of music emotion evoking. When the listener perceives an emotion within the music they listen to, they can sometimes mimic the emotion internally. Such as a sad song making an individual sad, not because it reminds them of anything, but because
they feel sympathy with the singer. Visual imagery refers to emotions evoked because of images conjured by listening to music (such as a song about a beach party inspiring an image of a pristine beach filled by friends and family). Episodic memory induces emotion by recalling a specific memory within the listeners experience (such as a couple’s first dance song). Musical expectancy induces emotion by violating the expectations that the listener had about the progression of the music. Such as when a song suddenly stutters in its beat, or switches keys into one higher or lower than was expected. These events can cause a sense of dissonance within the listener, evoking pleasant or unpleasant emotions. However, none of these explain why this occurs across linguistic and cultural barriers, regardless of ability to comprehend the actual vocals within the song.

Answering this question is beyond the scope of this thesis, even though the question is indeed an important one. Rather this thesis will discuss how music can be used in the context of learning. Is there a way to make use of this almost involuntary emotional evocation, to enhance another part of everyday life?

Regardless of a person’s position within the world, memory is a fundamental aspect of daily functioning. Consider high school students frantically cramming for their test, the Psychology student desperately trying to remember how to use a statistical package or the office worker trying to remember what the meeting they are about to attend is about. What if there was something that could be done to aid them in these dilemmas?

Previous studies appear to show that there seems to be a bias within the human condition, which orients individuals towards retaining information more accurately when it is conveyed in an aural manner, particularly if that information is accompanied by a musical intonation or rhythm (Lola Cuddy & Duffin, 2005; L. Cuddy, Sikka, & Vanstone, 2015; Farrugia, Jakubowski, Cusack, & Stewart, 2015; Simmons-Stern et al., 2010). These studies have also established a
connection between music and memory, in that it appears to aid retention in some ways. But not everyone likes the same musical styles. People are unique and highly variable, and it is these individual differences which may alter the pleasure they take in certain styles or genres of music. Personality traits, often referred to as Individual differences in academic literature, may impact which musical styles individuals find pleasant to listen to, and by extension, which ones might help them retain information more accurately (Verrusio et al., 2015). After all, pleasant stimuli are more easily remembered, such as the taste of your favourite birthday cake, or the sound of a loved one’s laughter (Vuilleumier & Trost, 2015). Thus, knowing what influences what stimuli is favourable would be a great help in aiding memory.

Previous research has investigated music and memory (Farrugia et al., 2015; Jakubowski & Müllensiefen, 2013; Simmons-Stern et al., 2010; Verrusio et al., 2015), personality and musical preferences (Delsing, ter Bogt, Engels, & Meeus, 2008; Rentfrow & Gosling, 2003; Yang & Li, 2013), and personality and memory (Cummings, Poropat, & Loxton, 2016; McDougall & Pfeifer, 2012; Rasmussen & Berntsen, 2010). However, no study appears to bridge the gap and investigate them together. That is, to date, no study to our knowledge has investigated musical preferences, memory retention and personality traits within the same study. This thesis will rectify this by investigating whether the mere presence of music can enhance the retentive capabilities of the human brain, or if there is an unconscious bias towards preferred music that would allow for better recollection. Furthermore, it will add to the understanding of how music preferences are influenced by personality traits, and if the effect of these personality traits influence the effectiveness of music as a memory-enhancing tool.

Understanding this possible interconnection will contribute to a greater understanding of the human brain. If it is truly a machine, as theorised by Information Processing Theory (Gurbin, 2015), then despite the individual preferences, there should be a distinct imbalance in the results. Similar to a computer with too many browser windows open, listening to music should
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decrease memory performance abilities. If, however, there is something to this bias toward preferred music, that would allow for music and memory to be strongly associated and for those associations to be influenced by personality traits, then it would raise important questions about the ways in which information is encoded within the brain. Furthermore, given the academic focus towards learning rote information (Fazio, 2008; Hermann, 2013; Hunter-Doniger & Berlinsky, 2016; Jones & English, 1926; McDowd & Botwinick, 1984; Roche et al., 2009), would it not be prudent to identify ways in which this crucial formative learning can take place more effectively?

It is, therefore, the purpose of this study to answer the questions raised above. To do so, this thesis will first review the significant literature in three key areas; Memory, Music and Personality. The discussion will then bring together the major theoretical reasoning found in the literature in each key area and use this to establish a framework for the current study and the key hypothesis that form the basis for the studies reported herein.
Chapter two: Memory

Since this thesis focuses on the effect of music on memory function, this chapter will discuss the significant theories associated with memory. Understanding the importance of memory function both to human kind, and within the brain itself, helps to better appreciate its relevance and why improving its capacity, and our ability to expand it, is of such interest. Memory is the gateway to the past. Without it there can be no culture, no purpose in moving forward (Brewer & Rubin, 1996). Stories are carried from person to person ensconced in memory, across generations, to keep alive knowledge of a time long past. It provides the basis for culture and society as it is currently understood to be (Brewer & Rubin, 1996). A collective and shared knowledge of the world, an assembly of communal experiences that allow for cohabitation and cooperation with other individuals in society, are based on memory. Memory forms not only the basis of cultural formation and identity, but the basis of individual identity as well. This is what memory is understood to be, at least at a societal level. But what exactly is meant by the term itself, memory?

Memory is the process by which information from the outside world is internalized, recorded and sorted. It is the method by which the brain learns and adapts to its environment, consisting of three primary processes; Encoding, Storage and Retrieval (Iqbal & Ahmad, 2015). Encoding allows for information to be sensed through physical and chemical stimuli and translated into a pattern the brain can record. This pattern includes any interpretations (emotional or cognitive) relating to the stimuli that the brain has made. Storage, the second process, allows for the creation of a permanent record of the encoded information amongst the neural synapses. The third process, Retrieval, involves accessing the stored encoded information and restoring it to conscious awareness (Iqbal & Ahmad, 2015). Depending on the type of information stored, and the vividness and emotional potence with which the information itself was encoded, retrieval may be a simple and effortless process, or it may involve a more cognitively
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demanding search. From a practical standpoint, understanding the ways in which information is absorbed and retained within the brain itself is incredibly important as it forms the basis of our culture and society (Gamino, Chapman, Hull, & Lyon, 2010).

**Forms of Memory**

Previous research has established that there are two main forms of human memory, short and long term. Short term memory, also referred to as working memory (McDowd & Botwinick, 1984; Nisbett, 2009), allows for the recollection of information for a short duration (Approximately several seconds to a minute) without rehearsal. For example, in order to hold a conversation with someone, multiple items must be kept in memory. First, the individual must retain memory of the previous sentence that was spoken by the conversation partner, including any impressions or reactions they had to these words. Second, the relating answer to that sentence must also be considered, although not always to a complete extent. After completing that exchange however, the information – unless critical or emotionally salient- is no longer useful and can be forgotten. Early research into memory formation, particularly in the area of short term, indicated that the short-term memory could typically hold seven distinct items (McDowd & Botwinick, 1984). However, modern research estimates this capacity to be far lower (between 2-5 items; (Nisbett, 2009)Short-term memory is believed to rely mostly on an acoustic code for storing information, with a lesser focus on visual information (Brainerd, Reyna, & Ceci, 2008; McDowd & Botwinick, 1984). These studies found that participants had difficulty in recalling collections of letters that were acoustically similar as opposed to those that were visually similar. This was ascertained by grouping sections of words together that sounded acoustically similar, such as ‘puh’ and ‘buh’, or bough or bow. While the visual system was able to distinguish these collections and recall them, participants experienced particular difficulty with the acoustically similar words. As the confusion was centred on the
acoustic similarities rather than the visual, it implies that the information was encoded at an acoustic level.

The storage in short term memory generally has a strictly limited capacity and duration, as described above, which means that information cannot be retained within this system indefinitely. While this limited capacity and retention for information can be improved, through a technique known as chunking, it cannot be extended infinitely (McDowd & Botwinick, 1984; Nisbett, 2009). The process of Chunking involves breaking down the information into more palatable and meaningful items, such as a phone number being broken down into three sections (Area code, three digits, and then the last four digits; Nesbitt, 2009). It is theorised by some (Mastin, 2010), that the relatively small capacity of short term memory is to provide an evolutionary advantage. That is, the imperative to pay attention to a small number of important objects or events in the surrounding area in order to speed up mental processing and reaction time for decision making.

Working memory, refers to the processes of attention that take place while the information is in short term storage. That is, the ability to retain information and direct conscious attention to it. Examples of this can be seen in the everyday, when students must keep certain mathematical equations in the forefront of their mind, even as they attempt to solve it (De Liaño, Stablum, & Umiltà, 2016).

Short-term memory itself, is a capacity within the brain for holding information, but not necessarily for manipulating it. Hence where the working memory aspect comes into this. Instead, short-term memory allows for information to be retained for a short amount of time, allowing for the choice to be made to bring meaningful attention to it (i.e., processed by working memory and evaluated), thus providing the opportunity for integration into long-term memory (Mastin, 2010). Furthermore, it is assumed that information within the short-term
memory capacity spontaneously decays over time (Mastin, 2010). This decay can be prevented or delayed by extending subject rehearsal, ensuring that the information is consistently new and re-entering the limited storage capacity again.

In contrast to this limited space, long-term memory can store much larger quantities of information for, potentially, unlimited durations (Brainerd et al., 2008). For example, a randomized set of seven digits may only be recalled for a few seconds before forgetting commences (indicating that it is stored within the short-term memory). However, once the information is made meaningful in some way (i.e., into a telephone number or bank code) and repetitive, it is transferred to long-term memory and becomes available for continued recall (Brainerd et al., 2008).

While short-term memory appears to mostly encode information acoustically, long-term memory seems to encode it semantically (i.e., in meaningfully similar ways). Previous research into memory acquisition studies indicate that past events are best remembered when they are immersed in emotional context or are emotionally salient (Erk et al., 2010; Ochsner & Gross, 2008) or when they are subjected to a deep semantic analysis (Lockhart & Craik, 1978). Semantic encoding, or semantic analysis in this case, is the processing and encoding of sensory input alongside particular meanings or contexts (Campoy, Castellà, Provencio, Hitch, & Baddeley, 2015; Crespo-Garcia, Cantero, Pomyalov, Boccaletti, & Atienza, 2010; Guimond & Lepage, 2016), such as a shopping list that, when recalled later, is organised into categories such as Fruits, Vegetables and Meat or Dinner, Lunch and Breakfast (Guimond & Lepage, 2016).

Studies of verbal short-term memory usually involve an immediate recall of unrelated words or letters (Campoy et al., 2015; Crespo-Garcia et al., 2010). When this information is made meaningful, given a category or context, it becomes markedly easier to recall (Campoy
et al., 2015). Interestingly, the higher the imageability of the words themselves, the better the participants were able to recall them (Campoy et al., 2015) indicating that, at least in part, the information was progressing to being stored in long-term memory rather than short-term. That is, the more easily a word can be associated with a picture, such as with Tree, Pencil, or Fire, the easier these words become to recall. In contrast, abstract words such as Justice or Morals, are significantly harder to associate with an immediate picture, thus making them a little more difficult to remember.

As for how it is clear that long term memory is semantically encoded as opposed to acoustically, previous research has discerned that after a twenty minute period participants had difficulty recalling words with similar meaning as opposed to words that were not meaningfully similar (Odigwe & Davidson, 2005). The authors indicate that the semantically similar words would become grouped together into one category, such as dog, which made it difficult to recall individual words such as Dachshund, Husky, Doberman, or Chihuahua. As the short-term memory can be said to be encoded acoustically, some form of combination or alteration must occur for that information to then transfer to the long-term memory storage. If this is the case, then perhaps by combining music with unrelated information, it may be possible to trick the brain into encoding meaning where there is none and aid the shift from short to long-term memory.

**Methods of Improving Memory**

Over the course of human development, the amount and type of information that it has become necessary to remember has increased significantly. No longer relying on primitive survival reasonings, such as what game is safest to hunt, what berries are not toxic, humans must endeavour to remember a wide variety of seemingly meaningless information. This has resulted in different forms of memory storage, from the early depictions of humans hunting drawn on cave walls, through to the invention of the written language, to the mass digital storage and
media capabilities in use today. Along with these physical memory deposits, a number of memory enhancement strategies have been developed. Some of these forms for enhancing memory will be discussed below.

Rote Learning and Gist Reasoning

Rote learning, or rote memorisation, can be defined as a repetitive rehearsal of visual or auditory information (i.e., telephone numbers, grocery lists, verses of a song, etc.) for the purpose of moving it from short to long-term memory (Iqbal & Ahmad, 2015; Odigwe & Davidson, 2005). In short, the process of rote learning fixes information in long-term storage through sheer repetition rather than requiring someone to engage intellectually or emotionally with the material (Gamino et al., 2010; Iqbal & Ahmad, 2015; McDowd & Botwinick, 1984; Odigwe & Davidson, 2005). As such, rote learning is often associated with a more surface or superficial understanding of a topic, as opposed to a deeper and arguably more profound view that gist reasoning is seen to provide (Gamino et al., 2010; Iqbal & Ahmad, 2015; McDowd & Botwinick, 1984; Odigwe & Davidson, 2005). Gist reasoning requires individuals to explore how new information resonates with their current knowledge and use that interaction to abstract meaning. This process allows them to understand the key themes or meanings rather than the exact text verbatim (Alberts, 2009).

There are two theories that examine the ways in which individuals process information into memory. The first is Information processing theory. This theory has been described as an essential frame work for understanding human cognitive functionality across several decades (Gurbin, 2015). While there is no single author associated with this theory, it is often considered to have evolved in the early 1960’s alongside the development of computers (Gurbin, 2015). Crucially, the theory describes human cognition as mimicking the mechanistic perspective of information. That is, in order for a computer to react to commands, it must first receive external data, extract meaningful information from that data, organize it into a category
based on established rules, and then express output according to those rules (Gurbin, 2015). People, supporters of this theory believe, act in similar ways, with neurobiological systems of the brain and sensory organs acting as the hardware, and the consciousness of the individual (i.e., their personality and history) acting as governing rules. These rules then inform the individuals reaction to the stimuli with which they are presented (Gurbin, 2015). Within this model, information is processed singularly, or in parallel. That is, all information is invariably connected to other pieces of information, as it is with the computer mainframe (Gurbin, 2015).

The second theory to examine human cognition, is that of the Fuzzy Trace Model (Brainerd & Reyna, 1990; Brainerd & Reyna, 2015; Brainerd et al., 2008; Reyna & Brainerd, 1995; V. Reyna, 2012). This theory makes predictions about an individual’s judgement, decision making ability and memory. The research on this theory comes from multiple perspectives, including psycholinguistics, emotion and social judgement, memory and cognition and Gestalt theory. Initial concepts for this theory were developed by psycholinguists and mimic the rote and gist memory forms listed above. According to the Fuzzy Trace Theory, memory is encoded in two key forms, a verbatim representation and a gist representation. Gist was defined as being based on the essential overall meaning of the information (without specific detail), and Verbatim which was characterised as a more surface form interpretation of stimuli (V. Reyna, 2012). The verbatim representation is the sensory input, the actual events or objective stimuli as it is without participant perception. Gist, however, is the subjective interpretation of that input which is entirely unique to each individual and in line with the previous knowledge the individual has (Reyna, 2012). These levels are believed to be separately encoded (Brainerd & Reyna, 1990; Brainerd & Reyna, 2015; Brainerd et al., 2008; Reyna & Brainerd, 1995; V. Reyna, 2012) That is, encoded both in separate places and in different ways.
Gist representations are primarily used in judgements and decision making, especially in the short term (i.e., within minutes of information intake). It is also the primary focus in long term decision making as well (Brainerd & Reyna, 1990; Brainerd & Reyna, 2015; Brainerd et al., 2008; Reyna & Brainerd, 1995; V. Reyna, 2012). Research indicates that people tend to have a processing preference, that is, they prefer to rely on gist rather than verbatim whenever possible (Reyna, 2012). This is thought to be because gist representations often support intuitive processing, an unconscious and typically resource light form of processing. Verbatim representations however, generally support a conscious analytical approach, which is more cognitively demanding (Reyna, 2012). While a curious development, given the overall content information of verbatim memory, the preference for gist-based processing tends to improve reasoning, as gist memory tends to be more stable and less subject to interference. This can be because there are less specifics to remember, and because emotional impressions are markedly more vibrant in the memory than facts, or perhaps because the information is more closely connected with encoded memory.

Since both types of memory are encoded differently, an individual who displays high proficiency at remembering factual information (i.e., lists, or objective events) may not necessarily be adept at gist reasoning, and vice versa. This evidence of dissociation between the two forms appear to counter previously held notions within information processing theory which indicated that proficiency in one area would invariably be linked with another (Brainerd & Reyna, 1990; Reyna & Brainerd, 1995; Reyna, 2008; Reyna, 2012). More recently however, it has been proposed that in the rare occasions a relationship does exist between the two levels, it is most likely that gist reasoning will shape the content of the verbatim memory rather than vice versa, favouring a top down processing approach (Gamino et al., 2010).
Mnemonics

The word mnemonic can be traced back to Mnemosyne, the Greek titan of memory, and is generally considered to mean something, be it word or process, that aids memory (Higbee, 1979; Nissen, 1997; Odigwe & Davidson, 2005; Rust & Blick, 1972; Soemer & Schwan, 2012). Verbal mnemonics are a process by which information is paired with certain lexical devices, such as assonance, monosyllables or rhyme to facilitate recall (Nissen, 1997). Colloquially, mnemonics are used in ways that many would not initially suspect, such as various folk proverbs. For example, when to plant crops, when rivers would flood or when storms were due (Nissen, 1997). Rhymes such as ‘Red Sky at night, shepherds delight, Red Sky at dawn, shepherds warn’ is one such example, one that predicted a storm should the sky be tinted with a red hue as the sun rose.

When the word mnemonic is used in a more formal setting however, it generally refers to one of three distinct categories. The first, the Loci et Res method (Method of Loci), in which a familiar structure (the locus) was paired with the item to be remembered (the res) (Higbee, 1979; Soemer & Schwan, 2012). Typically, this system is most effective when attempting to remember items in a serial order. For example, a person would choose a familiar house, in which the walls, windows, decorations are all associated with certain names or events by means of symbolic images. To recall these items, the person would search the rooms where this information is stored. The second category is that of the mnemonic Peg system, which works by creating mental associations between two concrete objects (typically nouns and numbers)

Finally, the phonetic mnemonic system, which is primarily used to memorise numbers. This is done by converting the numbers into consonants, then by adding vowels to make them into words (Higbee, 1979; Rust & Blick, 1972; Soemer & Schwan, 2012).
Both visual and acoustic encoding mnemonics have been shown to improve paired associate learning, the positive effects of which remained stable without further rehearsal for a period of a week (Soemer & Schwan, 2012).

Relative usefulness of types of memorisation

In regard to Gist memorisation, there are several advantages to consider, especially regarding improving recollection. Research has indicated that memory for information encoded via Gist memorisation is more persistent over time, compared to memory for detail (Reyna, 2012). Similarly, by being a more general form of information, it becomes far more applicable to a wider set of circumstances and problem-solving contexts (Reyna, 2012). Particularised details, like those recorded by verbatim memory, are relevant to a far narrower range of problems. Furthermore, as a processing system, it is less effortful than verbatim. Consider a computer trying to render a game, the more detail heavy the environment, the harder the computer must work at creating it. Reduce the detail however, and the processing speed increases. Gist processing in the human brain records less detail but allows for faster decision-making cognition (Brainerd & Reyna, 1990; Reyna & Brainerd, 1995; Reyna, 2008; Reyna, 2012).

Knowing this however, it may be hard to understand why verbatim memorisation would be of any use at all. However, there are distinct circumstances where verbatim memory is the more useful of the two. As stated above, verbatim is adept at recording detail heavy situations, which are sometimes required (Reyna, 2012). Consider a medical student, or a lawyer, both must have an encyclopaedic knowledge of their field that cannot be substituted with a generalised understanding. Verbatim memorisation is also ideal for short term approaches, when complete understanding is impossible in the short amount of time given, such as in timed memory tests (V. Reyna, 2012). Furthermore, verbatim memorisation is the most susceptible to the ‘chunking’ memorisation technique, given the necessary formation and structure (V. Reyna, 2012).
Verbatim memorisation is also of considerable interest because while most people have demonstrated a preference for gist processing, especially regarding decision making and making judgements (Reyna, 2012), gist processing is not what is primarily emphasised in many contexts within the education system. To learn, information must be repeated and rehearsed until each word is verbatim, rather than understanding the meaning behind the words. For example, consider when students must learn the rules of grammar (I before E except after C) or when they must memorise the periodic table elements. Some students would create acronyms that expressed the first twenty elements by their symbol and used the novelty of saying such a ridiculous word aloud to help cement that into memory. For clarification, the resulting acronym is HHELIBECNOFNAMGALSIPSLARKCA (Hydrogen, Helium, Lithium, Beryllium, Boron, Carbon, Nitrogen, Oxygen, Fluorine, Neon, Sodium, Magnesium, Aluminium, Silicon, Phosphorus, Sulphur, Chlorine, Potassium, Calcium) pronounced as ‘Hee-leo-be-bo-k-nof-ne-na-mgal-sips-clack-a’.

It is for this reason, despite the natural preference towards gist, that this study has chosen to focus on Verbatim memory. Of the two, verbatim memorisation is perhaps the more challenging for students to develop. However as discussed above, it is a necessary part of learning in many situations, being the method of memorisation more likely to aid in recall exact lists.
Chapter three: Music

Music can be a multitude of things, depending on who is consuming it. This chapter does not seek to define what music is, as that would take many more pages than we have room for, rather it will explore the key relationships between music and the various components of memory and other key factors that appear to influence this relationship.

**Music & Memory**

It is believed that as linguistic capabilities developed in human culture, music became a way of conveying important information and expressing restrained or restricted emotions and opinions. As such, music has become almost intrinsically linked to the formation of both individual and collective identities (Smythe, 2013). Music, like paintings and dance, is one of the few expressive forms that can transcend cultural and linguistic barriers (Smythe, 2013). Music, vivid artwork and dance can express emotions that do not require formal translation. In a way, the emotions evoked by these expressive forms bypass ordinary methods of understanding (i.e., verbal comprehension) and instead appeal to the more creative and empathic regions of the brain (Greenberg, Müllensiefen, Lamb, & Rentfrow, 2016; Smythe, 2013). Music, regardless of type, can influence and shape our perception of the world around us (Greenburg et al., 2015).

Whether it is because of this linguistic flexibility, or because it has a way of imparting meaning to otherwise meaningless information, music has been intertwined with communicative exploits throughout history (Smythe, 2013). Martial tunes and marches have been used for hundreds of years in an effort to call the populace to war and to instil parochial pride. Songs were often designed to provide entertainment (thus maintaining an individual’s attention) while also imparting difficult or complex knowledge about the society in which it existed.
Alongside this cultural aspect, which has occurred throughout the development of human kind, music also has been shown to act as a mnemonic device (Simmons-Stern et al., 2010). Typically, the most successful mnemonic devices use repetitive melodies, simple lyrics and follow a tail rhyming scheme, where the rhyme is present in the final syllable of the verse (Simmons-Stern et al., 2010). For example, in the children’s show ‘Sesame Street’ the characters teach children the English alphabet through song “A is for Annie, B is for Bert, C is for Cookie monster and D is for desert” (Sesame Street, 2013). In this example, the beat is simplified; lyrics are basic, and the rhyme occurs at the end of each line (i.e., BERT rhymes with de-SERT).

**Music & Autobiographical memory**

Music is the closest thing to time travel that we humans currently possess, “hearing a song from the past can transport you back in time, triggering the sights, sounds and feelings of a specific event” (pg. 1, Abstract) (Belfi, Karlan, & Tranel, 2015). Certain songs have the capability of returning one to the moment it was first heard, when the emotional connection was forged. This includes sights, sounds and feelings (Belfi et al., 2015). Belfi, Karlan and Tranel (2015) found that the addition of music increased the vivacity of autobiographical memories. This means that not only were the memories evoked by music, but that they were more vivid than the other conditions in the study (i.e., memories evoked by famous faces).

**Music & Short-term memory**

It has been suggested by some (Cirigliano, 2013; Michael, David, Gerald, & Volker, 2014) that the temporal pattern structure in music can enhance cognition. Recent research has examined if a musical rhythmic structure can enhance verbal learning in patients with Multiple Sclerosis (MS- Michael et al., 2014). What these researchers found was that musical mnemonics allowed for a deeper encoding process to occur during verbal learning, and that this effect was present in patients with MS- whose neural networks are degraded by demyelination (a characteristic of
MS in which the myelin sheath that surrounds nerve fibres degrades, resulting in delayed or entirely ceased nerve impulses. What this appears to indicate is that the presence of music combined with the information presented and allowed it to bypass the usual short-term memory limit and begin to be encoded within long-term memory.

Previous research has shown that music memory provides access to verbal knowledge, that is, recollection for verbal information is improved, even in patients with memory disorders (Simmons-Stern, 2012). It has been established that use musical mnemonics display significantly improved reactions over verbal rehearsal techniques, especially with developmentally disabled students (Claussen & Thaut, 1997; Skeja, 2014). A structured music listening protocol, in which music and information are coordinated, enhanced a broad range of cognitive functions in autistic children (Bettison, 1996).

Music can serve as a sort of auditory scaffold in order to improve recall (Wallace, 1994). The melodic and rhythmic structure provides a recognizable and organised cue for the temporal order and correct sequencing of information. It is particularly useful when attempting to use the chunking technique (Deutsch, 1982; Michael et al., 2014; Snyder, 2000).

Music & Long-term memory

However, rhyming alone does not seem to be the only factor that influences memory. In one study, the popular notion that textual memory— that is memory for the written word or for various poems and stories— can be supported by music was extended to foreign language learning (Good, Russo, & Sullivan, 2015). In this instance, the focus was on the addition of singing to otherwise verbally imparted information, in contrast to a text presented as poetry. Ecuadorian children (who spoke Spanish) that sang a novel English passage for two weeks outperformed those that learned the same passage as part of a poem (Good et al., 2015). This
indicates that it is not merely the presence of rhyme that impacts retention, but the addition of music itself. Perhaps, it is the music that helps to assign meaning.

**Memory for Music**

In another study, further evidence to support the theory that music influence memory retention was found. In contrast to typical studies in this area, this study did not test the memorisation in the context of the practical aspects of music learning (i.e., playing an instrument or singing), but rather exposure to instrumental and vocal melodies (Weiss, Schellenberg, Trehub, & Dawber, 2015; Weiss, Vanzella, Schellenberg, & Trehub, 2015). In this study, musicians and non-musicians were pitted against each other in a test of musical memory. That is, could musicians, who have experience analysing and using melodies, remember songs (i.e., instrumental and vocal melodies) better than non-musicians? While they found that musicians showed an advantage for remembering instrumental melodies, when it came to vocal melodies both groups performed comparatively (Weiss, Schellenberg, et al., 2015; Weiss, Vanzella, et al., 2015). These results indicate that while familiarity with certain types of musical pitch and tone may help for remembering abstract information (i.e., music without voice), it is not necessary when that information is given meaning (i.e., when lyrics and vocals are included).

Another study supported these results, indicating that music could improve cognition and that this effect exists from a young age (Weiss, Schellenberg, et al., 2015). What was found was that adults remembered melodies when they were accompanied by vocals, as did children as young as seven or eight. The study found that there was a differential processing of vocal and instrumental melodies as a subject developed, and further supporting the concept that information is deemed cognitively important when conveyed musically (Weiss, Schellenberg, et al., 2015).
MUSIC FOR THE MIND

Music effects on Cognitive ability

Colloquially it is believed that classical music, particularly Mozart, makes you smarter. The ‘Mozart Effect’ as it is known, draws on a popularised study from the literature that many believe proved the relationship between music and intelligence. For example, in 1998 the governor of Georgia announced that his budget would include a set amount per year in order to provide each child born in Georgia with a tape or cd of classical music (Sack, 1998). The relationship, however, is a little more complex than most would believe. The original study was (Rauscher, Shaw, & Ky, 1993)which found that listening to a specific composition of Mozart enhanced performance on a test of spatial reasoning in a group of college students for about 15 minutes. However, there was no evidence that the effect was specific to Mozart, or that it increased general intelligence, or that it worked in children.

Subsequent studies have shown that the effect also works with other types of music including Phillip Glass (a contemporary composer) and popular music. Verussio et al., (2015) examined the impact of Mozart on the participants brains, specifically after they had listened to L’Allegro Con Spirto (Mozart’s Sonata) and found that there was a distinct increase in alpha wave frequency. As Alpha waves are responsible for memory formation, cognition and problem solving, thus it was believed that any increase in these rhythms would allow for markedly improved cognitive performance (Verrusio et al., 2015). However, there is no indication that this is a permanent effect, nor does it appear to persist after a significant duration of time. There are other ways that music could enhance cognitive functioning, one of which may lie in the Arousal theory, which is discussed below.

Arousal theory

While it is relatively easy to characterize states of sleep and wakefulness, it is significantly more difficult to quantify arousal. Arousal is characterised as a state of being activated or excited (Jeong & Biocca, 2012). Operationally, the more aroused a person is, the more
Responsive they become to sensory stimuli from any modality. This increase also occurs in the motor systems and reactive emotionality responses (Quinkert et al., 2011). Physiologically, arousal is characterised as a heightened activation of the Autonomic Nervous system (ANS) which consists of two major systems (Parasympathetic Nervous System and Sympathetic Nervous system), both of which are involved in the affective cognitive and behavioural responses of individuals (Jeong & Biocca, 2012). Researchers consider arousal to be crucial for an individual to meet social goals, as it allows for emotions to be tuned and adapted to what the situation requires (Chambers et al., 2015). Arousal is one of the key dimensions in two-dimension models of emotion, the other being Valence (a hedonic tone of feeling, pleasant vs unpleasant). According to this model, all emotions can be described according to these two dimensions. For example, serenity may be classified as a pleasant emotion which is low in arousal, while excitement may be similarly pleasant, but is typically high in arousal.

A certain level of arousal is, according to the research, conducive for high functioning cognitive tasks, i.e., one does not generally perform well on cognitive tasks when feeling sleepy (Bullock & Gilliland, 1993; Chang et al., 2016; Cohrdes, Wrzus, Frisch, & Riediger, 2017; de Lecea, Carter, & Adamantidis, 2012; Garde, Albertsen, Persson, Hansen, & Rugulies, 2012; Jeong & Biocca, 2012; Lawson, Gauer, & Hurst, 2012; Quinkert et al., 2011; Ünal, de Waard, Epstude, & Steg, 2013; Zantinge et al., 2017; Zeng et al., 2017).

Within the field of arousal studies, there are several important findings related to this. Firstly, is the Yerkes-Dodson Law (Yerkes & Dodson, 1907), which states that performance increases with physiological or psychological arousal, but only to a certain extent. If levels are too high, or too low, then performance decreases (Jeong & Biocca, 2012).

Following this, is Eysenck’s theory of optimal stimulation (Bullock & Gilliland, 1993). Bullock and Gilliland (1993) discussed the biological basis of arousal, arguing that extraverts
and introverts have differing levels of initial activation within the Ascending Reticular Activation system (ARAS). The ARAS is thought to moderate the cortical arousal capabilities and resting arousal of an individual. Bullock and Gilliland argued that the threshold at which introverts and extraverts can become aroused, and the level at which they normally exist (resting or baseline arousal levels) tend to differ. A key factor of Eysenck’s theory is the argument that introverts have a higher baseline rate of arousal, meaning that they require far less stimulation to become overstimulated.

Incorporated within this theory is another (Hebb, 1955). Hebb introduced the concept of optimal arousal, that both introverts and extraverts search for optimal arousal levels in order to function successfully in both cognitive and physical tasks. What is most intriguing about this information is that it presents the possibility that highly arousing music may be more effective for improving cognitive function in extraverts but may not have the same positive effects for introverts, due to their resting arousal. In contrast, highly arousing music might overstimulate introverts, leading to a decrease in their cognitive performance due to the Yerkes Dodson Law. It is here that the effect of Mozart’s music becomes clearer, perhaps it is not merely a reaction to the music of Mozart, but rather a set of circumstances resulting in optimum stimulation. It could explain why the effect was not replicated with a similar classical music track from Beethoven (Verrusio et al., 2015)

Previous research has also found that emotionally arousing information or material has been associated with a higher rate of recall than information that is neutral in nature (Jeong & Biocca, 2012). As one of the primary functions of music is its capacity to be emotionally arousing in nature (Farrugia et al., 2015; Proverbio et al., 2015), combining it with neutral information may engender difficult to recall information with an emotional affect, increasing its chances of being recalled. This capacity for music to increase emotional arousal will be discussed in more detail in the next subheading.
**Music & Emotion**

Music has demonstrated an ability to influence emotional states, with a capacity to alter the emotions of participants at any given point to echo the emotion of the song being played (Greenburg et al., 2015). Further research indicates that this emotional connotation, particularly in regards to classical music, has a direct impact on cognitive ability and memory (Farrugia et al., 2015; Proverbio et al., 2015). One study compared the impact of four distinct pieces of classical music on facial recognition and participant response times (Proverbio et al., 2015). Two of these classical pieces were categorized as emotional in nature (Bach II movement from Concert in D minor for two violins and Part-Cantus in memoriam de Benjamin Brittan), and were shown to increase participant accuracy whilst also decreasing response times.

But what is it that imbues emotional connection? What is it that allows for music to cause such reactions in us, and furthermore, given what is known about memorisation in general, what is it that might affect our ability to memorize rote information?

**Musical preferences**

Research indicates that individuals show stronger preferences for some genres of music over others, but what is it that determines these preferences? Are certain individual differences (i.e., personality traits) associated with preferences for certain types of music?

Cattell was one of the first to consider these questions, hypothesizing that music could help psychologists understand personality. It was theorised that the preferences people displayed for certain genres of music could reveal important information about the personality that most personality tests overlook (Cattel & Anderson, 1953; Cattell & Saunders, 1954). But where Cattell believed that musical preferences could provide a window into the unconscious, more current researchers theorize that they are a manifestation of explicit personality traits (i.e., those that are expressed outwardly through behavioural preferences and reactions). For example,
sensation seeking behaviours, such as those exhibited by people high on Extraversion (Delsing et al., 2008) demonstrate positive correlations with preferences for Heavy metal, Punk Music, and Rock (Delsing et al., 2008). Those that demonstrate sensation seeking behaviours also demonstrate negative correlations with preferences for Religious and Soundtrack genres (Little & Zuckerman, 1986). In addition to this, those that score highly on scales of Extraversion and Psychoticism (an early version of Clinical Psychopathy (Miller et al., 2010)) have been shown to prefer music that emphasises a heavy bass line (such as those that are present in Rap or Dance music; (McCown, Keiser, Mulhearn, & Williamson, 1997).

There are two key theories that provide support for the link between musical preferences and personality traits. These are Arousal theory and Social Identity (Rentfrow & Gosling, 2003). First, physiological arousal (i.e., the heightened state of physical activation as described above) has been shown to be affected by the type of music played. For example, those that prefer Heavy metal as a genre tend to experience a higher state of resting arousal than those that prefer Country music. Following this, when heavy metal fans listened to heavy metal (i.e., when their preferences were matched) their arousal levels showed a higher increase than those that of country music fans (Gowensmith & Bloom, 1997). Similarly, those that demonstrate a preference for highly arousing genres of music (Rock, Alternative, Rap, Heavy Metal and Dance) show a positive correlation to resting arousal, sensation seeking behaviours and antisocial behaviours (McNamara & Ballard, 1999). This could be an example of the optimal stimulation principle at work, with introverts and extraverts attempting to attain the optimal state of arousal by manipulating it through external stimuli.

Previous research into musical preferences has indicated that judgements in musical preferences also serve as cues in interpersonal communication, due to stereotypical attitudes towards specific musical types (Lastinger, 2011) which then extends to fans of those musical types (Rentfrow & Gosling, 2003). Notably, some studies have found that people appear to
prefer to listen to music that reflects specific personality characteristics that they either have or wish to emulate (Delsing et al., 2008; Rentfrow & Gosling, 2003). Similarly, there is evidence to suggest that people make use of music to communicate their values, attitudes, and self-perceived status (Delsing et al., 2008; North & Hargreaves, 2000).

A key study on the theory of musical preferences and personality traits was conducted by Rentfrow and Gosling (2003). To determine a theory of musical preferences, it was first important to understand the level of abstraction (i.e., Most specific- Song, Artist, to less specific – Genre, to very broad – loud or soft) necessary to categorize this previously unexplored subject. The consensus reached by the researchers was that it was best to use genres, as it was the natural level that people would use when conversing about musical taste. While there were occasions where the subjects would broaden their terminology (i.e., loud music) or narrow it down to a specific artist or song, genres remained the most consistent category to arise in normal conversation (Rentfrow & Gosling, 2003).

In order to determine which genres and subgenres were necessary to include in the development of this new measure, a multistep process was used (Rentfrow & Gosling, 2003). First, a preliminary pool of music preference categories was created via a free association task. Then, to ensure a wide variety of music multiple online music stores were consulted. This resulted in 80 music genres and subgenres (14 genres, 66 sub genres). While preference rating of these genres and subgenres indicated that very few of the test participants were familiar with all the sub genres, most were familiar with the 14 broader genres presented, further cementing the level of abstraction chosen (Rentfrow & Gosling, 2003). This allowed researchers to develop the Short Test of Musical Preferences (STOMP- Rentfrow & Gosling, 2003), which is composed of: Alternative, Blues, Classical, Country, Electronica, Dance, Pop, Jazz, Folk, Heavy Metal, Religious, Soundtracks and Soul/Funk.
To determine the major dimensions of musical preferences, the authors performed a principal components analysis on participant ratings (on the STOMP questionnaire). This resulted in four main factors being determined, and thus arose the problem of labelling these four dimensions. To do this, seven psychologists (including the authors of the study) investigated the factor structure and generated labels that described the main themes of the music within each factor. Factor 1, later named Reflective and Complex, was composed of Blues, Jazz, Classical and Folk Music. These genres were thought to encourage introspection and displayed structurally complex formations. Factor 2, later named Intense and Rebellious, consisted of Rock, Heavy metal and Alternative music, all of which were high energy and highlight themes of rebellion. The third factor (Upbeat and Conventional) was composed of Country, Soundtracks, Religious and Pop- genres that were structurally simple and that emphasize positive emotionality. The fourth factor (Energetic and Rhythmic) was defined by Soul/Funk, Rap/ Hip Hop and Dance/Electronica, all of which share a common liveliness and highlight rhythm over all else.

The study revealed some important connections between the four key music preference categories identified by the authors and certain personality traits from the Big Five Model and other measures of personality. Personality and the models used to characterise it will be discussed in more detail in the subsequent chapter. However, at this point, several key findings from Rentfrow and Gosling’s study can be noted. First, the Reflective and Complex Dimension showed a positive relationship to Openness to Experience (from the Big Five Model), self-perceived intelligence, verbal ability and political liberalism. This lead researchers to characterise those that prefer music within this dimension as inventive, creative, people who find value in aesthetic experiences, and show a high tolerance for others and tend to reject conservative ideals.
The Intense and Rebellious dimension showed a positive relationship with Openness. Interestingly while this dimension contains music that highlights negative emotionality, those that prefer music from this dimension do not appear to display any correlations with Neuroticism, or negative correlations with Agreeableness. Individuals that prefer this dimension of music are characterised as curious, risk takers that prefer to engage in physical activity and consider themselves to be intelligent.

The Upbeat and Conventional dimension showed positive correlations with three traits from the Big Five Model; Extraversion, Agreeableness and Conscientiousness, but was negatively correlated with Openness. The researchers suggested that individuals who prefer this dimension tend to be cheerful, socially outgoing, reliable and altruistic. The Energetic and Rhythmic dimension was positively related with Extraversion and Agreeableness. These individuals were characterised by the researchers as talkative, forgiving, full of energy and tending to perceive themselves as physically attractive.

While these were important findings, and they established the first foray into personality traits and musical preference research, there were some key areas that remain to be explored. While knowledge of these preferences is important, Research to date does not seem to have investigated comprehensively if these preferences influenced other aspects of cognition such as memory. It is the intention of this study to expand upon the conclusions found in this research and to investigate if an interconnection exists between musical preferences and short-term memory retention.
Chapter Four: Personality

While some of the preceding topics have been discussed at length for many years, personality, or rather the Five Factor Model and the concept of personality traits, has only recently begun to gain popularity among social scientists (Anusic & Schimmack, 2016). This means that there is still a large amount that is undefined and not understood. This includes relationships, interactions, impacts and effects of personality traits on many psychological characteristics.

The Five factor Model, and the concept of personality traits as a whole, have become more popular among social scientists in recent years (Anusic & Schimmack, 2016). Personality traits are of interest to social scientists since they represent endogenous basic tendencies that are reportedly relatively stable across the lifespan of an individual. Personality traits are also strongly associated with a range of behaviours and attitudes, including political participation and Ideology (Barceló, 2017; Thimm, 2011). The strength of the Five Factor Model lies in its capability to reduce the large variable expanse of individual personality into small, universal core traits that are somewhat robust across time and space (Barceló, 2017). This model consists of five unique dimensions, thought to encapsulate the wide nature of human variation. These traits, in no particular order, are Extraversion, Neuroticism, Openness to Experience, Conscientiousness and Agreeableness (DeYoung, Quilty, & Peterson, 2007).

The domain of Extraversion is often characterised by a gregarious nature, warmth and positive emotionality (Aslan & Cheung-Blunden, 2012; Barceló, 2017; Otero-López & Villardefrancos Pol, 2013; Straud, McNaughton-Cassill, & Fuhrman, 2015; Thimm, 2011). It is associated with the tendency to engage in sensation seeking behaviours, and to be highly assertive during daily actions (Aslan & Cheung-Blunden, 2012; Barceló, 2017; Otero-López & Villardefrancos Pol, 2013; Straud et al., 2015; Thimm, 2011).
Neuroticism, perhaps the most agreed upon definition within the Five Factor Model, centres upon emotional stability (Aslan & Cheung-Blunden, 2012; Merz & Roesch, 2011; Straud et al., 2015; Thimm, 2011). At its core, Neuroticism represents individual differences in the experience of stress, depression and anxiety. Those that score highly on this dimension often demonstrate irrational thinking, low self-esteem and generally ineffective emotional coping strategies (Straud et al., 2015). In general, the higher an individual scores on this trait, the more intense the distress that is felt in response to stressors (Merz & Roesch, 2011).

Openness to Experience is also one of the five principle domains of the Five Factor model (Bergh & Akrami, 2016). It is characterised by curiosity, attraction to the unknown and a certain willingness to experience new things (Aslan & Cheung-Blunden, 2012; Barceló, 2017). Key characteristics of this trait include intelligence, perception, creativity and flexibility (Merz & Roesch, 2011; Straud et al., 2015).

Conscientiousness is a particularly difficult trait to define, as many studies have a variety of definitions (Buchanan, 2017; Chen, 2016; Cummings et al., 2016; Dahm et al., 2017). However, a common theme within those definitions is that those who score highly on this dimension employ strong behavioural inhibitions and have high achievement focus (Buchanan, 2017; Chen, 2016; Cummings et al., 2016; Dahm et al., 2017; Maples-Keller, Berke, Miller, & vanDellen, 2016). Characteristically speaking, those who score highly on this trait can be described as goal oriented with high impulse control (Chen, 2016; Merz & Roesch, 2011; Straud et al., 2015). Out of the five factors described by the model, it is considered the most adaptable to everyday situations (Chen, 2016).

The domain of Agreeableness represents the personality tendency to be warm, cooperative and prosocial (Bergh & Akrami, 2016; Wang, Hartl, Laursen, & Rubin, 2016). As
a personality trait, those that score highly on it tend to desire harmonious social relationships (Wang et al., 2016).

**Personality & Memory**

During the 1960’s and 70’s there was a considerable amount of academic focus placed upon the relationship between personality types and language tasks (See Eysenck, 1976 for a review). From this research, it was discovered that performance appeared to differ between those on opposite sides of the Extraversion/Introversion scale. These differences were attributed to arousal theory (Eysenck, 1967). Essentially, the key difference between the two states is that introverts show greater resting arousal and demonstrate higher sensitivity towards sensory stimuli than extraverts. This results in significantly less stimuli being needed for introverts to reach both optimal arousal and to exceed that threshold into overstimulation (Eysenck, 1967; McDougall & Pfeifer, 2012).

Previous research has also discovered that the levels of cortical arousal can be influenced by high levels of Neuroticism (McDougal & Pfeifer, 2012). Based on the concepts put forward by the arousal theory, research at the time predominantly focused on manipulating arousal states through word choice stimuli (i.e., High arousal words vs low arousal words) and then examined how behaviour and cognition would change. More recently, a study by McDougal and Pfeifer (2012) investigated the effects of personality traits, specifically Extraversion and Neuroticism, on the self-reported vividness of visual imagery and memory span accuracy. Recall, they found, was best for concrete nouns, followed closely by concrete homonyms and then abstract nouns. Concrete, for this experiment, refers to words that describe world items (i.e., flag or tree). Contrastingly, abstract refers to words that describe ideas and concepts such as Justice (McDougal & Pfeifer, 2012).
The researchers found that while extraverts indicated more vividness in their mental imagery than introverts did, the effects did not necessarily translate into an improvement in recall. Initial analyses indicated a connection between Extraversion and word type sensitivity, but further analyses ascertained that the fluctuations in the domain of Neuroticism was the key determinate behind the differences in recall ability (McDougal & Pfiefer, 2012).

Previous research ascertained that excessive levels of arousal impeded cognitive ability, specifically regarding information retention tasks. That is, when an individual was overstimulated, their ability to retain and report information was decreased (Eysenck, 1963). This is of interest to memory conformity studies (Doughty, Paterson, Maccann, & Monds, 2017). Memory conformity occurs when an individual’s memory of a certain event is altered by post event information, often provided by a secondary witness (Doughty et al., 2017). Doughty et al., (2017) investigated the susceptibility of certain personality types towards memory conformity. Crucially, the aim of the study was to discover if certain personality traits showed a proclivity towards frequent alterations to event memory, and if there were any that proved particularly resistant. Results of the study revealed that low levels of Openness, along with high levels of Neuroticism and Extraversion, resulted in an increased chance of misinformation being reported. Following this, low levels of Conscientiousness and high levels of Neuroticism resulted in participants being more likely to fabricate events. The only trait that seemed to show resilience to memory conformity was agreeableness. High levels of Agreeableness were correlated with more accurate event reports (Doughty et al., 2017).

Previous research in this area has established that the Openness to Experience dimension was a predictor of susceptibility to misinformation (Liebman et al., 2002). Higher levels of Openness were correlated with accuracy in retention of event information. Furthermore, as Openness is associated with higher levels of intelligence and higher acculturated knowledge (Ackerman & Heggestad, 1997; Ashton, Lee, Vernon, & Jang, 2000)
and as higher levels of intelligence predicts a certain resistance to misinformation (Zhu et al., 2010), there is good reason to believe a link between levels of Openness and susceptibility to misinformation. Individuals high on the Openness domain also display an adept ability to detect deception, indicating that they are more likely to evaluate information for accuracy before internalizing it (Zhu et al., 2010). In contrast, those individuals high in Neuroticism and Agreeableness demonstrated a susceptibility to misleading information (Liebman et al., 2002; Doughty et al., 2017).

In a study by Rusting (1998) a potential gap in the literature was closed. The aim of the study was to explore how personality traits and mood states interacted to influence both memory and judgement. Understanding the ways in which cognitive processes, personality traits and emotional states was both a key part of their study and of particular interest to this thesis project. One key piece of theory that drove the formation of the Rusting (1998) study was that previous research in the area had shown that people tended to retrieve memories and make judgements that were congruent with their mood at the time. For example, a positive mood made people more likely to retrieve positive memories and make more positive judgements. During a negative mood however, this was reversed. People were more likely to make negative judgements and retrieve negative memories (Rusting, 1998).

Similarly, research also posited a link between personality traits and mood congruent retrieval. Those who scored highly on positive emotion traits (i.e., Extraversion) were more likely to mimic the positive mood results (i.e., retrieve positive memories and make positive judgements). Those that demonstrated high scores on negative emotional traits (i.e., Neuroticism) were more likely to mimic the negative mood behaviours (Rusting, 1998).

What is clear from the studies above, is that the relationship between personality and memory is more complex and important than one would initially believe. Personality is a factor that
influences far more than just displayed behaviours. It appears to influence cognitive functions, such as in Arousal theory (Eysenck, 1967), sensitivity to memory conformity (Doughty et al., 2017) and vividness of mental imagery (McDougal & Pfeifer, 2012).

Correlations have also been found between the remaining personality traits (Extraversion, Neuroticism, Agreeableness and Conscientiousness) and compliance. Conscientiousness demonstrated a resistance to suggestive questioning manipulations.

**Personality & Music**

In the past decade, we have grown to learn more about the psychological aspects of music than ever before. There have been multiple avenues of research that aspired to connect social behaviours to music (A. North, C., Hargreaves & Mckendrick, 1997; A. C. North & Hargreaves, 1997) as well as the role that music plays as a factor in social identity (A. North, Hargreaves, & Neill, 2000; Tarrant, North, & Hargreaves, 2000; Tekman & Hortaçsu, 2002) and the relationship between personality traits and musical preferences (Rentfrow & Gosling, 2003). The research relating to the link between personality and music preferences was discussed extensively in the previous chapter. However, as a newly emerging field, there are a few gaps that are yet to be fully addressed, such as the relationship between personality traits and uses of music, or whether people listen to music in different or similar ways from one another, along with the factors that drive them to do so (Rentfrow & Gosling, 2003).

However, as discussed above, there is considerable research about the psychology of musical preferences (Rentfrow & Gosling, 2003; Chamorro-Premuzic & Furnham, 2007). That is, the associations between personality traits and musical preferences have been shown to influence the ways in which people use music, how and why they choose to listen to it (Chamorro-Premuzic & Furnham, 2007).
The current trend of research in these areas is to focus on musicians and other musically inclined performers. These form the basis for a wide array of personality and musical studies. For instance, previous research has ascertained that musical performers were more likely to, on the whole, score highly on certain personality traits (Kawase, 2016). For instance, Introversion and the characteristics of Openness (Intelligence and Pathemia – fantasy mindedness) were found to be common personality traits among the musician population regardless of participant age (Kawase, 2016). Personality traits have been shown to both help and hinder musicians in their craft. High levels of Introversion (i.e., low levels of extraversion) enabled and encouraged the musician to practice (Kawase, 2016). However, musicians also display higher levels of anxiety than actors or dancers who are also on the public stage (Marchant-Haycox & Wilson, 1992). Personality traits have also been shown to relate to musical instrument preferences, with pianists displaying consistently higher levels of Extraversion than brass or string players (Chmurzynska, 2012).

A study by Kawase (2016) investigated associations between musical performers’ personality traits and their ensemble performance aptitudes. Furthermore, they also investigated the performers empathy and performance aptitudes. They discovered that those who displayed high scores on Extraversion, Agreeableness or Openness were more likely to perform aptly in the ensemble. They also discovered that ensemble preferences were positively correlated to the dimension of Conscientiousness. Participants were found to practice daily alongside other performers, but not alone (Kawase, 2016).

What this establishes is that there is a definite link between music that is experienced (i.e., played) and personality traits. In the above studies, it becomes clear that personality traits influence both the type of instrument played, practice preferences and aptitude for ensemble performances (Kawase, 2016). While not directly relevant to this study, it opens the possibility
that there are yet more connections that are not understood, especially given the areas focus on musical performers.

The relationship between music, memory and personality could also be modulated by the frequency and tempo of the music stimuli. Previous academic research in this area has attempted to connect musical characteristics to the arousal model and has ascertained that tempo appears to be crucial in modulating the effect of music on arousal (Dobrota & Reić Ercegovac, 2015). Slower tempos relate strongly to sad music (characterised as low arousal) and faster tempos appear to relate to happy music, characterised as high arousal (Schellenberg, Krysciak, & Campbell, 2000). Those that score highly on Extraversion show a distinct preference for energetic and fast songs (Rentfrow & Gosling, 2006, while those that score highly on Neuroticism showed preferences for slower tempos (Daly et al., 2014). Overall, participants in previous research appeared to favour faster tempos over slower ones (Dobrota & Reić Ercegovac, 2015; Finnas, 1989; LeBlanc & Cote, 1983; LeBlanc & McCrary, 1983). Similarly, when asked of elementary school students, there was an overwhelming preference for faster tempos in both classical and jazz genres (LeBlanc & McCrary, 1983). These connections appear to support the theory of optimal stimulation, meaning that people prefer to listen to music that satisfies their need to achieve an ideal state of physiological arousal. Furthermore, it provides support to the theory that musical preferences, in some way, influence cognitive states and in doing so may actively influence an individual’s ability to recall information. Additionally, personality traits appear to influence these musical preferences, making them important to examine alongside any test of cognition and musical preferences.

A study by Dobrota and Reic Ercegovac (2015) investigated the relationship between musical preferences of differing tempos and modes alongside personality traits. What they discovered was that, overall, female students showed a higher degree of favouritism towards any type of music regardless of tempo and mode than their male counterparts. Altogether however, both
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males and females showed a particular preference for music that was composed of a faster tempo (Dobrota & Reić Ercegovac, 2015). Low levels of Neuroticism (i.e., Emotional stability) and optimistic outlook were discovered to be significant predictors for preferences in fast tempos and major keys, while introversion and openness were significant predictors of preferences in slower tempos and music in minor keys (Dobrota & Reić Ercegovac, 2015).

This study relied on two major theories to form its premise (Dobrota & Reić Ercegovac, 2015). First, the theory of musical preferences (Rentfrow & Gosling, 2003), in which personality traits, self-concept and cognition were stated as three of the most important factors that formed the musical preferences of an individual. The second theory was the third model of Musical preferences (Bailes, 2006), which focuses on the ways individuals responded to stimuli. Three key reactions occur in an individual when exposed to music; Emotional, Cognitive, and affective assessment reactions. The combination of the listeners personality traits, characteristics of the music itself and the social characteristics of the surrounding context is crucial to the shape these reactions take.

A meta-analysis investigated the association between musical preferences and personality traits in recent literature (Schäfer & Mehlhorn, 2017). Within the literature, the most common personality model chosen was that of the Five Factor Model, alongside traits of sensation seeking. This made them the most appropriate categories to form the basis of the analysis.

To summarise, most recent literature on the connection between music and personality traits has taken two main forms. First, it tends to examine the role of personality traits in those that perform music both onstage and off. Second, it examines the impact of personality traits on musical preferences and the possible reasons for such.
Chapter Five: Rationale/ Key Aims

The human brain seems uniquely suited towards retaining information when it is conveyed musically, particularly if that music is aesthetically and rhythmically pleasing (Farrugia et al., 2015; Verrusio et al., 2015). Previous musical preference studies have primarily been concerned with the ways in which music affects physiology (Bullock & Gilliland, 1993; Iqbal & Ahmad, 2015; Maples-Keller et al., 2016; Simmons-Stern et al., 2010; Verrusio et al., 2015; Zantinge et al., 2017), or the ways in which it can be predicted by personality (Delsing et al., 2008; Rentfrow & Gosling, 2003; Schäfer & Mehlhorn, 2017). Furthermore, where the literature theorises a connection between music and memory, the research tends to refer instead to a memory for music, i.e., for remembering specific songs, tones or musical notes, without considering the effect of music on memory more generally (Ünal et al., 2013; Weiss, Schellenberg, et al., 2015; Weiss, Vanzella, et al., 2015). While certainly important areas to study, to our knowledge, no studies have considered the possibility of an interconnection between personality traits, musical preferences and memory retention skills.

Rationale

In Chapter two, the literature on memory was examined. Crucial conclusions for this section, necessary for the formation of these hypotheses are as follows (i), Short-Term memory is acoustically coded, making it more likely to be receptive to the influx of musically inspired meaning. (ii) while gist reasoning is a more in-depth processing, verbatim memorisation is often required in real life. (iii) in terms of convenience to test, most previous research tends to use short word lists to test immediate recall (i.e., rote information), giving it a strong experimental validity the current study.

In Chapter three, we examined the current literature on music and its interconnections with other aspects such as Memory, Arousal, and Cognitive ability. Crucially, it highlighted that
music seems to be able to enhance cognition in some situations, regardless of form. Whether this is due to the Arousal effect or because it creates emotional salience is unknown, but it does provide support for the basis the arguments presented in this thesis.

In Chapter four the literature on personality was examined. A few key understandings were gained. First, personality models such as the Big Five Model provide a useful way to investigate individual differences in both memory retention and how music influences that. Much recent literature tends to examine the role of personality traits in those that perform music, rather than those that passively experience it. However, there is some significant literature examining the impact of personality traits on musical preferences and the possible reasons for such. This literature has established some links between personality traits and preferences for specific types of music.

The literature discussed under these three areas of consideration which have thus far been discussed (memory, music and personality) thus form a framework for the current study. The current study uses current understandings about the link between personality and music preferences to investigate further the ways in which music may influence short term memory recall.

Aims

The primary aims of the studies presented in this thesis are to:

1. Investigate whether listening to any form of music, whether of a preferred genre or not, can improve performance on a short-term memory test than a silent condition. Support for this premise can be seen in Chapter two (Memory) and in Chapter Three (Music)
2. Investigate whether performance on a short-term memory test is further enhanced by the use of music that matches the individuals self-reported music preferences. Support for this premise can be seen in Chapter Two (Memory) and Chapter Three (Music)
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3. Explore the degree to which previous findings in the literature about links between specific personality traits and a liking for a music genre are predictive of how effective listening to music is in enhancing performance on a short-term memory test.

To explore these aims, a pilot study was first conducted, to test the basic premises that form the basis of the arguments presented in this study, as well as to examine the viability of the measures, recruitment rates, and test delivery system. Following the conclusions gained in that pilot study, a second study was devised and conducted. The two studies will be discussed individually in the following chapters.
Study One: Pilot study into Musical Preferences, Memory Retention and Personality traits.

Rationale

What we have established thus far in this thesis project, is that music has a unique effect on the human brain. That it has the capability to alter the very chemistry and rhythms of its structure. We have also discussed how personality and music have been intertwined in previous studies. However before embarking on this field of study, it was important to first determine if the assumptions we had were empirically viable. To do this, this thesis project was divided into two studies. The main purpose of the first study was to pilot the study design and conduct an initial investigation into the relationship between musical preferences, short term memory retention, and personality.

Hypothesis

1. People who listen to any form of music demonstrate higher scores in short-term memory tests than those in the silent condition.

2. When preferences for music are matched, participants demonstrate higher rates of correct answers in short-term memory tests than those whose preferences are mismatched or are in the silence condition.

3. People who listen to music that matches their dominant personality traits as predicted by findings in the literature (Rentfrow & Gosling, 2003; Dunn, 2012; Delsing et al., 2008) will perform better on a short-term memory test than people listening to music that is not similarly matched.
**Method:**

**Study Design:**
This study used a 3-group randomized experimental design to compare the effect of music that matched participant preferences (Matched), against the use of music that did not match participant preferences (Mismatched), and a control group (Silence) on participant performance on a short memory test.

**Participants**
This study recruited 42 undergraduate participants from Western Sydney University (WSU) and through social media. Undergraduate participants were recruited through the online research platform localised to WSU known as SONA. This system allowed for participants to engage in the study in exchange for credit points. Participants recruited through social media were offered a $20 Coles and Myer gift card for their participation. While 42 participants were recruited, only 31 completed the study in its entirety. Those without a complete data set were excluded from some analysis, but still had relevant results to be included in others.

**Measures and Materials:**
Musical Preferences: STOMP

Participants’ musical preferences were assessed by means of the Short Test of Musical Preferences (STOMP; Rentfrow & Gosling, 2003). The Stomp Consists of fourteen genres in total; Alternative, Blues, Classical, County, Electronica/Dance, Folk, Heavy metal, Rap/ Hip Hop, Jazz, Pop, Religious, Rock, Soul/Funk and Soundtracks/Theme songs. Preferences for each genre were rated on a seven-point Likert scale with end points at 1 (Strongly dislike) and 7 (Strongly like). As in Rentfrow and Gosling, (2003), scores on these genres were aggregated to form four dimensions that describe the common characteristics of the music contained within; Reflective and Complex (Blues, Classical, Folk, Jazz), Energetic and Rhythmic (Dance
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Electronica, Rap/ Hip Hop, Soul Funk), Upbeat and Conventional (Country, Pop, Religious, Soundtracks/Theme Music), Intense and Rebellious (Alternative, Heavy metal, Rock).

In the current sample the reliability was as follows, the Reflective and Complex subscale consisted of 4 items ($\alpha=.78$), the Intense and rebellious subscale consisted of 3 items ($\alpha= .75$), the Upbeat and conventional subscale consisted of 4 items ($\alpha=.62$) and the Energetic and Rhythmic subscale consisted of 3 items ($\alpha=.53$).

Personality traits: BFAS

Participants were also asked to complete the Big Five Aspects Scale (BFAS; De Young et al., 2007). This scale measured the five main categories of the Five Factor Model (Openness to Experience, Conscientiousness, Extraversion, Agreeableness and Neuroticism) along with the individual facets within each trait dimension (Withdrawal, Volatility, Compassion, Politeness, Industriousness, Orderliness, Enthusiasm, Assertiveness, Intellect, and Openness). Similar to the STOMP measure, participants were asked to rate their agreement with certain phrases that describe them using a five-point Likert scale (1-Strongly Disagree, 5-Strongly Agree). In this study, the reliability for these traits are as follows. The Extraversion subscale consisted of 20 items ($\alpha=.86$), the agreeableness subscale consisted of 20 items ($\alpha= .86$), the Neuroticism subscale consisted of 20 items (.88), the Conscientiousness subscale consisted of 20 items (.85), and the Openness to Experience subscale consisted of 20 items ($\alpha=.79$).

Memory Test:

This study makes use of a word list from Gavett and Horwitz (2012). As list learning tests are the most commonly used way for researchers to examine participants ability for both immediate and delayed recall, it was determined that this would be the best way to test our hypothesis. The word list contains fifteen simple to difficult words, designed to exceed the recorded rates or retention (5-6 items; Gavett & Horowitz, 2012)
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Equipment:

Survey measures were added to an online survey created in Qualtrics. A Lenovo Laptop, running Windows 10, was used to both collect answers for the questionnaires and to play music for the experimental conditions. During the second portion of the study, a pair of Turtle Beach headphones were provided to participants to listen to the music.

Stimuli

To ensure relative familiarity and popularity of the selected music, songs were selected from the top 50’s charts of 2015. Each genre was searched (i.e., Alternative, Blues etc.) and the top three results were selected. Instrumental versions of these top three songs for each genre were selected to create a playlist for each genre, then songs from those three were randomly selected for inclusion into the dimension playlist for each participant. As music differs greatly, both between genres and dimensions, it was important to eliminate as many confounding variables as possible. Thus, only instrumental tracks were selected, as that was the key similarity between all genres (see appendix for a complete list). For example, if a participant was matched with the Intense and Rebellious dimension, they could have listened to a playlist that was composed of songs from nine options. That is, they would have three possible options from the nine alternatives. Following this example, a participant could have had a combination of ‘Disturbed: Sound of Silence Instrumental cover’ (Drawn from the Heavy Metal genre) followed by ‘AWOLNATION- Hollow Moon (drawn from the Alternative genre) and finally ‘Elle King: Exes and Oh’s’ (drawn from the Rock genre).

Procedure:

The study was divided into two sections, first an online survey which took place in the laboratory and an in-person memory test which took place on a second occasion in the laboratory. In part one, participants were asked to complete an online questionnaire containing
the BFAS and STOMP scales. Consent was obtained after an information was sheet provided to participants (See Appendix). Upon consenting to continue into the study, participants completed the online survey containing the STOMP scale and the BFAS.

After completion of these scales, participants were invited to participate in part two of the study, which took place in person in the laboratory. Before their arrival however, based on the aggregated scores presented on the STOMP, their preferred genre style (Reflective and Complex, Intense and Rebellious, Upbeat and Conventional, Energetic and Rhythmic) was recorded. Participants were then randomized into one of the three conditions, (Music Matching, Music Mismatch and Silence). This was done by following a (1,2,3,2,1) pattern for the participant sign ups, a variation of the simple randomization pattern used in other psychological studies (Suresh, 2011). As they were not required to sign up at specific times, the order in which they were scheduled to arrive on certain days was used to randomize the conditions (i.e., the first participant of Part 2 was in group 1, regardless of if they were the first participant to complete the online survey section or not). To randomize the music each participant would experience (if randomized to either of the music listening conditions) songs from individual genres were put together into a playlist for each dimension. For each participant the music that they heard could have come from any of the genres within the domains (i.e., Blues, Jazz, Pop etc.). A minimum of nine songs were available for each Dimension (3 for each genre), and the playlist was randomised on which song it took from each genre.

As described in Chapter three, Rentfrow and Gosling (2003) had found that participants with certain personality traits were most likely to report a liking for particular categories of music based on their aggregate scores (Classical, Blues, Country, Dance/Electronica, Folk, Rap/Hip Hop, Soul/Funk, Religious, Alternative, Jazz, Rock, Pop, Heavy Metal, Soundtracks/ Theme songs). Participants’ personality scores were calculated by aggregating their scores on the scales for the BFAS dimensions (Extraversion, Neuroticism, Conscientiousness,
Agreeableness, Openness to Experience). If participants had been randomized to condition 1 (Music Matching) then the preferences, they displayed in the STOMP questionnaire would match the dimension from which their playlist would be created. If participants were in condition 2 (Music Mismatch), then their playlist was composed of songs from dimensions in which they displayed particularly low preference scores. For example, if a participant’s scores on the STOMP measure indicated that they preferred the Reflective and Complex dimension, and they were randomized into the Music Matching condition, then the music they would be exposed to would be from the genres making up that dimension. If, however, that participant was randomized into the Music Mismatch category, then the music that they would be exposed to would be drawn from a different dimension, such as Intense and Rebellious. Participants in the third condition (Silence) were not exposed to any music.

Upon arrival for the experimental portion of the study, participants were given the opportunity to ask questions, and were reminded of the purpose of the study with an additional copy of the information sheet provided in the online survey. Upon giving consent participants were asked to read over the fifteen-word memory test over a two-minute period, timed by a visible timer displayed on the laptop screen, while listening to their assigned musical track or silence, after the researcher left the room. The assigned musical track was set to randomly play one of the songs within the playlist. After two minutes, participants were asked to turn over the word list (so that they could no longer see the words) and write as many words as they could remember on the worksheet provided the playlist continued during this portion of the study. At the end of the four-minute allotted time frame (2 minutes for reading the list, 2 minutes for recall), the researcher returned, turned off the music, and the trial was concluded. Participants were debriefed and given the opportunity to ask any questions that they had.
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Analysis:
To determine the music preferences of individual participants for the purposes of determining what music they listened to in the Matched or Mismatched conditions, the aggregate scores were taken together from the selected genres. The dimensions with the highest score (i.e., Reflective and Complex) was then noted as the preferred genre. When the conditions were later assigned (Matching, Mismatching or Silence) it became a matter of choosing whether the participant listened to music from their highest rated dimension (Matched), or whether they listened to music from another dimension (mismatched).

Data analysis was conducted using IBM SPSS Statistics 24. For all significance tests we set $\alpha = 0.05$. The STOMP and BFAS scores were calculated as per the instructions of the authors of those scales, to create continuous variables on each of the personality and music preference dimensions. However categorical variables were also created based on these scales as follows:

A variable that described participants dominant personality trait was created, by selecting the BFAS trait with the highest score for each participant and assigning it a number (1, Neuroticism, 2, Agreeableness, 3, Extraversion, 4, Openness to Experience and 5, Conscientiousness). We also added a categorical variable that described whether or not the music to which the participant listened to aligned with the predicted musical preferences in the literature (See musical preferences above). This was done by assigning 0 (Mismatch) or 1 (Match) for all participants based on whether the music they had listened to was found in the literature to be a preference for individuals with the same dominant personality traits. For example, a person that demonstrated high scores in Neuroticism who listened to the music category ‘Reflective and Complex’, would have been coded as ‘Matched’ as previous literature ascribes this connection (Dunn, de Ruyter, & Bouwhuis, 2012). Similarly, if a person with Extraversion as their dominant trait listened to Upbeat and Conventional or Energetic and Rhythmic music this would have also been coded as ‘Matched’ (Rentfrow & Gosling, 2003).
**Results:**

**Hypothesis One: Music Vs Silence Memory Test Results**

Homogeneity of Variance, Normality tests were performed, with no cause for concern.

A One-Way ANOVA was conducted to test the first hypothesis, with music condition vs. silence condition as the independent variable and the memory test results as the dependant variable. Results were not significant ($F(1,30) = 3.60, p > .06$). However, results were approaching significance, with a trend in the expected direction. People in the Music condition scored higher on the memory test ($M=12.5, SD=3.3$) than those in the silence condition ($M=9.7, SD=4.8$).

<table>
<thead>
<tr>
<th>Memory Test Responses</th>
<th>N</th>
<th>Mean</th>
<th>Std. Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Music</td>
<td>23</td>
<td>12.48</td>
<td>3.329</td>
</tr>
<tr>
<td>Silence</td>
<td>9</td>
<td>9.67</td>
<td>4.770</td>
</tr>
<tr>
<td>Total</td>
<td>32</td>
<td>11.69</td>
<td>3.922</td>
</tr>
</tbody>
</table>
**Hypothesis two: Matching Music Preferences vs Mismatched preferences/Silence results**

A One-way ANOVA was conducted to test the second hypothesis, with the music matching vs. mismatch and silence condition as the independent variable and the memory test results as the dependent variable. Results were not significant ($F(1, 30) = .63, p > .43$). However, the music matched condition ($M=12.45, SD=2.42$) was slightly higher than the music mismatched/silence condition ($M=11.29, SD=4.51$).

### Table 2
**Descriptive Statistics: Music Match vs Mismatch and Silence**

<table>
<thead>
<tr>
<th>Memory Test Responses</th>
<th>N</th>
<th>Mean</th>
<th>Std. Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Music Matching</td>
<td>11</td>
<td>12.45</td>
<td>2.423</td>
</tr>
<tr>
<td>Music Mismatch and Silence</td>
<td>21</td>
<td>11.29</td>
<td>4.518</td>
</tr>
<tr>
<td>Total</td>
<td>32</td>
<td>11.69</td>
<td>3.922</td>
</tr>
</tbody>
</table>
Hypothesis three: Dominant Personality Traits X Expected Preferences X Short term memory test results

To test this third hypothesis, a One-way ANOVA was run with Predicted Preference Match as the independent variable and the Memory test results as the dependant variable. Results were not significant ($F(1,30) = .47, p > .49$). In fact, the Predicted Preference Match (M=11.14, SD=4.13) results were slightly lower in this scenario than the not matched versions (M=12.11, SD=3.81).

Table 3
Descriptive Statistics: Predicted Preferences (Matched vs. Mismatched)

<table>
<thead>
<tr>
<th>Memory Test Responses</th>
<th>N</th>
<th>Mean</th>
<th>Std. Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not matched</td>
<td>18</td>
<td>12.11</td>
<td>3.818</td>
</tr>
<tr>
<td>Matched</td>
<td>14</td>
<td>11.14</td>
<td>4.130</td>
</tr>
<tr>
<td>Total</td>
<td>32</td>
<td>11.69</td>
<td>3.922</td>
</tr>
</tbody>
</table>

Exploratory Analysis:

Since results had not been as expected in the third hypothesis, in a follow up Analysis, we decided to look at whether Rentfrow and Goslings (2003) results had been replicated in this study. Therefore, we redid their analysis by running a Bivariate Pearson correlation on the Musical Preference Genres and the Personality Dimensions which can be seen in Table 4. The only result to match the predictions made by Rentfrow and Gosling (2003) was that of Openness to Experience, with a positive correlation with the Intense and Rebellious dimension ($r=.40, p < .009$). No other significant results were discovered.
## Table 4
Bivariate Correlation: Personality Dimensions X Musical Preference Dimensions

<table>
<thead>
<tr>
<th></th>
<th>Reflective and Complex</th>
<th>Intense and Rebellious</th>
<th>Upbeat and Conventional</th>
<th>Energetic and Rhythmic</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Neuroticism</strong></td>
<td>Pearson Correlation</td>
<td>-0.124</td>
<td>-0.231</td>
<td>0.197</td>
</tr>
<tr>
<td></td>
<td>Sig. (2-tailed)</td>
<td>0.434</td>
<td>0.141</td>
<td>0.211</td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>42</td>
<td>42</td>
<td>42</td>
</tr>
<tr>
<td><strong>Agreeableness</strong></td>
<td>Pearson Correlation</td>
<td>0.071</td>
<td>0.059</td>
<td>0.096</td>
</tr>
<tr>
<td></td>
<td>Sig. (2-tailed)</td>
<td>0.653</td>
<td>0.711</td>
<td>0.546</td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>42</td>
<td>42</td>
<td>42</td>
</tr>
<tr>
<td><strong>Conscientiousness</strong></td>
<td>Pearson Correlation</td>
<td>-0.106</td>
<td>0.045</td>
<td>0.099</td>
</tr>
<tr>
<td></td>
<td>Sig. (2-tailed)</td>
<td>0.505</td>
<td>0.777</td>
<td>0.534</td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>42</td>
<td>42</td>
<td>42</td>
</tr>
<tr>
<td><strong>Openness</strong></td>
<td>Pearson Correlation</td>
<td>0.264</td>
<td><strong>0.400</strong></td>
<td>0.077</td>
</tr>
<tr>
<td></td>
<td>Sig. (2-tailed)</td>
<td>0.092</td>
<td>0.009</td>
<td>0.626</td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>42</td>
<td>42</td>
<td>42</td>
</tr>
<tr>
<td><strong>Extraversion</strong></td>
<td>Pearson Correlation</td>
<td>0.012</td>
<td>0.039</td>
<td>-0.044</td>
</tr>
<tr>
<td></td>
<td>Sig. (2-tailed)</td>
<td>0.938</td>
<td>0.808</td>
<td>0.783</td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>42</td>
<td>42</td>
<td>42</td>
</tr>
</tbody>
</table>
**Discussion:**

It was hypothesised that people who listened to any form of music (Matching and Mismatching preferences) would demonstrate higher scores on a short-term memory test than those that were in the Silence condition (Hypothesis 1). It had also been hypothesised that when preferences for music were matched, participants would demonstrate higher rates of correct answers on the memory test than those whose preferences were mismatched or in the silence condition (Hypothesis 2). Finally, it had also been hypothesised that people that listened to music that matched their dominant personality trait as predicted by findings in the literature (Rentfrow & Gosling, 2003; Dunn, 2012; Delsing et al., 2008) would perform better on a short-term memory test than people listening to music that was not similarly matched (Hypothesis 3).

Statistically speaking, both Hypothesis 1 and 2 were rejected, based on insignificant findings. However, there were several statistically insignificant trends that appear to indicate that an increase in sample size, as well as participant completion rates, may allow for the procurement of significant findings for these hypotheses. Similarly, the third hypothesis must also be rejected.

In fact, the data revealed a slight trend in the opposite direction, to what was hypothesised. The follow up analysis examined the predictions found in previous literature about the relationship between personality and music preferences. For clarification they were: (i) Neuroticism would demonstrate a correlation for preferences in Classical music (and by extension the dimension which reflects this genre, Reflective and Complex; Dunn, Ruyter & Bouwhuis, 2012), (ii) Extraversion would show a positive correlation with both Upbeat and Conventional and Energetic and Rhythmic (Rentfrow & Gosling, 2003; Delsing et al., 2008) (iii) Agreeableness would demonstrate correlations with both the Upbeat and Conventional and Energetic and Rhythmic (Rentfrow & Gosling, 2003), (iv) Conscientiousness would show a positive correlation with the Upbeat and conventional dimension (Rentfrow & Gosling, 2003), (v) and
Openness to Experience would demonstrate positive correlations with Reflective and Complex and Intense and Rebellious, along with negative correlations to the Upbeat and conventional dimension (Rentfrow & Gosling, 2003). However, in the Bivariate correlation run above (See table 4), only Openness demonstrated the predicted connection, with a positive correlation with the Intense and rebellious dimension.

It was important then, to try and ascertain why such a drastic difference occurred between our study and that of previous literature. There are several reasons why this might have occurred. First, the type of personality measure differed. Unlike Rentfrow and Gosling (2003), this study made use of the Big Five Aspect scale, a measure designed to allow for an exploration of sub-facets as well as entire dimensions. Although this was not analysed in Study 1, it may be possible that only particular aspects of the Big Five personality traits will be associated with the predicted music preferences rather than overall factors. Furthermore, with the small sample size of the pilot study, it may have simply been that it was too small to detect any correlations in these other areas. Also, as the sample consisted of primarily undergraduate students, the results may have been skewed towards a preference.

As for the influence on short-term memory performance (Hypothesis 1 and 2), previous studies have found that acoustic melodies have been shown to improve associate learning (Soemer & Schwan, 2012), improve cognition (Belfi et al., 2015; Farrugia et al., 2015; Jakubowski & Müllensiefen, 2013; Proverbio et al., 2015; Simmons-Stern et al., 2010; Ünal et al., 2013; Yang & Li, 2013) and alter the brainwave composition of the participant to increase participant accuracy and decrease response times (Verrusio et al., 2015). Unfortunately, this pilot study was unable to replicate these examples. However, non-significant trends in the data for both Hypothesis 1 and 2, suggest the value of testing these hypotheses in a broader sample.
Primarily, increasing the sample size would allow for a better chance of statistically significant results. However, during the testing, a few other problems became clear. Multiple participants did not return for the second half of the study (i.e., the Memory test portion), indicating that the form it took, or the process by which it was delivered was in some way incumbent. That is, by requiring participants to take two separate tests on separate days, decreased the chances of them returning, even for course credit. It was also discovered that the SONA system alone was not enough to draw in participants for this study. It was important, therefore, to reconsider the form in which the test was delivered, and to discover a less cumbersome method of delivery and recruitment. Furthermore, during the course of this pilot study, it became apparent that it was important to explore more about how the participants felt about the music they listened to (Lola Cuddy & Duffin, 2005; Delsing et al., 2008; Dobrota & Reić Ercegovac, 2015; Rentfrow & Gosling, 2003; Simmons-Stern et al., 2010; Snyder, 2000; Zantinge et al., 2017; Zeng et al., 2017). While their self-reported preferences may have been for a certain genre, it may not necessarily mean that the particular songs they listened to necessarily matched those preferences exactly as there is a large variety in musical styles, even within genres. For example, classical music can include music by a wide range of composers, such as Beethoven and Mozart, and participants who reported liking classical music may have disliked the particular piece that they listened to. Furthermore, participants may not have been familiar with the music with which they were presented. As stated above, music even within genres is incredibly varied, thus the relative familiarity of the song might have had an impact on how much a participant liked or disliked the song they listened to. This could have had an influence on how effect the musical selections were at aiding short-term memory recollection. It was for this purpose that additional questions would be added to the second study.
Study Two: Study into Musical Preferences, Memory Retention and Personality traits.

The Pilot study suggested that a larger sample size could lead to significant findings about the relationship between music listening and short-term memory retention. Furthermore, it was believed that the second study required not only a wider sample, but one that included non-student participants. Furthermore, in order to eliminate the need for participants to attend the lab twice, the format of the study was changed from an in-person design, to one that was entirely online and could be completed in one sitting. Given that participant burden was reduced by this change, we were also able to maximise the amount of data it was possible to obtain by asking each participant to complete a second memory test. This also had the advantage of minimising the chance that results were related to the relative ease or difficulty of a single word test. By placing this study entirely online, it was also possible to recruit from a wider audience, having already obtained ethical permission to recruit participants from other sources.

Given what was found in the first study, that our results did not match the ones listed in literature, it was important to examine why this might be the case. Crucially, Rentfrow and Gosling, 2003 used a different personality measure, as opposed to the Big Five Aspect Scale used by this thesis. This difference could help to explain why the results of the study differed.

It may be possible to discover preferences through an examination of the individual aspects of the Big Five. For example, it would make sense that the withdrawal aspect of the Neuroticism factor would be associated with Reflective and Complex music, as characteristically speaking those that score highly on this facet prefer to deal with their emotions in private and would perhaps prefer music that reflects that. Similarly, with the Compassion facet of the Agreeableness dimension, there may be a preference for Upbeat and Conventional music,
colloquially known as happy music. It is this music that is typically used to bond people together, allowing for a common ground to be reached, something that characteristically speaking, compassionate people seek out.

Furthermore, the Enthusiasm facet of the Extraversion dimension could possibly display preferences for Upbeat and Conventional or Energetic and Rhythmic music, as both are characterised as happy, and both engage with both the movement centres of the brain as well as encourage group activity.

Finally, the Intellect dimension of the Openness to Experience dimension may demonstrate preferences towards the Reflective and complex dimension of music. Characteristically speaking, the reflective and complex dimension is thought to embody intelligent musical types, such as Classical music (Verrusio et al., 2015)

Given the lack of connection found between the dominant personality trait preferences and the musical preferences predicted in the first study, we decided to alter the final hypothesis to one that would possibly explore and explain the differences between this study and that of Rentfrow and Gosling, 2003).

However, to maximise the chances of understanding the data, and the possible interconnections therein, it was decided that this second study would examine the individual facets of the personality traits and musical genres. This was not done in the first study, as the sample size was far too small to gain any significant understanding. To date, there have been no studies that examine the Big Five Facet scales alongside the musical genres, and their effect on memory retention. Thus, it was the intention of this study to do so, as well as testing the original hypothesis.
Hypothesis

1. People who listen to any form of music demonstrate higher scores in short-term memory tests than those in the silent condition.

2. When preferences for music are matched, participants demonstrate higher rates of correct answers in short-term memory tests than those whose preferences are mismatched or are in the silence condition.

3. Specific aspects of the Big Five personality traits are associated with preferences for particular types of music:
   a. The Withdrawal subscale of Neuroticism is associated with preferences for Reflective and complex music
   b. The Compassion subscale of Agreeableness is associated with preferences on Upbeat and Conventional music.
   c. The Enthusiasm subscale of Extraversion is associated with preferences for Upbeat and Conventional and Energetic and Rhythmic.
   d. The Intellect subscale of Openness to Experience is associated with preferences for Reflective and complex music.
Method:

Study Design:

This study used a 3-group randomized experimental design, as in Study 1, to compare the effect of music that matched participants preferences against music that did not match preferences, and a control group on a short-term memory test.

Participants:

This study recruited 111 participants, (11 of which had to be deleted for incomplete responses) who completed two memory tests each, through the online participant recruitment system SONA, and through various social networks. These networks included, LinkedIn, Reddit, Facebook, Twitter, email contacts, personal contacts. While 200 participants were recruited, only 176 completed the study in its entirety. Those without a complete data set were excluded from some analysis, but still had relevant results to be included in others.

Measures and Materials

Several changes were made between this study and study 1. First, the format of the study was changed from in person to entirely online. This was done through the online survey platform Qualtrics. In order to properly assure randomization, a few key steps were followed. First, a question (Question 10- What musical genre do you most prefer?) was selected as a predictor. Based on participant answers to this question, they would be taken to one of three memory test options. The lists in this section were identical, the only component that differed was the attached music file. Participants were either exposed to music (that matched or mismatched their selected preferences) or to silence. This was achieved through the in-system equal randomization function of Qualtrics. The answers on question 10 also predicted the condition for the second memory test, following the same randomization process as the first. However, this did not necessarily mean that participants would be in the same condition twice. Rather it allowed for the same participant to be in multiple conditions. Finally, participants were asked
MUSIC FOR THE MIND

to record their familiarity and like of the songs they were presented with (if they were presented with any). While many participants simply did not answer this question, there were some answers given, allowing for a preliminary analysis to take place, the information on which can be seen in the analysis section.

Musical Preferences: Stomp

Participants’ musical preferences were assessed by means of the Short Test of Musical Preferences (STOMP; Rentfrow & Gosling, 2003). As used in Study 1 (Measures and Materials, Study 1). The Reflective and Complex subscale consisted of 4 items (α=.64), the Intense and rebellious subscale consisted of 3 items (α=.64), the Upbeat and conventional subscale consisted of 4 items (α=.44) and the Energetic and Rhythmic subscale consisted of 3 items (α=.63).

Personality traits: BFAS

Participants were also asked to complete the Big Five Aspects Scale (BFAS; De Young et al., 2007). As used in study 1 (Measures and Materials, Study 1). The Extraversion subscale consisted of 20 items (α=.91), the agreeableness subscale consisted of 20 items (α=.84), the Neuroticism subscale consisted of 20 items (α=.89), the Conscientiousness subscale consisted of 20 items (α=.85), and the Openness to Experience subscale consisted of 20 items (α=.84).

The facet subscales were also calculated. The Withdrawal Facet consisted of 10 items (α=.85), the Volatility facet consisted of 10 items (α=.86). The Compassion Facet consisted of 10 items (α=.87), the Politeness Facet consisted of 10 items (α=.76), the Industriousness Facet consisted of 10 items (α=.83), the Orderliness Facet consisted of 10 items (α=.81), The Enthusiasm Facet consisted of 10 items (α=.84), the Assertiveness facet consisted of 10 items (α=.88). The
Memory Test:

This study makes use of a word list from Gavett and Horwitz (2012). As list learning tests are the most commonly used way for researchers to examine participants ability for both immediate and delayed recall, it was determined that this would be the best way to test our hypothesis. The word list contains fifteen simple to difficult words, designed to exceed the recorded rates or retention (5-6 items; Gavett & Horowitz, 2012).

The first word list presented in this study was the same as was used in Study 1, a word list from Gavett and Horwitz (2012). No alterations were made to this test. This study also makes use of a second memory test from Bastian and Oberauer (2013). Similar to the above test, this memory test made use of fifteen easy to hard to remember words. Originally the list contained 25, but to assure equality across samples, only the first 15 words recalled were used in the current analysis. Thus, scores on both memory tests ranged from 0-15.

Stimuli:

As in Study 1, it was important to ensure that the participants would both be familiar with the music, and to try and select popular music as to increase their preference match. No alterations were made to the music list from the first study (for a complete explanation see Study 1, Stimuli)

Procedure:

After completing preliminary questions (i.e., Consent), participants were asked to record their answers on the STOMP and BFAS questionnaires. Following this, they were presented with a question that asked them to select their preferred genre of music (i.e., Classical, Blues, etc). Their response on this question was used to determine the music they would listen to based on
the condition to which they had been randomized. For example, if a participant selected Classical music as their most preferred genre, using randomization features in Qualtrics, participants were randomly directed taken to one of three memory test pages within the online survey (the Matched condition, the Mismatched condition, or the Silence condition). The only difference between the pages was the music or silence that accompanied them. So, in this instance, they would either be taken to a page on which classical music would be available to play (Music Match), or music from another genre would be available (Music Mismatch) or no music at all (Silence). This randomization process was generated by the equal randomization program on Qualtrics. After clicking play (as the case may be) or entering the page (if there was no music) participants then had one minute to read the list of words presented to them. after which they were automatically taken to the next screen, where they were asked to list as many words as they could remember. Upon completion of this stage, they were asked to record their familiarity and like of the music to which they had been exposed. Then the randomized process would assign them to a condition, similar to the way the first conditions were assigned, and take them to the second memory test. As before, the participants were asked to complete the familiarity and like scales after listing the words they could remember.

Analysis:

Analysis was conducted using IBM Statistics SPSS 24. All significance levels were set at $\alpha=.05$.

The Familiarity and Like questions were designed to be answered on a five-point Likert scale. Participants were asked to rate their familiarity and like of the music that they were presented with on a scale from 1 to 5. For the familiarity question, the endpoints were 1 (Not at all) and 5 (Very familiar). For the Like scale, the endpoints were 1 (Strongly dislike) and 5 (Strongly like). However, many participants failed to complete these questions. Overall, of the participants who answered the question, most found the music to be relatively familiar, giving
ratings above neutral ($M=3.3$, $SD=1.09$), but reported relatively neutral ratings for the liking of the music they listened to ($M=2.56$, $SD=.97$).

Furthermore, with the addition of a new memory test, it was important to assure that there was no statistically significant difference between the first memory test and the second. The two were not statistically different. The first memory test ($M=5.73$, $SD=4.83$) was only slightly higher in participant recall than the second memory test ($M=4.98$, $SD=4.68$), but this difference was not statistically important when compared with an ANOVA ($F(1,174)=1.093$, $p>.29$).
Results:

Hypothesis one: Music (Matched and Mismatched) Vs Silence x Memory test results

These factors did not violate the assumptions of normality.

A One-Way ANOVA was conducted to test the first hypothesis, with music condition vs. silence condition as the independent variable and memory test results as the dependant variable. Results were not significant (F (1,174) = .26, p > .60). The conditions were only slightly different regarding mean score. While the Music category (M=5.48, SD=4.68) was slightly higher than the Silence category (M=5.09, SD=4.94), these differences were not statistically significant. Therefore, the first hypothesis was not supported in this study.

Table 5
Descriptive statistics Music vs. Silence x Memory results

<table>
<thead>
<tr>
<th>Mem test res</th>
<th>N</th>
<th>Mean</th>
<th>Std. Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>118</td>
<td>5.48</td>
<td>4.684</td>
</tr>
<tr>
<td>2</td>
<td>58</td>
<td>5.09</td>
<td>4.943</td>
</tr>
<tr>
<td>Total</td>
<td>176</td>
<td>5.35</td>
<td>4.761</td>
</tr>
</tbody>
</table>
Hypothesis two: Matching Musical Preferences vs mismatched preferences/ Silence x Memory test results

A One-Way ANOVA was conducted to test the second hypothesis, with Matched vs. Mismatched/ Silence as the independent variable and Memory Test results as the dependant variable. Results were again not significant ($F(1,174) = .05, p > .82$).

Table 6
Descriptive statistics Music Matching vs Mismatch/Silence x Memory results

<table>
<thead>
<tr>
<th>Mem test res</th>
<th>N</th>
<th>Mean</th>
<th>Std. Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>59</td>
<td>5.24</td>
<td>4.786</td>
</tr>
<tr>
<td>2</td>
<td>117</td>
<td>5.41</td>
<td>4.767</td>
</tr>
<tr>
<td>Total</td>
<td>176</td>
<td>5.35</td>
<td>4.761</td>
</tr>
</tbody>
</table>
Hypothesis three: Aspects of the Big Five will demonstrate connections to genres

3.1: Withdrawal x Reflective complex

Results of the Bivariate Pearson correlations are noted in Table 7. The Withdrawal facet demonstrates a negative correlation with the Reflective and Complex Dimension. It also demonstrated a negative correlation with the Blues genre, Soul/Funk, Jazz, and Heavy Metal. However, the withdrawal facet demonstrated a positive correlation with the Alternative music genre.

The Volatility facet, however, showed only one correlation of note, in that it was negatively correlated with a preference for Blues music. Our hypothesis that the Withdrawal facet would be positively correlated with the Reflective and Complex dimension was therefore not supported. In fact, the negative correlation indicates the opposite direction to what we had expected.

3.2: Compassion x Upbeat and Conventional

The Agreeableness facet of Compassion demonstrated a positive correlation with the Musical dimension of Upbeat and Conventional. Intense and Rebellious and Reflective and complex. A positive correlation was discovered between the Compassion facet and Soul/Funk, Alternative, Rock, and Pop.

The second facet of Politeness showed some interesting correlations as well. This facet demonstrated a positive correlation with the Intense and Rebellious dimension. It also demonstrates a positive correlation with the Dance/Electronica Genre, Alternative. Alongside this it also demonstrated a significant negative correlation with the Rap/Hip Hop genre. Our hypothesis that the Compassion facet of Agreeableness would be positively correlated with the Upbeat and Conventional dimension is supported.
3.3: Enthusiasm x Upbeat and Conventional, Energetic and Rhythmic

The enthusiasm facet of Extraversion demonstrated two correlations of note. First was in the expected direction, with a positive correlation to preferences on the Upbeat and Conventional genre. Second was, unexpectedly, a positive correlation to the Reflective and Complex dimension. Furthermore, positive correlations were found between the Enthusiasm facet and the Classical genre, Blues, Country, Soul/Funk, Religious, Rock, and Pop.

The Assertiveness facet also demonstrated multiple correlations to the genres but not to the dimensions. Assertiveness demonstrated positive correlations to Classical ($r=.18, p<.01$), Blues, Soul/Funk, Jazz. This facet also demonstrated negative correlations with Folk, and Alternative. Our hypothesis that the Enthusiasm facet of Extraversion would be positively correlated with both the Upbeat and Conventional dimension and the Energetic and Rhythmic dimension was partially supported, with one correlation being found in the expected direction.

3.4: Intellect x Reflective and complex.

The Intellect facet demonstrated a positive correlation with the Intense and Rebellious dimension, but no correlations were present with the Reflective and complex dimension as predicted. However, the Intellect facet demonstrated some interesting positive correlations, namely with Classical music and Rock. Curiously, it was one of the only few facets to correlate with memory test results. The others being Industriousness and Orderliness.

The Openness facet of the Openness to Experience dimension however, did show significant positive correlations with both the Reflective and Complex dimension) and the Intense and Rebellious dimension. This facet also demonstrated positive correlations with Classical music, Blues, Soul/Funk, Alternative, Jazz, Rock. The Openness facet also demonstrated a negative correlation with preferences for the Pop dimension. Our hypothesis that the Intellect facet would be positively correlated with the Reflective and Complex was not supported.
Table 7
Bivariate Pearson Correlation: Musical Genres, BFAS Facets, Music Dimensions and Memory test scores

<table>
<thead>
<tr>
<th>Musical Genre</th>
<th>Withdral</th>
<th>Volatility</th>
<th>Compassion</th>
<th>Politeness</th>
<th>Industriousness</th>
<th>Orderliness</th>
<th>Enthusiasm</th>
<th>Assertiveness</th>
<th>Intellect</th>
<th>OP</th>
<th>Memory Stress</th>
</tr>
</thead>
<tbody>
<tr>
<td>Classical</td>
<td>-0.142</td>
<td>-0.009</td>
<td>0.049</td>
<td>0.110</td>
<td>0.033</td>
<td>0.006</td>
<td>(0.186^*)</td>
<td>(0.180^*)</td>
<td>(0.242^{**})</td>
<td>(0.321^{**})</td>
<td>-0.139</td>
</tr>
<tr>
<td>Blues</td>
<td>(-0.316^{**})</td>
<td>(-0.150^{*})</td>
<td>0.136</td>
<td>0.029</td>
<td>0.119</td>
<td>(-0.195^{**})</td>
<td>(0.241^{**})</td>
<td>(0.192^{*})</td>
<td>0.127</td>
<td>(0.303^{**})</td>
<td>-0.026</td>
</tr>
<tr>
<td>Country</td>
<td>-0.104</td>
<td>-0.092</td>
<td>0.109</td>
<td>-0.032</td>
<td>0.054</td>
<td>-0.048</td>
<td>(0.164^{*})</td>
<td>0.090</td>
<td>-0.005</td>
<td>-0.109</td>
<td>-0.059</td>
</tr>
<tr>
<td>Dance/Electronic</td>
<td>0.128</td>
<td>0.083</td>
<td>0.107</td>
<td>(0.165^{*})</td>
<td>-0.147</td>
<td>0.073</td>
<td>-0.063</td>
<td>-0.118</td>
<td>0.007</td>
<td>0.086</td>
<td>0.046</td>
</tr>
<tr>
<td>Folk</td>
<td>-0.011</td>
<td>-0.076</td>
<td>0.147</td>
<td>0.122</td>
<td>(-0.196^{**})</td>
<td>(-0.261^{**})</td>
<td>0.103</td>
<td>(-0.163^{*})</td>
<td>-0.109</td>
<td>0.125</td>
<td>-0.087</td>
</tr>
<tr>
<td>Rap/Hip-Hop</td>
<td>0.001</td>
<td>0.056</td>
<td>0.077</td>
<td>(-0.208^{**})</td>
<td>-0.094</td>
<td>(-0.171^{*})</td>
<td>0.003</td>
<td>0.077</td>
<td>(-0.151^{*})</td>
<td>-0.06</td>
<td>0.045</td>
</tr>
<tr>
<td>Soul/Funk</td>
<td>(-0.250^{**})</td>
<td>-0.102</td>
<td>(0.192^{*})</td>
<td>0.039</td>
<td>0.050</td>
<td>-0.049</td>
<td>(0.175^{*})</td>
<td>(0.159^{*})</td>
<td>0.027</td>
<td>(0.244^{**})</td>
<td>-0.068</td>
</tr>
<tr>
<td>Religious</td>
<td>-0.098</td>
<td>-0.086</td>
<td>0.037</td>
<td>-0.058</td>
<td>-0.033</td>
<td>-0.107</td>
<td>(0.161^{*})</td>
<td>0.035</td>
<td>-0.084</td>
<td>0.077</td>
<td>-0.083</td>
</tr>
<tr>
<td>Alternative</td>
<td>(0.156^{*})</td>
<td>0.014</td>
<td>(0.186^{*})</td>
<td>(0.187^{*})</td>
<td>(-0.209^{**})</td>
<td>-0.004</td>
<td>-0.093</td>
<td>(-0.210^{**})</td>
<td>0.089</td>
<td>(0.272^{**})</td>
<td>0.017</td>
</tr>
<tr>
<td>Music Type</td>
<td>Pearson Correlation</td>
<td>-.225**</td>
<td>-0.072</td>
<td>0.069</td>
<td>-0.092</td>
<td>-0.025</td>
<td>-.190*</td>
<td>0.094</td>
<td>.152*</td>
<td>0.076</td>
<td>.235**</td>
</tr>
<tr>
<td>---------------------</td>
<td>---------------------</td>
<td>---------</td>
<td>--------</td>
<td>--------</td>
<td>--------</td>
<td>--------</td>
<td>--------</td>
<td>--------</td>
<td>--------</td>
<td>--------</td>
<td>--------</td>
</tr>
<tr>
<td>Jazz</td>
<td>Pearson Correlation</td>
<td>-0.142</td>
<td>-0.102</td>
<td>.295**</td>
<td>0.082</td>
<td>0.097</td>
<td>-0.100</td>
<td>.201**</td>
<td>0.077</td>
<td>.241**</td>
<td>.276**</td>
</tr>
<tr>
<td>Pop</td>
<td>Pearson Correlation</td>
<td>0.012</td>
<td>0.027</td>
<td>.296**</td>
<td>-0.046</td>
<td>0.100</td>
<td>-0.030</td>
<td>.268**</td>
<td>0.102</td>
<td>-0.008</td>
<td>-0.156*</td>
</tr>
<tr>
<td>Heavy Metal</td>
<td>Pearson Correlation</td>
<td>-.159*</td>
<td>-0.067</td>
<td>0.022</td>
<td>0.068</td>
<td>0.043</td>
<td>-0.075</td>
<td>0.077</td>
<td>0.101</td>
<td>0.055</td>
<td>-0.064</td>
</tr>
<tr>
<td>Soundtracks/Theme Songs</td>
<td>Pearson Correlation</td>
<td>-0.085</td>
<td>-0.130</td>
<td>0.021</td>
<td>0.028</td>
<td>0.124</td>
<td>.231**</td>
<td>0.093</td>
<td>0.051</td>
<td>0.008</td>
<td>-0.031</td>
</tr>
<tr>
<td>Reflective</td>
<td>Pearson Correlation</td>
<td>-.234**</td>
<td>-0.110</td>
<td>.150*</td>
<td>0.102</td>
<td>-0.017</td>
<td>-.213**</td>
<td>.243**</td>
<td>0.116</td>
<td>0.129</td>
<td>.357**</td>
</tr>
<tr>
<td>Intense</td>
<td>Pearson Correlation</td>
<td>0.034</td>
<td>-0.040</td>
<td>.266**</td>
<td>.164*</td>
<td>-0.091</td>
<td>-0.051</td>
<td>0.035</td>
<td>-0.102</td>
<td>.176*</td>
<td>.314**</td>
</tr>
<tr>
<td>Upbeat</td>
<td>Pearson Correlation</td>
<td>-0.113</td>
<td>-0.098</td>
<td>.200**</td>
<td>-0.063</td>
<td>0.066</td>
<td>-0.070</td>
<td>.292**</td>
<td>0.114</td>
<td>-0.049</td>
<td>-0.086</td>
</tr>
<tr>
<td>Energetic</td>
<td>Pearson Correlation</td>
<td>0.025</td>
<td>0.059</td>
<td>0.131</td>
<td>-0.037</td>
<td>-0.123</td>
<td>-0.075</td>
<td>-0.002</td>
<td>0.012</td>
<td>-0.084</td>
<td>0.041</td>
</tr>
</tbody>
</table>

N=176
**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).
Discussion:

Statistically, both Hypothesis 1 and 2 must be rejected, with no significant results in either condition. While, similar to the pilot study, those in the Music category demonstrated a higher average mean of correct answers than those in the Silence category, it was far smaller than the difference presented in the first study. This indicates, that despite predictions, we were unable to find a significant effect indicating that music improves short term memory recall over silence.

Similarly, the data for the second hypothesis reveals much the same as the first. While the means of the groups differed, in this instance the average mean of correct answers was slightly higher for the Mismatch and Silence category than it was for the Music matching. Like hypothesis 1, we were unable to find any significant results to say that music that matches stated preferences is better than music that mismatches or silence.

These results however, could be explained by the familiarity and liking scales that participants were asked to answer. While, admittedly, not all the participants recorded their answers, from the initial answers on the questions, most found the music to be familiar, but not highly enjoyable. This indicated that even though participants knew the songs, it is possible that they did not particularly like the songs or pieces that they listened to. This is something that could be addressed in further studies.

The third set of Hypotheses however, is where significant correlations were found. For 3.1, the hypothesis was that the Withdrawal facet of Neuroticism would demonstrate positive correlations with the Reflective and Complex music category. This was rejected as our results demonstrate a negative correlation with this dimension. Furthermore, it also demonstrates negative correlations with Blues, Soul/Funk, Jazz and Heavy metal. There was, however, a significant positive correlation found for the Alternative music genre.
Despite the overall facet of Neuroticism being correlated with Classical music in previous literature (Dunn et al., 2012), the Withdrawal facet demonstrated negative correlations with almost all of the genres within the Reflective and Complex dimension (Rentfrow & Gosling, 2003). While it may simply be that the songs selected were disliked or relatively unfamiliar, given the small amount of results returned on those questions, it may also mean that musical preferences in general are far more complex than can be entirely explained by this study. This premise can be supported by the results obtained on the Volatility facet. Despite being a sub facet of the same dimension (Neuroticism), it demonstrates only one similar correlation, in that it was negatively correlated with a preference for Blues music. While the facets measure different aspects, it is curious that they would not share more correlations. Another explanation could be that the music within these genres were not sufficiently arousing for the participant (Eysenck, 1963, 1967; Jeong & Biocca, 2012). As discussed in the introduction to this paper, Arousal levels are thought to be important for cognitive functioning. Therefore, if the music was not sufficiently arousing for the participants, then it may have had an effect on their preferences and subsequent memory scores. This theory may also explain why the preference for Alternative music was positively correlated with the Withdrawal facet, given that the Alternative music is often characterised with a faster tempo than that of the Reflective and Complex dimension’s genres (Rentfrow & Gosling, 2003).

For the second part of this hypothesis, 3.2, which described the prediction that Compassion would demonstrate a positive correlation with the Upbeat and Conventional music. This hypothesis was supported with a significant correlation found between the two. Furthermore, positive correlations were also found between the Compassion Facet and the Intense and Rebellious dimension, along with the Reflective and Complex dimension.
MUSIC FOR THE MIND

At a genre level, the Compassion facet demonstrated positive correlations with Soul/Funk, Alternative, Rock and Pop. As theorised, we believe that this correlation occurred due to the social aspects of the Upbeat and Conventional music. That is, music from the genres within this dimension (Country, Pop, Soundtracks/Theme music and Religious) tend to be used in social settings (Merz & Roesch, 2011; A. North, C. et al., 1997; Paulson et al., 2013; Rentfrow & Gosling, 2003), something that those high on Agreeableness seek out. It would make sense then, for these genres to be preferred, to make social situations more pleasant for individuals to engage in.

The positive correlations found on the second Agreeableness facet, Politeness, were not entirely expected. Particularly the correlations with the Intense and Rebellious Dimension, along with the Dance/ Electronica and Alternative genres. These correlations indicate that it may be a matter of arousal, given that the only thing in common between the genres is that they are characteristically higher tempo than the other dimensions and genres. It may be that those who score highly on this Politeness facet may be using these music genres as a means of mood regulation or arousal regulation (Bailes, 2006; Cohrdes et al., 2017; Eysenck, 1963, 1967; Rentfrow & Gosling, 2003). The negative correlation with the Rap/hip hop genre is not entirely unexpected however. Given the propensity for Rap/Hip hop songs to be vulgar (something averse to those high on the politeness facet), and their atypical rhythms that don’t always follow the predicted rules, which can be a cause for negative affect (Patrik N. Juslin & Västfjäll, 2008).

The third section of the Hypothesis 3, 3.3, was the prediction that the Enthusiasm facet of Extraversion would be positively correlated with the Upbeat and Conventional and Energetic and Rhythmic dimensions. One correlation followed this expected direction, with a positive correlation to preferences on the Upbeat and Conventional dimension. A
second correlation, however, was an unexpected positive correlation to the Reflective and Complex dimension. This defies the earlier predictions and encourages a closer look at the data presented. Extraversion is a trait that is particularly known for its propensity towards highly arousing music, typically those characterised in the Upbeat and Conventional and Energetic and Rhythmic dimensions. However, the positive correlation with the Reflective and Complex dimension of music, could possibly indicate that music is being used as an arousal modifier, or that musical preferences are far more complex than previous research has implied. Like Agreeableness, a correlation with the Upbeat and Conventional genre may be a combination of positive stimuli (i.e., socializing) and the music typically found in social places (i.e., Pop, Country, Religious etc.). By examining the genre level correlations, this seems to hold true with all but the positive correlation for the Classical music. This could, however, be explained by Rentfrow and Gosling’s theory that people will, when given an opportunity to share, potentially lie about their preferences in order to appear to embody the characteristics they associate with that preference (Rentfrow & Gosling, 2003). For example, Classical music is typically considered to be something that refined ‘classy’ people enjoy, someone wishing for others to believe they embody those traits may, when asked, indicate a preference for classical music despite their natural inclinations.

The fourth section, 3.4, described predictions for the Intellect facet to be positively correlated with the Reflective and Complex dimension. The results of this analysis were particularly surprising. Given the colloquial association between the characteristics of Intellect and the characteristics of the Intense and Rebellious dimension, it is unique that this particular facet would demonstrate this connection. At the genre level, there was a preference for Classical and Rock music, perhaps indicating that those who demonstrate
high intellect scores within the Openness to Experience dimension have an eclectic taste. Or, more likely, they use these genres as a form of mood regulation and arousal regulation.

Classical music, as explored above, is typically low arousal in nature, whereas rock is typically high arousal. It was, curiously, one of the few facets to correlate with memory test results. The others were Industriousness and Orderliness, facets of Conscientiousness.

Interestingly, even though the Musical dimensions weren’t always correlated, there were some genres from within those genres that were correlated with specific facets. Such as the Assertiveness facet displaying positive correlations for multiple genres within the Reflective and Complex genre, but not correlating with the genre itself. Could this be because of the additional genre, on which they displayed a negative correlation?

By examining the facet level of personality traits, and of the music genres, important correlations were found. Highlighting the importance of understanding these genres and the effects personality may have on them.

Although the research has reached its aims, there were some unavoidable limitations. First, by formatting the study into an entirely online one, while addressing the participant recruitment and retention problem described in the first study, added additional problems to this study. Such as an inability to assure that people were, in fact, listening to the music tracks that they were assigned to. This may have confounded results, as if the participants weren’t listening to the music they were assigned, then the connection between music and memory was not explored. Furthermore, by removing the vocal melodies, it may have altered the participants experience of the song, even in an attempt to equalize the tracks across genres (Weiss, Schellenberg, et al., 2015; Weiss, Vanzella, et al., 2015). This may
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have even unduly distracted participants, who might have focused on trying to discover the
song rather than reading the word list for the memory test. Finally, there might have been
a possible flaw in the musical tracks selected. The music selected was intended to be
examples of the genre, but music is a highly personally experience (Blum, 2013; P. N.
Juslin et al., 2015; Koelsch, 2015; Krumhansl, 1991; Paulson et al., 2013; Samson et al.,
2009), meaning that while preferences were matched, the songs themselves were not liked.

We attempted to discover if this was the case by including a familiarity and
enjoyment question after each musical exposure. However, most participants appeared to
ignore that question, leaving us with little understanding of their opinions of the musical
tracks played. From the results obtained however, it was clear that while the participants
did recognise the music they were exposed to, they weren’t very fond of it. Future studies
could allow for a more personal music selection, rather than researcher dictated, which may
allow for significant results.

There are several alternate explanations that could explain the results seen above. First, by
removing the vocal tracks from songs that had them, could it possible that we removed an
important factor from the music make up. Previous research in the literature has
emphasised the importance of voice impacted music (Weiss, Schellenberg, et al., 2015;
Weiss, Vanzella, et al., 2015) and presence of rhyme (Good et al., 2015; Michael et al.,
2014; Odigwe & Davidson, 2005; Paulson et al., 2013; Simmons-Stern et al., 2010) in
aiding recall. It may be that by removing these factors from the music, we eliminated the
combination impact that music and vocals could have (Michael et al., 2014; Soemer &
study may wish to investigate if songs with their vocal melodies retained gather different
results from the ones found above.
MUSIC FOR THE MIND
Another possible explanation is that, as participants musical conditions were not determined by their personality traits, some participants may have been overstimulated or under stimulated by the music to which they were exposed (Jeong & Biocca, 2012). Thus, impacting their performance on the following cognitive tasks. Future studies could investigate this by using participant personality traits as the determining factors for what songs they would be exposed to (within their selected preferences or range etc.). In addition, this study did not investigate the tempo of the songs to which the participants were exposed. As seen in the previous literature, the effects of tempo and mode could have an impact on an individual’s ability to remember information alongside that beat (Snyder, 200; Deustch, 1982; Michael et al., 2014).

Finally, Rentfrow and Gosling (2003), raised the possibility of participants lying on their musical preferences in order to project the image they most associated with the music they ascribed to. We did not control for this in the study, and it may have influenced the results forthwith. After all, if those participants who were in the Matched condition lied about their preferences and were, in fact, mismatched, then it may have confounded the results this study obtained. Future studies could control for this by adding an implicit and explicit preference test, in order to both give the participants a chance to declare their stated preferences but also examine their actual preferences through the implicit test.
Conclusion

In conclusion, this study aimed to investigate if the presence of music, and if it matched or mismatched stated preferences, could influence the effectiveness of short-term memory recollection. Furthermore, in Study 1 it attempted to replicate the results found in the previous literature. Being unable to do so, the hypotheses were changed for the second study, to include a facet level examination of both personality traits and musical preference dimensions. This study has added to the current literature on Musical Preferences, Memory Retention and Personality traits. Furthermore, it has established a few key findings that will be listed here. First, that understanding the facet levels of personality traits, while important in personality studies, is also important to consider when comparing those personality traits to musical preferences. Furthermore, it has provided evidence that musical genres are far more complex than what their characteristics describe and are constantly evolving. Future studies could explore whether having participants select their own songs would improve the results of the memory tests as opposed to researcher selected items. Third, it is clear that arousal plays a very large part in music preferences, and the extent to which those preferences impact other aspects of cognition. Future studies could refine this and examine the direct impact of High arousal vs. low arousal songs on short-term memory retention. Following this, it may be a possibility for future research to explore the effect of tempo upon short-term memory recollection.

While the initial hypothesis (Hypothesis 1 and 2), were not found to be significant, this research has allowed us to conclude that while we do not entirely understand the ways in which music, memory and personality traits interact, it is an important field to continue to explore.
 Ackerman, P. L., & Heggestad, E. D. (1997). Intelligence, personality, and interests: evidence for overlapping traits. *Psychol Bull, 121*(2), 219-245.


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responses: Listening to emotionally touching music enhances facial memory capacity. *Scientific Reports, 5.* doi: 10.1038/srep15219


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Participant consent form (Study 1)

Consent Form

Project Title: Music for the mind: A study into personality traits, musical preferences and memory retention.

I hereby consent to participate in the above named research project.

I acknowledge that:

- I have read the participant information sheet (or where appropriate, have had it read to me) and have been given the opportunity to discuss the information and my involvement in the project with the researcher/s

- The procedures required for the project and the time involved have been explained to me, and any questions I have about the project have been answered to my satisfaction.

I consent to:

☐ Participate in an online portion of this study (which involves two questionnaires)

☐ Listen to assigned music and complete a memory test on the second portion of this study.

Data publication, reuse and storage

This project seeks consent for the data provided to be used in any other projects in the future.

To make reuse of the data possible it will be stored under Western Sydney University’s Open Access Policy.

I understand that in relation to publication of the data my involvement is confidential and the information gained during the study may be published but no information about me will be used in any way that reveals my identity.

☐ the researchers intend to make the non-identified data from this project available for other research projects

☐ I can withdraw from the study at any time without affecting my relationship with the researcher/s, and any organisations involved, now or in the future.

Signed:

Name:

Date:

This study has been approved by the Human Research Ethics Committee at Western Sydney University. The ethics reference number is: H12088

What if I have a complaint?

If you have any complaints or reservations about the ethical conduct of this research, you may contact the Ethics Committee through Research Engagement, Development and Innovation (REDI) on Tel +61 2 4736 0229 or email humanethics@westernsydney.edu.au.
MUSIC FOR THE MIND
Any issues you raise will be treated in confidence and investigated fully, and you will be informed of the outcome.
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How is the study being paid for? Study is funded by the Western Sydney University.

What will I be asked to do?

You will be asked to answer some questions about yourself and the music that you like. This will take around 10 to 15 minutes and will take place online. Then, on another day, you will be asked to complete two separate memory tests while listening to different music tracks.

How much of my time will I need to give?

We believe that the online portion of this study will take between 10 to 15 minutes to complete, as will the in person portion. In total around half an hour.

What benefits will I, and/or the broader community, receive for participating?

Reimbursement will consist of online course credit through SONA.

Will the study involve any risk or discomfort for me? If so, what will be done to rectify it?

We think that you will enjoy listening to the music that we play for you. However there is a small chance that the music may elicit recall of sad memories or thoughts. If that happens you are free to stop listening and we will refer you to a counsellor who will be able to offer you extra support.

How do you intend to publish or disseminate the results?

It is anticipated that the results of this research project will be published and/or presented in a variety of forums. In any publication and/or presentation, information will be provided in such a way that the participant cannot be identified, except with your permission. The information that we collect about you will be non identifiable, meaning that we will not keep your name or any identifying details with the data itself.

Will the data and information that I have provided be disposed of?

Please be assured that only the researchers will have access to the raw data you provide and that your data will not be used in any other projects. Please note that minimum retention period for data collection is five years post publication. The data and information you have provided will be securely disposed of.

Can I withdraw from the study?

Participation is entirely voluntary and you are not obliged to be involved. If you do participate you can withdraw at any time without giving reason.

If you do choose to withdraw, any information that you have supplied will be destroyed.

What if I require further information?
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Please contact Rhiannon Rogers or Dr Sandra Garrido should you wish to discuss the research further before deciding whether or not to participate

Rhiannon Rogers (Masters Student) – 17071491@Westernsydney.edu.au

Dr Sandra Garrido (Supervisor) MARCS Institute at Western Sydney University on Tel: 0403 87000 or email: s.garrido@westernsydney.edu.au.

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Any issues you raise will be treated in confidence and investigated fully, and you will be informed of the outcome.

If you agree to participate in this study, you may be asked to sign the Participant Consent Form. The information sheet is for you to keep and the consent form is retained by the researcher/s.

This study has been approved by the Western Sydney University Human Research Ethics Committee. The Approval number is H12088
MUSIC FOR THE MIND

*Big Five Aspect Scale*

Here are a number of characteristics that may or may not describe you. For example, do you agree that you seldom feel blue, compared to most other people? Please fill in the number that best indicates the extent to which you agree or disagree with each statement listed below. Be as honest as possible, but rely on your initial feeling and do not think too much about each item.

Use the following scale:

<table>
<thead>
<tr>
<th>Strongly Disagree</th>
<th>Neither Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>5</td>
<td></td>
</tr>
</tbody>
</table>

1. ___ Seldom feel blue.
2. ___ Am not interested in other people's problems.
3. ___ Carry out my plans.
4. ___ Make friends easily.
5. ___ Am quick to understand things.
6. ___ Get angry easily.
7. ___ Respect authority.
8. ___ Leave my belongings around.
9. ___ Take charge.
10. ___ Enjoy the beauty of nature.
11. ___ Am filled with doubts about things.
12. ___ Feel others' emotions.
13. ___ Waste my time.
14. ___ Am hard to get to know.
15. ___ Have difficulty understanding abstract ideas.
16. ___ Rarely get irritated.
17. ___ Believe that I am better than others.
18. ___ Like order.
19. ___ Have a strong personality.
20. ___ Believe in the importance of art.
21. ___ Feel comfortable with myself.
22. ___ Inquire about others' well-being.
23. ___ Find it difficult to get down to work.
24. ___ Keep others at a distance.
25. ___ Can handle a lot of information.
26. ___ Get upset easily.
27. ___ Hate to seem pushy.
28. ___ Keep things tidy.
29. ___ Lack the talent for influencing people.
30. ___ Love to reflect on things.
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31. ___ Feel threatened easily.
32. ___ Can't be bothered with other's needs.
33. ___ Mess things up.
34. ___ Reveal little about myself.
35. ___ Like to solve complex problems.
36. ___ Keep my emotions under control.
37. ___ Take advantage of others.
38. ___ Follow a schedule.
39. ___ Know how to captivate people.
40. ___ Get deeply immersed in music.
41. ___ Rarely feel depressed.
42. ___ Sympathize with others' feelings.
43. ___ Finish what I start.
44. ___ Warm up quickly to others.
45. ___ Avoid philosophical discussions.
46. ___ Change my mood a lot.
47. ___ Avoid imposing my will on others.
48. ___ Am not bothered by messy people.
49. ___ Wait for others to lead the way.
50. ___ Do not like poetry.
51. ___ Worry about things.
52. ___ Am indifferent to the feelings of others.
53. ___ Don't put my mind on the task at hand.
54. ___ Rarely get caught up in the excitement.
55. ___ Avoid difficult reading material.
56. ___ Rarely lose my composure.
57. ___ Rarely put people under pressure.
58. ___ Want everything to be “just right.”
59. ___ See myself as a good leader.
60. ___ Seldom notice the emotional aspects of paintings and pictures.
61. ___ Am easily discouraged.
62. ___ Take no time for others.
63. ___ Get things done quickly.
64. ___ Am not a very enthusiastic person.
65. ___ Have a rich vocabulary.
66. ___ Am a person whose moods go up and down easily.
67. ___ Insult people.
68. ___ Am not bothered by disorder.
69. ___ Can talk others into doing things.
70. ___ Need a creative outlet.
71. ___ Am not embarrassed easily.
72. ___ Take an interest in other people's lives.
73. ___ Always know what I am doing.
74. ___ Show my feelings when I'm happy.
75. ___ Think quickly.
76. ___ Am not easily annoyed.
77. ___ Seek conflict.
78. ___ Dislike routine.
79. ___ Hold back my opinions.
80. ___ Seldom get lost in thought.
81. ___ Become overwhelmed by events.
82. ___ Don't have a soft side.
83. ___ Postpone decisions.
84. ___ Have a lot of fun.
85. ___ Learn things slowly.
86. ___ Get easily agitated.
87. ___ Love a good fight.
88. ___ See that rules are observed.

89. ___ Am the first to act.
90. ___ Seldom daydream.
91. ___ Am afraid of many things.
92. ___ Like to do things for others.
93. ___ Am easily distracted.
94. ___ Laugh a lot.
95. ___ Formulate ideas clearly.
96. ___ Can be stirred up easily.
97. ___ Am out for my own personal gain.
98. ___ Want every detail taken care of.
99. ___ Do not have an assertive personality.
100. ___ See beauty in things that others might not notice.
Word list 1:

<table>
<thead>
<tr>
<th>Drum</th>
</tr>
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<tbody>
<tr>
<td>Curtain</td>
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<tr>
<td>Bell</td>
</tr>
<tr>
<td>Coffee</td>
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<tr>
<td>School</td>
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<tr>
<td>Parent</td>
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<tr>
<td>Moon</td>
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<tr>
<td>Garden</td>
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<tr>
<td>Hat</td>
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<tr>
<td>Farmer</td>
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<tr>
<td>Nose</td>
</tr>
<tr>
<td>Turkey</td>
</tr>
<tr>
<td>Color</td>
</tr>
<tr>
<td>House</td>
</tr>
<tr>
<td>River</td>
</tr>
</tbody>
</table>


Word list 2:

<table>
<thead>
<tr>
<th>Nine</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plugs</td>
</tr>
<tr>
<td>Army</td>
</tr>
<tr>
<td>Clock</td>
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<tr>
<td>Desk</td>
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<td>Swap</td>
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<td>Lamp</td>
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<td>Bank</td>
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<td>Horse</td>
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<td>Hold</td>
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<tr>
<td>Cell</td>
</tr>
<tr>
<td>Apple</td>
</tr>
<tr>
<td>Fire</td>
</tr>
<tr>
<td>Colour</td>
</tr>
<tr>
<td>Find</td>
</tr>
</tbody>
</table>
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Music Playlist (Sorted by Dimension and Genre)

Energetic and Rhythmic

- Dance Electronica
  - Where are you now (Skrillex Diplo ft Justin Bieber)
  - Lean on (Major Lazer & DJ Snake Feat. MO)
  - Hey Mama (David Guetta Feat. Nicki Minaj, Bebe Rexha & Afrojack)

- Rap/ Hip Hop
  - Know Yourself (Drake)
  - Watch me (Silento)
  - 679 (Fetty Wap feat. Remy Boyz)

- Soul/ Funk
  - Can’t feel my face (The Weeknd)
  - Post to Be (Omarion feat. Chris Brown & Jhene Aiko)
  - Slow Motion (Trey Songz)

Intense and Rebellious

- Alternative
  - Hollow Moon (AWOLNATION)
  - Shut up and Dance (Walk the Moon)
  - Tear in my Heart (twenty one pilots)

- Heavy Metal
  - Sound of Silence (Disturbed)
  - Follow You (Bring me the Horizon)
  - Psycho (Muse)

- Rock
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- Ex’s and Oh’s (Elle King)
- Renegades (X ambassadors)
- Immortals (Fall out boy)

Reflective and Complex

- Blues
  - Wild heart (Samantha Fish)
  - Love and Money (Bobby Messano)
  - A Fool to Care (Boz Scaggs)

- Classical
  - Shatter me (Lindsey Stirling)
  - Wonders (The Piano guys)
  - Awakening (Jackie Evancho)

- Folk
  - Take me to church (Hozier)
  - Before this world (James Taylor)
  - Free (Cody Simpson)

- Jazz
  - Coast to Coast (Vincent Ingala)
  - Silk (Rick Braun)
  - When you love somebody (Nick Colionne)

Upbeat and Conventional

- Country
  - Kick the dust up (Luke Bryan)
  - Crash and burn (Thomas Rhett)
MUSIC FOR THE MIND

- Pop
  - Take your time (Sam Hunt)
  - Cheerleader (OMI)
  - See you again (Wiz khalifa)
  - Uptown Funk! (Mark Ronson Feat. Bruno mars)

- Religious
  - Something in the water (Carrie Underwood)
  - Soul on Fire (Third day)
  - Touch the Sky (Hillsong UNITED)

- Soundtracks and Theme music
  - Evil Like me (Descendants)
  - Guardians of the Galaxy Original Score 27 (Guardians of the Galaxy).
  - Pitch perfect 2 (Pitch perfect 2)
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Reimbursement will consist of online course credit through SONA.

Will the study involve any risk or discomfort for me? If so, what will be done to rectify it?

We think that you will enjoy listening to the music that we play for you. However there is a small chance that the music may elicit recall of sad memories or thoughts. If that happens you are free to stop listening and we will refer you to a counsellor who will be able to offer you extra support.

How do you intend to publish or disseminate the results?

It is anticipated that the results of this research project will be published and/or presented in a variety of forums. In any publication and/or presentation, information will be provided in such a way that the participant cannot be identified, except with your permission. The information that we collect about you will be non identifiable, meaning that we will not keep your name or any identifying details with the data itself.

Will the data and information that I have provided be disposed of?

Please be assured that only the researchers will have access to the raw data you provide and that your data will not be used in any other projects. Please note that minimum retention period for data collection is five years post publication. The data and information you have provided will be securely disposed of.

Can I withdraw from the study?

Participation is entirely voluntary and you are not obliged to be involved. If you do participate you can withdraw at any time without giving reason.

If you do choose to withdraw, any information that you have supplied will be destroyed.

What if I require further information?
Please contact Rhiannon Rogers or Dr Sandra Garrido should you wish to discuss the research further before deciding whether or not to participate.

Rhiannon Rogers (Masters Student) – 17071491@westernsydney.edu.au

Dr Sandra Garrido (Supervisor) MARCS Institute at Western Sydney University on Tel: 0403 87000 or email: s.garrido@westernsydney.edu.au.

**What if I have a complaint?**

If you have any complaints or reservations about the ethical conduct of this research, you may contact the Ethics Committee through Research Engagement, Development and Innovation (REDI) on Tel +61 2 4736 0229 or email humanethics@westernsydney.edu.au.

Any issues you raise will be treated in confidence and investigated fully, and you will be informed of the outcome.

If you agree to participate in this study, you may be asked to sign the Participant Consent Form. The information sheet is for you to keep and the consent form is retained by the researcher/s.

This study has been approved by the Western Sydney University Human Research Ethics Committee. The Approval number is H12088.