EXPLORING EVERYDAY MUSICAL IMAGERY: AN EXPERIENCE-SAMPLING STUDY

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This research report is submitted to the Faculty of Humanities, University of the Witwatersrand, Johannesburg, in partial fulfilment of the degree of Master of Arts in Psychology.

May 2011

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ABSTRACT

Psychological research regarding mental imagery is heterogeneous in nature owing to its internal nature. Mental imagery involving music is most simply defined as *hearing music in the mind's ear*. Musical imagery (MI) is an understudied phenomenon particularly by means of non-experimental methods. This study investigated four dimensions of everyday MI: namely it's content, nature, constancy and associated corporeal manifestations (for instance, foot-tapping, humming and so forth), via experience-sampling methods. Stage one of data collection involved a cross-sectional survey (n = 87) whereby participants provided retrospective self-reports concerning MI, pertinent demographic information, and particulars concerning their musical history. Stage two – implemented subsequent to piloting – utilised iterative sampling to illuminate the dimensions and descriptive facets of MI during everyday activities. Each participant (n = 16; 8 musicians; 8 non-musicians) was selected based on specific inclusion criteria, following stage one participation, and were invited to complete 21 questionnaires over seven days, receiving three SMS prompts per day. In terms of prevalence, MI was consistently experienced by participants, regardless of their musical background although musicians reported higher rates of MI occurrences. There was a statistically significant association between MI and musical training/experience ($\chi^2 = 6.35$; *d.f.* = 1; p = .012). Furthermore, odds ratios suggested that the musicians demonstrated an 85% likelihood of experiencing MI as compared to the non-musicians (OR 1.85; CI 1.14 – 2.99). Daily exposure to music appeared to be an equally significant factor relating to every day MI incidences, particularly given the finding that the majority of participant's MI episodes were familiar and recently heard.

Keywords: auditory imagery; corporeal manifestations; experience-sampling; musical imagery; musical imagery dimensions; musicians; non-musicians

ACKNOWLEDGEMENTS

Perhaps these are some of the most significant words I will write in this report. One of the most important aspects of research is reflecting on the process. Most notably, attempting to express or sincerely capture my deep gratitude to those individuals who have provided me with invaluable support. Since I am extremely thankful to have been given both this privilege and opportunity of undertaking a Masters degree, I hope I am able to sufficiently express a small portion of my gratitude to every person who has assisted me during the course of attempting to accomplish this goal.

This research does not exist in vacuity, even if it may have felt like a solitary process at times. There are numerous narratives, dialogues, and experiences which are intrinsic elements of the study and allowed me to develop the report. It has been a journey, an immeasurable challenge, as well as an exceptionally educative process. However, I ought to recognise a range of individual's roles in its progression.

Firstly, to the **participants** of this study, without whom, this research would not have been possible. A heartfelt thank you is extended to all those individuals who demonstrated both commitment and passion, and willingly gave up their time, in order to participate in this research. I am immensely appreciative of your conscientiousness and your assistance.

To my supervisor, **Mr Michael Pitman**, I am extremely grateful for your patience, your time, your intellectual insights and your assistance throughout this journey. Your dedication to my work has encouraged me throughout this project. I am indebted to you for your ability to impart some of your criticality in the way in which you analyse research. It is an invaluable skill that I hope I will be able to develop further. I am also particularly appreciative of your ability to illuminate the blind-spots, which periodically immobilised my progress, along with your aptitude for instilling a sense of fastidiousness in my work, by pinpointing errors in my logic. Thank you for continually challenging me through your constructive feedback, and supervision. It has been tremendously educative.

I am truly grateful for **my family's** guidance too. I am especially thankful to my mom, Esther, and my dad, Alan, for their unwavering support in every single way. I appreciate your assistance in helping me trouble-shoot various obstacles, for believing in my abilities and for

providing me with an opportunity neither one of you have ever had. I am so blessed, thankful and fortunate to have had your wisdom, ongoing love, and endless patience throughout this degree. Thank you for everything you have sacrificed for my growth! I will always love you and be appreciative to you both, particularly for your generosity and devotion to me. To my brother, Brett, and my special granny (Katie Stokol), thank you both for your continued support, your empathy, patience and thoughtfulness. It means more to me than I can express.

To **Shawn Rogers**, you are an extraordinary friend. Thank you for your kind-heartedness, encouragement, guidance and understanding. I am indebted to you. Your benevolence will never be forgotten.

To my dearest friend, **Sean Frawley**, you have been immensely supportive during this degree and I am so thankful for your wisdom, your inspiring words, and your ability to motivate me when I felt defeated. Thank you for helping me to believe in myself and encouraging me when I needed it. You are truly incredible.

I would also like to express my sincere gratitude to the **University of the Witwatersrand** for the post-graduate merit award. The award provided me with the financial opportunity to pursue this degree and it is a wonderful privilege. I would also specifically like to express my thanks to **Professor Brendon Barnes**, for his dedication to his students, his helpful guidance and his compassion. Similarly, a note of thanks to **Ms. Julie Poyser**, from the Postgraduate Faculty of Humanities Office, for her helpfulness and assistance, particularly in relation to administrative queries.

Finally, but absolutely not reflecting any diminished significance, I would like to express my appreciation to my **friends** who have provided ongoing encouragement, valuable insights, and inspiration throughout this degree. You are all very important to me and I am so fortunate to be able to depend on you. Please realise that I am trying to express my appreciation to each person equally; so, this is a sincere thank you to the following wonderful friends: Ziggy, Debbie, Pam, Jay (Nina), Lynn, Mike (Batman), Alex (Grim), Gwyn, May, Cait, Granville, Jojo, Nadia, Sherianne, Mark, Pasha, Will, Warrick, Ipeleng, Gordon, Deanne, Yaseen, Kirsten, Candice, Nick, Jay (drummer), Drè, Hal, Paul and the N3 boys (Matt, Jaco, Dave and Danny). I am unable to fully state how every one of you has supported me throughout the course of this degree. Nonetheless, please realise I am truly grateful.

I dedicate this research in remembrance of three extraordinary souls who touched my life in more ways than I could ever have expected. I will always love you, cherish our memories, and feel your enchantments etched in my heart. I wish to express my innermost gratitude for the blessings of all three of your friendships. Your loving, and passionate spirits will not be forgotten. I hope the music of our memories together will always play on in my mind...

"*Shine on forever. Shine on benevolent sun[s].*"

(Tool, 2006; quoted from '*Jambi*' lyrics)

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CONTENTS

CHAPTER 1

INTRODUCTION, RATIONALE AND AIMS

1.1. INTRODUCTION

This study explores the everyday experience of an interesting phenomenon known as musical imagery. What is obvious about the phenomenon is that it involves both music and mental imagery – essentially, it is mental imagery of a musical nature. Musical imagery (hereafter denoted by the acronym **MI**) is most simplistically defined as *hearing music in the mind's ear* (Kosslyn, Ganis & Thompson, 2006) or the ability to "hear a tune in your head" (Zatorre & Halpern, 2005, p.9). Although, these definitions do not necessarily imply that the experience of MI automatically relies on the perception of music. Rather, it suggests that there is an element of imagination which is, at least in a sense, linguistically related to the concept. For example, Beethoven who became completely deaf during adulthood was, in all likelihood, capable of continuing to compose music, because he was able to imagine music (Sacks, 2008; Zatorre & Halpern, 2005) in the absence of perceiving it.

However, Beethoven's apparent ability does make one wonder several things about the nature of his MI. Did Beethoven experience MI prior to or during the period he became entirely deaf? Was his MI voluntary or involuntary or spontaneous? Did Beethoven's MI consist of original or familiar music? Was his MI loud, or vivid, or complete musical compositions? Since Beethoven was originally a virtuoso pianist, was he able to imagine music of other instruments (violins, flutes and so forth)? Clearly these questions are not likely to be answered in any certain terms. It does however point to questions about whether his MI was essentially rare or perhaps the norm, especially since he was a professional musician with numerous years of musical training. Perhaps, during Beethoven's era, MI was an experience of musicians alone, or maybe it was characteristically voluntary in nature. Beethoven's case also highlights factors which might underpin the experience of MI, such as musical training, daily exposure to music, a passion for (composing) music, musical culture during a particular era and so forth. Arguably, in a modern era, typified by portable technology, music is so readily available that it often permeates daily living (Levitin, 2006). Consequently, it is conceivable that the nature and experience of MI is likely to be quite different to Beethoven's era or even in the mid-twentieth Century. In a globalised, technologically advanced society,

easily obtainable music includes a more extensive range of music genres as compared with previous generations (Levitin, 2006). These factors alone are likely to shape the phenomenon of MI. This study is unable to address all these questions, but it does intend to investigate the everyday experience of MI in a particular context since, for the most part, the knowledge regarding MI does not relate to its prevalence in naturally occurring environments.

Currently, there is insufficient empirical evidence to make definite inferences regarding the worldwide prevalence of MI. Nevertheless, it has been argued that generally, most individuals naturally understand the expression: 'having a tune in your head' (Zatorre & Halpern, 2005). Sacks (2008) posits that universally[1], most individuals have in fact experienced the phenomenon of mental replays of songs, tunes and fragments of music. His claim in not necessarily purely speculative, since a study conducted by Liikkanen (2008) presented findings from a fairly large sample (n = 11,910) which indicated that approximately 90% of the participants reported experiencing involuntary MI at least once a week, signifying that involuntary MI was a reasonably consistent and pervasive occurrence in the Finnish sample. However, it has been stated that further research is required to verify its presence in other cross-culturally representative samples (Liikkanen, 2008). Interestingly, Hubbard (2010), in a review of research concerning auditory imagery, indicates that involuntary MI is typically viewed as a clinical pathology known as musical hallucinosis, and its prevalence in psychiatric patients is estimated to range from 0.16% to 27%. Based solely on this information, either the majority of Liikkanen's (2008) sample was describing musical hallucinations, or it is more reasonable to suppose that involuntary episodes of MI are quite common. Regardless, with only a handful of studies investigating naturally occurring episodes of MI, this is an unverified assumption.

There is some evidence to indicate that MI is experienced but its universal prevalence has not yet been established or confirmed. To some extent, other aspects that are also unknown about MI relate to its history, its general nature, its everyday characteristic dimensions, its overall utility, it aetiology and its manifestation in different historical and cultural contexts. However, as previously noted, the phenomenon of MI is connected to music. Moreover, since auditory perception and imagery are stated to share a range of neural structures (see for

[1] Arguably, only once cross-culturally representative, reliable research concerning naturally occurring MI dimensions and prevalence has been generated, would it be appropriate to conclude that MI is universally experienced.

example Zatorre, Halpern, Perry, Meyer & Evans, 1996; and Herholz, Lappe, Knief & Pantev, 2008), it is reasonable to believe music perception and MI share an important relationship too. Accordingly, a summary of a few aspects of music's function in everyday living might provide some insights into why people may well have the capacity for MI.

Music is extremely common in most individual's daily lives (Sacks, 2008). In fact it is ubiquitously present given the technological advances of the contemporary era (Levitin, 2006). Logically, it is possible that music's pervasiveness is a primary trigger or catalyst for an episode of MI. Indeed, Beaman and Williams (2010) speculate that this is perhaps true for a closely related experience known as an 'earworm'. It is has even been hypothesised that everyday music is likely to demonstrate more cross-cultural similarities than language (Trehub, 2003). Sacks (2008) describes an excerpt from Arthur C. Clarke's book titled *Childhood's End* to emphasise his point about the universality of music and our species' proclivity for it. Following Clarke's story, Sacks (2008) suggests that from an extraterrestrial species' viewpoint, humans' fascination, or arguably our obsession (Levitin, 2006), with music might appear absurd or even incomprehensible, since music itself does not offer any power of representation[2] such as languages do (Trehub, 2003). Additionally, it is well-established that music has the capacity to promote social cohesion. Trehub (2003, p.672) states that "music is not communicative in the sense of sharing information. Instead, it is concerned with sharing feelings and experiences and the regulation of social behaviour". This quote emphasises the social role of music. Lipson (2006) argues something quite similar and suggests that one function MI offers, in a therapeutic context, is that it acts as a metaphor for understanding the emotional states of his patients. Lipson (2006) also hypothesises that people might experience MI more regularly when they are alone because it could be a psychological mechanism to cope with separation anxiety. Although these statements are unconfirmed hypotheses, they do illustrate that the role and nature of everyday music provides a basis for the formulation of hypotheses concerning MI.

What is equally remarkable about music is its antiquity, in view of the fact that it has embedded itself within almost every cultural fabric in one form or another across time (Sacks, 2008; Bicknell, 2007; Trehub, 2003). It has been noted that the power of music in inducing and augmenting emotional responses has also been harnessed by multiple industries

[2] Presumably, this claim specifically applies to non-vocal, non-lyrical music and does not necessarily relate to exclusively vocal or lyrical music.

across various cultures (for example, advertising, marketing, filmmaking, the military and so forth) (Levitin, 2006). It is therefore viewed as an evocative and psychologically intoxicating phenomenon (Trehub, 2003). Sacks (2008) boldly extends this argument by coining the expression 'musicophilia', with the aim of capturing the sheer magnetism of music for our species. He states that music "lies so deep in human nature that one is tempted to think of it as innate, much as E. O. Wilson regards "biophilia", our feeling for living things" (Sacks, 2008, p.*x*). Additionally, it is asserted that listening to, performing and creating music utilises almost every known cortical region within the human brain (Levitin, 2006). The tremendous allure music has for our species and our neurological capabilities for the perception of musical sound could essentially explain a large portion of the cognitive capacity to produce MI. If this is true, then what is the biological advantage of music perception and could MI enhance that function?

Sacks (2008, p.*x*) explains that music might not have an essential adaptive or evolutionary function by quoting Steven Pinker's fairly contentious "auditory cheesecake" argument[3]. Essentially, Pinker's controversial hypothesis is that the perception of music is non-adaptive because it does not offer any biological survival advantage from an evolutionary perspective and that it merely stimulates neurological pleasure-centres (Sacks, 2008; Levitin, 2006). Similarly, Levitin (2006), notes that even though there are roughly 250 individuals who specifically research the perception and cognition of music, there is still considerable debate[4] about the essential function of music in our species (Levitin, 2006). Proponents who argue against its adaptive function merely view "music only as disembodied sound" (Levitin, 2006, p.257). Nevertheless, both Sacks (2008) and Levitin (2006) emphasise that music perception is an important feature of humanity even if it might not offer an evolutionary benefit. It has also been suggested by Pinker (as cited in Levitin, 2006) that music perception is a spandrel[5] – it is an unintended by-product of language or an evolutionary mishap. The argument is based on the observation that these two abilities also share similar neural pathways but that music perception does not offer any survival advantage. According to Levitin (2006, p.249),

[3] Levitin (2006, p.248) quotes Pinker as having stated the following: "Music is auditory cheesecake, it just happens to tickle several important parts of the brain in a highly pleasurable way, as cheesecake tickles the palate". Thus, it is suggested that from a neurological perspective, music is able to tap directly into the normal pleasure receptors in the brain which originally evolved to reinforce adaptive behaviours like eating.
[4] See Chapter 9 of Levitin's (2006) book titled *This Is Your Brain on Music* for a more in-depth discussion of music's evolutionary function.
[5] An example of a spandrel is that birds originally evolved feathers for warmth but later feathers became a primary mechanism for flight – the unintended function of feathers is known as a spandrel (Levitin, 2006).

Pinker stated in a keynote speech[6] that "Music pushes buttons for language ability (with which music overlaps in several ways); it pushes buttons in the auditory cortex, the system that responds to the emotional signals in a human voice crying or cooing, and the motor control system that injects rhythm into the muscles when walking or dancing". However, Levitin (2006) believes that Pinker presented his "auditory cheesecake" argument to motivate cognitive scientists into re-examining music's evolutionary function. Nevertheless, it highlights another potential avenue to explore regarding the function of music perception, specifically whether it is intrinsically related to language development and if so, does this have any implications for MI?

It has been theorised that verbal communication is possible because biologically, the capacity to produce and perceive speech must have progressed concurrently as without their dual evolution, language acquisition would not have been possible (Liberman & Whalen, 2000, p.190). Following this logic, Brown and Martinez (2006) hypothesise that neural systems in the brain are equally proficient at recognising and encoding sounds (other than speech) as well as producing the corresponding sounds. Thus, to extend this assertion, if this statement holds true, then it is feasible that MI might have co-evolved with music perception. Following this logic, since not everyone is able to produce musical sounds either vocally or otherwise (specifically capable of reproducing musical sounds with musical instruments), MI is an alternate manner to produce musical sounds. Accordingly, MI could serve the same function as language production – in other words, it is both a complementary and a necessary faculty for the system of music perception to persist.

Brown and Martinez's (2006) premise[7] is primarily founded on functional magnetic resonance imaging (fMRI) results where the activation of the pre-motor vocal areas occurred during experimental tasks involving musical discriminations (n = 11; five male and six female, neurologically healthy amateur-musicians) (Brown & Martinez, 2006). The pre-motor vocal areas are neural pathways intricately linked to sub-vocalisations and the planning of speech (Brown & Martinez, 2006). In a companion study, using positron emission tomography (PET), the same group of participants were required to spontaneously vocalise improvised melodic and linguistic phrases in order to complete several presented but

[6] The speech was reported to be delivered at a music perception and cognition conference held at MIT in 1997.
[7] Neural systems in the brain are equally proficient at recognising and encoding sounds (other than speech) as well as producing the corresponding sounds.

unfamiliar auditory excerpts (Brown, Martinez & Parsons, 2006). The main findings indicated that there were nearly equivalent activations in the same functional areas across the two tasks. The primary differences related to lateralisation tendencies, thus, the language task typically activated left hemisphere cerebral activity (Brown, Martinez & Parsons, 2006). These findings were interpreted to suggest a close association between language and music perception. In addition, three separate experimental tasks (see Smith, Wilson & Reisberg, 1995) illustrated that participants performed best when both the inner ear and the inner voice were used in tandem to generate specific forms of auditory imagery. Thus, even for imagery manipulation tasks sub-vocalisation and auditory imagery (including MI) appear to exhibit an important connection with one another.

Thus, it is even plausible to hypothesise that non-verbal auditory imagery served as an historical antecedent to verbal communication and language acquisition, especially given the neurological results presented by Brown, Martinez and Parsons (2006). It has also been noted that there is evidence which can be interpreted to suggest that imagery predates the evolution of language (Marks, 1999). Similarly, Masataka (2007) tentatively argues that from an evolutionary perspective, primitive forms of communication were more comparable with music than with language, and that music may have formed an intermediate role in the evolution of language.

Considering the points made in this sub-section, it does not seem too astonishing that people might have the ability to imagine music in the mind's ear (whether through their own volition or not). However, the existence of this apparent capacity has not been proven universally or cross-culturally. Nevertheless, based on the literature which has been reviewed, the primary assumption operating in this study is that ordinary individuals do experience various forms of MI. Moreover, in view of the fact that there is no clear consensus regarding the evolutionary function of music perception (Levitin, 2006) it is reasonable to propose that MI, could be the key to discovering music perception's utility (if any). Essentially, this study explores the phenomenon of MI by drawing on everyday experiences and descriptions of MI, despite the obvious difficulties[8] relating to first-person reports.

[8] These concerns are discussed in Chapter 2 of this report.

1.2. RATIONALE

Kosslyn, Ganis and Thompson (2006) propose that the phenomenon of mental imagery has played a significant, historical role in beliefs about psychological functioning and consciousness, dating back to the time of Plato. During the early 20th Century, the study of consciousness waned in psychology owing, in part, to the introduction of behaviourism, the dismissal of introspective methods (Heavey & Hurlburt, 2008), along with the methodological complexities that hindered its empirical investigation (Kosslyn, Ganis & Thompson, 2006). This may, partly explain why MI has not been a popular topic of enquiry historically. The emergence of cognitive psychology in the 1960s, led to renewed interest in consciousness and imagery research (Hubbard, 2010). In the last three decades, the revived attention to imagery was primarily as a result of revolutionary and innovative neuro-imaging methodologies (for example, positron emission tomography (PET) scans and functional magnetic resonance imaging (fMRI) techniques) (Kosslyn, Ganis & Thompson, 2006; Zatorre & Halpern, 2005). Despite the resurgent interest in mental imagery, investigations pertaining to auditory imagery have lagged, particularly in direct contrast to visual and visio-spatial imagery research (Hubbard, 2010; Kosslyn, Ganis & Thompson, 2006). Accordingly, there is a paucity of research relating to auditory imagery (Hubbard, 2010; Kosslyn, Ganis & Thompson, 2006; Smith, Wilson & Reisberg, 1995), including MI.

Mental imagery forms part of daily cognitive activities including thinking, problem-solving, memory and imagination (Marks, 1999). It has also been strongly argued that imagery serves as an adaptive function. It is hypothesised to aid in planning motor behaviour (imaginatively generating difference response options coupled with their associated consequences) in addition to augmenting abilities for coping with unanticipated events (Marks, 1999). Marks (1999) posits that "mental imagery is a basic building block of all consciousness," since it underpins a wide array of perceptual-motor and cognitive activities, such as rehearsal, planning and faultless execution of adaptive actions. Furthermore, it is also noted that studying auditory imagery helps explain certain aspects of everyday higher-order cognitive abilities, such as memory (Eardley & Pring, 2006). For example, in two consecutive experiments with a balanced sample of 16 blind and 16 sighted participants (n = 32), who were matched according to age, gender, verbal IQ and verbal fluency, Eardling and Pring (2006, p.935) conclude that "nonvisual imagery has a role to play in everyday cognition". This conclusion was based on the observed findings that imagery was able to facilitate both

the recall of autobiographical information in addition to assisting with imagining future events in both groups of participants (Eardley & Pring, 2006). The authors recommended that future research was required in order to understand the relative roles of visual and non-visual imagery (such as auditory imagery, tactile imagery and imagery for abstract concepts).

The reliable investigation of everyday cognitive experiences is essential to understanding both perception (Heavey & Hurlburt, 2008) and imagery (Intons-Peterson, 1992). Doing so will enable researchers to determine whether MI and music perception are fundamentally different in nature and form across a wide array of settings (for example, under experimental conditions versus everyday settings). Although, validly investigating everyday experiences is not necessarily simple. Heavey and Hurlburt (2008) conducted descriptive experience-sampling (DES) research (n = 30) to investigate naturally occurring inner experience. They identified five different phenomena: namely, feelings (the experience of emotions); sensory awareness (attentiveness to bodily sensations e.g. cold wind against one's skin); un-symbolised thinking (awareness of a specific thought that is not generated through the inner voice); and two imagery modalities (specifically, inner speech and inner seeing). A particular conclusion they draw from their research is that by studying naturally occurring mental events, discoveries about novel forms of inner experience or everyday consciousness and psychological functioning can be revealed (Heavey & Hurlburt, 2008). This is based on the authors' assertion that un-symbolised thinking and sensory awareness are not commonly recognised or documented in academic literature (Heavey & Hurlburt, 2008). Following this logic, investigating everyday auditory imagery (specifically MI) is likely to augment theories of conscious experience along with specific cognitive processes associated with MI (Bennett, 2002). Additionally, investigating MI is expected to expand current psychology theories relating to the "organisation and functions of memory systems" (Bennett, 2002, p.6).

Baddeley and Logie (1992) hypothesise that the phonological loop (an important component of the working memory model) is the most suitable cognitive theory for explaining the primary processes during auditory imagery. The phonological loop is thought to be capable of rehearsing verbal and non-verbal sounds (for instance instrumental music or environmental sounds) even though it cannot generate original non-speech sounds. However, Baddeley and Logie (1992) qualify this theory by stating that the phonological loop serves to store auditory imagery temporarily rather than assisting with the retrieval of auditory imagery from long-term memory, specifically in the absence of the corresponding audio stimulus (Baddeley &

Logie, 1992). Studies concerning the role of sub-vocalisation or inner speech[9] provide some support for the hypothesis that the phonological loop is implicated in auditory imagery (Hubbard, 2010). However, there is some debate about whether auditory imagery precisely replicates the structural properties of auditory stimuli directly into memory since the empirical evidence in favour of this hypothesis is varied and unresolved (Hubbard, 2010).

Studying everyday occurrences of MI, preferably using methods aimed at capturing real-time data (particularly at some point during an episode of MI or even at its onset; see Heavey and Hurlburt, 2008), is expected to fortify generalisable theories regarding the memory systems underpinning MI. For example, if it was commonly observed that everyday MI usually involves short, repeated fragments of familiar and recently heard music, it might be logical to examine hypotheses, in an experimental context, regarding the role of echoic memory in MI. Conversely, if the dominant trend observed in everyday episodes of MI was that complete, unfamiliar or original songs were frequently imagined, it might indicate that some forms of MI are unrelated to memory and could represent a creative cognitive dexterity. Thus, examining MI has the potential to provide some indication of whether auditory imagery is manipulated or interpreted in the corresponding cortical regions (Hubbard, 2010).

Various methodologies have been utilised to examine the assorted imagery modalities (particularly visual imagery, spatial imagery and auditory imagery) as well as to identify the underlying neural structures underpinning them (Richardson, 1999). Research on MI displays analogous trends. What has emerged from the MI literature is that neurological, experimental and quantitative studies concerning MI appear to be the dominant methods (see for example Herholz, Lappe, Knief & Pantev, 2008; Brown, Martinez & Parsons, 2006; Bailes & Bigand, 2004; Halpern & Zatorre, 1999; Zatorre, et al., 1996; and Weber & Brown, 1986). However, in the last five years (2005 – 2010), MI studies are starting to employ non-experimental methods. Notably, within the abovementioned five year period, it seems that there are less than ten readily accessible[10], published studies which have examined the phenomenon from a non-experimental standpoint, specifically focusing on the everyday dimensions of MI. Of the non-experimental research, quantitative methods are often the primary method of enquiry,

[9] Refer to Smith, Wilson and Reisberg, (1995) for three experiments explicitly implicating sub-vocalisations and the phonological store in auditory imagery.

[10] A literature search was conducted using the following keywords (imagery, music, musical imagery, non-experimental, auditory imagery, audition), in various combinations across the following databases: ScienceDirect, PsycINFO, ProQuest Psychology Journals, Academic Research Library and ISI Web of Science.

typically employing closed-ended questionnaires (see for example Beaman & Williams, 2010; Wammes & Barušs, 2009; Bailes, 2007; and Bennett, 2002). The few exceptions include Lipson's (2006) theoretical paper which employed a psychoanalytic framework to explain the presence and features of MI from his personal experiences as a clinical psychologist; and Brown (2006), who performed a phenomenological analysis of his own experience of MI – what he labels a 'perpetual music track' – over a two year period.

However, some of the claims made by these non-experimental studies are dubious (such as the prevalence of MI) owing to problems inherent in the method of enquiry. For example, a limitation of at least three non-experimental studies examining MI, (see Study One of Beaman & Williams, 2010; Liikkanen, 2008; Bennett, 2002) is that there was an exclusive dependence on *ex post facto* MI reports. This is problematic since retrospective introspective reports of conscious experience are more likely to include errors. For example, participants may inadvertently over-report or conversely, under-report their average daily or weekly experiences of MI. Thus, the reliability of first-person data depends on the time in which it is recorded, (in-the-moment reports versus retrospective reports) by the participant (Piccinini, 2003).

Since temporal factors influence cognitive mechanisms underpinning the subject's ability to reliably recall and describe the experience, (such as attention, memory, language), retrospective reports are to some extent unreliable. Bailes' (2007) recommends that in order to reduce bias in recall arising from retrospective reports, future studies concerning MI, could employ iterative, real-time longitudinal sampling[11] in order to yield more reliable results. A second limitation of non-experimental MI research includes case studies where the participant is also the observer (Brown, 2006; Lipson, 2006). These methods are not necessarily scientifically valid, particularly if the observer does not describe the methods used to formulate their inferences. Piccinini (2011) refers to this issue as a debate between whether first person reports are essentially generated through private or public methods. Simply stated, private methods involve the generation of information that other researchers' are unable to reproduce either because the method is inherently flawed (it is unreliable, or inconsistent for each participant) or since there is insufficient information concerning the procedures to replicate the research in a different context (see Piccinini, 2011 for a discussion

[11] This methodology is commonly referred to as experience-sampling or descriptive experience-sampling (DES).

of private and public methods). Thus, Brown's (2006) study is one that could be considered problematic since it cannot be ascertained how the data and associated inferences were generated. Nevertheless, his study does highlight the apparent occurrence of MI during dream-states as well as providing a potential framework for thematic categories for analysis of MI data – namely, the nature, content, constancy and associated corporeal manifestations of MI (for instance, foot-tapping, humming and so forth) (Brown, 2006).

It is also important to distinguish between different modalities of MI (for example verbal and non-verbal imagery) as well as its underlying nature (voluntary and/or involuntary MI) (Hubbard, 2010) to augment conceptual and theoretical lucidity. Since MI is a subcomponent of auditory imagery, investigating how it manifests in people's daily lives is likely to offer information about the nature of MI in normal awareness. Depending on the method of enquiry, it is even be possible to collect data concerning imagery during dream-states (see Snyder, 1970, as cited in Hubbard, 2010). It is also essential to collect baseline data regarding the incidence of ordinary inner experiences, across diverse settings, prior to examining such phenomena in experimental settings (Heavey and Hurlburt, 2008). Currently, research concerning the everyday experience of MI involves participants from Britain, North America and a few European countries. There is an apparent absence of South African research on the prevalence and experience of MI. Thus, queries about the cross-cultural manifestations of MI form part of the rationale for the present study. If researchers fail to examine the characteristic attributes of everyday MI (for example, its vividness, loudness, involuntariness, associated motor responses), then imperative questions[12] concerning MI will remain partly unanswered. Since MI is experienced in the mind's ear, the manner of investigating it becomes fairly challenging (Zatorre & Halpern, 2005).

Thomas (2010) argues that evidence for any experience relies upon subjective data. The very nature of imagery indicates that "we are dependent here on reports from listeners" or first-person narratives (Sacks, 2006, p. 2530; Varela & Shear, 1999) even though functional brain imaging technologies enable scientists and researchers to explore the neural mechanisms underpinning various imagery phenomena (Sacks, 2006; Zatorre & Halpern, 2005). Descriptions of a phenomenon help uncover 'what it is like' to experience a particular mental

[12] For example: Does MI preserve the structural or temporal attributes of musical stimuli? or Are musical images interpreted or merely sensory copies of musical stimuli? Is MI an obligatory phenomenon? Although this study will not be able to directly answer these questions, it may provide some evidence in favour of developing hypothesis concerning the broad questions posed above.

occurrence, that may or may not be overtly observable, given that first-person narratives reveal characteristic aspects of consciousness (Nagel, 1974). In this study, first-person events are defined as "the lived *experience* associated with cognitive and mental events" (Varela & Shear, 1999, p.1). This implies that first-person events are dependent on how consciousness is defined. Consequently, in this study, the use of the term consciousness connotes the following: "the subject knows about, is informed about, or in other words is aware of, the phenomenon" (Varela & Shear, 1999, p.4). From this perspective, another fundamental assumption about consciousness is operational. To acknowledge that lived experience is worthy of investigation, is to recognise "the evidence that life and mind includes that first-person dimension which is a trademark of our ongoing existence" (Varela & Shear, 1999, p.4). Therefore, if data involving first-person events is omitted, then there is a truncation of lived experience or an absent link regarding scientific explanations of everyday consciousness (Varela & Shear, 1999). Similarly, it has also been argued that some scientific models become prone to reductionism if they fail to account for subjective experience in the course of aiming for objectivity (Nagel, 1974).

Following this line of reasoning, descriptions of the daily episodes of MI are an appropriate source of data for the purpose of investigating MI's intrinsic qualities and everyday characteristic dimensions. Exploring imagers' lived experiences – what it is like to have MI – does not necessarily locate this study within the philosophical tradition of Phenomenology. Rather, it is referring to phenomenology in a more general or broader sense – specifically denoting conscious experience or mental phenomena (Varela & Shear, 1999). Consequently, this study presupposes that first-person accounts are a rich source of information that should form part of a rigorous investigation if it is able to provide a thick description of a particular aspect of everyday consciousness (namely MI).

In a review of research concerning auditory imagery (inclusive of MI) Hubbard (2010) argues that since images cannot be directly observed by experimenters, countermeasures need to be established to ensure that auditory imagery was actually generated by the participants and that it explains the presented findings. If data concerning participant's behaviour is unreported alongside neurological results, then conclusions concerning the neural systems underpinning auditory imagery cannot be made (Hubbard, 2010). Following this logic, it seems that investigating everyday MI could serve two subsidiary purposes. Firstly, if experimental researchers have a broad spectrum of reliable research concerning naturally

occurring MI qualities and incidences from which to draw supplementary data, then when experiments are conducted, experimenters would be able to ascertain, with greater confidence, whether the imagery being studied is similar to the naturally occurring phenomenon or whether the experimental task(s) may have inadvertently altered the phenomenon. Secondly, examining dimensions of naturally occurring MI (or other auditory forms of imagery) may provide ideas regarding suitable control mechanisms designed for measuring behavioural data during neuro-imaging experiments.

Given the presented rationale, this study will explore daily experiences of MI in a systematic manner to capture the various dimensions of the phenomenon by way of mixed methods. Consequently, this study employs experienced-sampled descriptions of MI in addition to a cross-sectional survey concerning background demographic data relating to participant's musical history and activities. The experienced-sampled data will also be thematically analysed in terms of MI's nature, constancy, content in addition to specific co-occurring phenomena (motor responses and visual imagery) related to participant's experiences. Furthermore, the experienced-sampled data will be clustered according to temporal properties (real-time reports and retrospective reports) as well as by indicating the reported (in)voluntariness of each described episode.

1.3. RESEARCH AIMS

Given these motivations, the primary aim of this study was to explore the everyday experience of MI using experience-sampling methodology. Consequently, the overall focus of the study was to answer the following general question[13]: *what is the typical experience of MI in the participant's daily lives*? This study also aimed to address the following six gaps in the existing literature base:

i. To utilise mixed methods as a technique to elicit a more holistic understanding of everyday MI experiences, with the intention of strengthening existing findings within the non-experimental paradigm of MI research;
ii. To present results for both musicians and non-musicians, with the intention of providing a more balanced and comparative view of naturally occurring MI during participant's daily experiences;

[13] The specific research questions are presented in the subsequent Chapter of this report.

iii. To purposely present findings concerning both voluntary and involuntary variants of MI, since this distinction has not always been clear in preceding MI research;
iv. To analyse the various temporal subsets of MI derived from experienced-sampled data[14], which has not been previously reported on in similar research;
v. To present data that can supplement the cross-cultural manifestations of MI because this is expected to add an element of diversity in MI research since the sample will include South African participants; and
vi. To investigate co-occurring phenomena such as motor responses associated with MI (corporeal manifestations) and visual imagery with the intention of providing a thick description of the everyday MI phenomenon.

A subsidiary aim was to thematically characterise the documented MI occurrences based on four deductively derived dimensions described by Brown (2006). The four dimensions include the constancy, nature, content and corporeal manifestations (Brown, 2006) associated with everyday MI episodes as they occur in naturalistic environments. These dimensions were presumed to be useful in establishing the variability of MI in addition to the commonly experienced features of MI over time. The dimensions of MI posited by Brown (2006) form the primary underpinnings for the thematic analysis of the current study, given that they appeared to be a reasonable and logical point of departure. Additionally, this study endeavoured to verify the dependability and extent of these characteristics in a diverse and larger sample than Brown's (2006) study and other comparable research (Bailes, 2007). This could help facilitate the development of a theoretical framework for future research given that existing studies do not appear to share a common conceptualisation of the MI phenomenon. The primary methodology aimed to minimise biases in memory recall as well as to document the incidence of MI longitudinally.

1.4. STRUCTURE AND OUTLINE OF THE RESEARCH REPORT

Chapter 1 broadly describes problematic areas concerning existing MI research that essentially comprise the rationale for the current study. It also presents the general research question derived from the research aims in addition to providing a synopsis of the subsequent Chapters in this report.

[14] Temporal subsets refer to different categories of experience-sampled reports of MI, differentiated according to the amount of time that lapsed between the participant receiving an experience sampling request and their completion of the experience-sampling journal entry.

Chapter 2 begins with a general introduction to MI including a brief historical overview of some pertinent literature and research specifically focused on MI. Subsequently, research examining MI in everyday contexts is discussed since it forms this study's foundation. This is also done in order to locate this study within a broader set of literature. Based on the reviewed literature, a taxonomy of definitions is proposed. The MI taxonomy systematically presents the various sub-sets of MI. In concluding the Chapter, general methodological considerations concerning first-person reports are acknowledged since there are complexities linked to data of this nature. Lastly, it also introduces the primary methodology of experience-sampling.

Chapter 3 explains the research design, sample characteristics as well as the sampling technique. It then outlines the two data collection instruments and their overall development with reference to the study's objectives. Subsequently, it provides motivations for the methodology in addition to discussing theoretical explanations of the distinctive procedures concerning experience-sampling. It explains both the piloting and the practical phases of the study along with clarifying the techniques regarding the data analysis in addition to finally considering imperative ethical concerns.

Chapter 4 presents the results of the data analysis. It initially outlines the findings of the first stage of data collection with specific reference to the musical activities, experience and self-reported daily exposures of the larger sample group. Moreover, it presents findings related to the first dimension of MI – constancy – including both descriptive and inferential statistics. It subsequently provides an initial synopsis of the experienced-sampled data, which constituted the second data collection phase. It identifies specific themes and descriptive statistics related to the three remaining MI dimensions (specifically, the content, nature and corporeal manifestations). This Chapter utilises participant's direct quotations, where applicable, in order to illustrate interesting sub-themes within the qualitative sections of the results.

Chapter 5 compares the study's primary findings to analogous research with specific reference to MI constancy, content and its nature. Additionally, it examines contextual data which appeared to reinforce the everyday incidence of MI episodes within the sample. Lastly, corporeal manifestations are examined with the intention of revealing its proposed connection to MI.

Chapter 6 concludes the research report by highlighting theoretical and practical implications of this study. The relative strengths and limitations are also examined. Lastly, ideas for future directions in MI research are proposed and a final synopsis of the main findings in the study serves to conclude the Chapter.

CHAPTER 2

LITERATURE REVIEW

2.1. INTRODUCTION TO THE PHENOMENON OF MUSICAL IMAGERY

This Chapter serves to initially introduce the phenomenon of musical imagery (MI). It also offers some additional justifications highlighting why studying MI is important to psychology. Subsequently, it provides a concise historical overview of significant developments regarding the study of MI. The next section considers research that effectively underpins the current study and forms the basis for the chosen methodology. Reviewing relevant studies intends to locate this research within a broader literature base. It also highlights several gaps in theoretical understandings about MI. Discussing these pertinent studies, also aims to present notable research findings as well as emphasising limitations with extant studies. Based on literature which has been reviewed, a taxonomy of MI and its associated definitions will be proposed to illustrate its heterogeneous nature of MI. Finally, the Chapter concludes with a discussion of general methodological considerations concerning everyday MI. The purpose of this is to overview imperative issues intrinsically linked to first-person reports in addition to introducing experience-sampling as a methodology.

2.1.1. What is Musical Imagery?

An obvious point of departure is to ask the following logical question: What is musical imagery? MI is most simply defined (by adapting Kosslyn and colleagues' (2006) definition of mental imagery[15]) as *hearing music in the mind's ear.* This definition is deceptively simple and it might appear to connote that MI is a straightforward phenomenon. However, upon reviewing the literature, a pertinent observation is that the notion of MI is by no means a homogenous construct. This observation is premised upon the fact that a variety of similar phenomena associated with MI have been referred to by a wide range of terms, such as: 'earworms' (Beaman & Williams, 2010), 'brainworms', 'sticky music' (Sacks, 2008), 'stuck

[15] "Mental imagery occurs when perceptual information is accessed from memory, giving rise to the experience of "seeing with the mind's eye", "hearing with the mind's ear", and so on." (Kosslyn, Ganis & Thompson, 2006, p.195).

song syndrome' (Levitin, 2006), musical imagery (Bailes, 2007), the perpetual music track (PMT, Brown, 2006), involuntary musical imagery (Liikkanen, 2008), musical imagery repetition (MIR; Bennett, 2002) as well as a variety of other names. Consequently, all these synonyms indicate that MI is not a one-dimensional phenomenon, it is multifaceted. Nevertheless, the most obvious deduction is that MI consists of at least two distinct and interrelated elements, namely mental imagery and music.

In relation to the first component of MI, Thomas (2010) discusses the notion of *quasi-perceptual experience* with regards to the phenomenon of mental imagery. This phrase essentially means that the imagery (whether visual, auditory or relating to any other modality) bears a resemblance to perceptual experience, except that it frequently occurs in the absence of the directly corresponding external stimulus (Thomas, 2010). For instance, people are generally capable of imagining an elephant or a particular melody without such stimuli being present in the immediate environment. However, some individuals (for example, Beethoven) are likely to extend this ability further and are presumably able to creatively imagine, completely novel imagery that has by no means been previously perceived. We may wonder why the average person is able to imagine sounds or, more specifically, musical sounds whether original or familiar. The second component of MI, namely music, does provide a few intimations about the supposed capacity for it.

As noted in Chapter 1, music is powerful, emotionally evocative and ubiquitous (Sacks, 2008; Bicknell, 2007; Levitin, 2006). To quote the anthropologist, Alan Merriam (1964, p. 218), "There is probably no other human cultural activity which is so all-pervasive and which reaches into, shapes and often controls so much of human behaviour". Therefore, music is not simply a commodity that is created, distributed, and consumed (North, Hargreaves & Hargreaves, 2004). It is a medium that serves various functions (North, Hargreaves & Hargreaves, 2004). From an evolutionary perspective, it has been suggested that music has served as an effective means of creating social unity and cohesion and suggests an underlying intra-group function (Trehub, 2003). Moreover, music's function can be analysed from an individual level, an intra-group level as well as at an inter-group level (North, 1999). In certain instances, theories concerning music's utility, at the individual level, are suitable for direct extension to MI's underlying function. For instance, it has been theorised that music can shape individual identity given that musical preference appears to emerge in a time of

great developmental transition[16], typically during adolescence (North, Hargreaves, & Hargreaves, 2004). North (1999) also suggests that the social function of music offers an individual three distinct areas of self-management, specifically with regard to their identity, their interpersonal relationships in addition to their mood. In relation to MI, perhaps music's ability to regulate mood would be one of the stronger arguments in favour of our ability to imagine music. It could be argued that humans' apparent propensity for MI may well be explained by our affinity for music. Inversely, our ability to imagine music may too explain some aspects of our predilection for music, our species' so-called *musicophilia* (Sacks, 2008). In all likelihood, there is a reciprocal interplay between music and MI.

For the purposes of this study, it is not essential to provide an in-depth discussion of music's function[17]. It is also unnecessary to present a broad or universal definition of music as it is particularly complex to do so (Cross, 2001). This is because there is insufficient consensus about a general definition since music has a multitude of meanings that are intricately linked to context, culture and history (Cross, 2001). Accordingly, it is not within the scope of this Chapter to digress into these debates. However, it is important to provide at least a basic explanation of what types of auditory stimuli may well be classified as examples of MI. Levitin's (2006, p.14) explanation of rudimentary musical attributes, eloquently explains the essential components of music even though he does not attempt to provide a conceptual definition:

> The basic elements of any sound are loudness, pitch, contour, duration (or rhythm), tempo, timbre, spatial location, and reverberation. Our brains organize these fundamental perceptual attributes into higher level concepts – just as a painter arranges lines into forms – and these include meter, harmony and melody. When we listen to music, we are actually perceiving multiple attributes or "dimensions".

Similarly, Hubbard (2010) provides a clear distinction between different forms of auditory imagery which assist in differentiating between complex (such as musical contour, melody,

[16] Arnett (2003) argues that some of the lure for adolescents in relation to their music preference relates to the transgressive appeal it has. He suggests that adolescents are expected to breach cultural norms during this developmental period and that it is not surprising that adolescents like music which also transgresses social norms. Arnett (2003) argues that jazz, rock 'n roll and rock music all transgressed social boundaries in terms of sexuality. In other words, all three genres pushed the boundaries of what was acceptable in terms of sexuality until the norms of societies evolved (Arnett, 2003). He states that the novelty of the transgressive appeal wears off as societies expand their conceptions of social norms and theorises that once social norms evolve, these genres are no longer viewed as deviant (Arnett, 2003).

[17] See Chapter 1 for an overview of some of music perception's general function.

and harmony[18]) and simple musical sounds (for example, pitch, timbre and loudness). Jointly these two conceptual descriptions help to differentiate between the kinds of musical sounds that will fall within the scope of MI. Thus, for the purposes of this study, examples of MI will include auditory imagery involving higher level musical attributes (complex musical sounds). This research specifically excludes rudimentary musical components that occur in isolation (for instance, MI which involves only one musical note). Accordingly, only MI that involves a combination of basic musical elements will be classified as a case of MI. Environmental noises will be also excluded from auditory stimuli which fall within the scope of MI (for instance sounds produced by animals and/or sounds arising from objects or events in the environment – e.g. rain, traffic, a boiling kettle and so forth). The underlying rationale is that complex musical attributes are common musical stimuli presumed to be present in everyday musical exposure. Undoubtedly, this is a somewhat arbitrary distinction except that, since this study aims to explore general trends in the daily occurrence of MI rather than examining unusual or atypical sounds, it is a sensible approach to differentiate between episodes of MI and non-MI cases.

2.1.2. Why study Musical Imagery?

Although the rationale presented in Chapter 1 discusses the primary motivations for examining MI, a few supplementary arguments will also be presented. In a general sense, it is important to investigate MI because it can explain something novel about our species' cognitive abilities. As highlighted in Chapter 1, several arguments were proposed regarding MI's potential to reveal important aspects of cognition. These included its reciprocal relationship to music perception, its prospective evolutionary role as a precursor to language acquisition, its role in auditory memory formation and retrieval, and its suggested utility for imagination and musical aptitude. In essence, investigating MI has the potential to innovatively advance current theories of everyday cognitive activities. Essentially, understanding the various facets of MI is also expected to reveal its cognitive utility and function.

Following this logic, it is sensible to question why some individuals are presumably capable of imagining musical sounds. To ask the question in another way: what, if any, is MI's

[18] However, since the study employed a sample of musicians and non-musicians, complex musical terminology was avoided. Thus, songs, melodies and tunes were the general descriptors of MI that were used by the researcher in her communication with the participants.

primary function? This study will not be able to answer such broad questions in any conclusive terms. To all intents and purposes, it is a study aiming to build a small portion of the foundation for generalisable cognitive theory concerning the phenomenon of MI. Metaphorically speaking, and to quote Pink Floyd lyrics, "all in all, it's just another brick in the wall" of research investigating specific dimensions of MI experiences. Evidently, asking these general questions assumes that this phenomenon is, to some extent, universally experienced. In other words, it is presumed that the average person is capable of creating a musical image, regardless of its content, nature, form or cause. This ability could be linked to why, as a species, music generally has such a potent allure for us (Sacks, 2008). In order to begin to respond to such enquiries, an illustrative argument is presented.

As outlined in Chapter 1, Steven Pinker (cited in Levitin, 2006) has controversially claimed[19] that music perception is merely "auditory cheesecake". This statement serves as the basis for the following hypothetical working example. Suppose that the perception of music activates neural substrates linked to pleasure-seeking systems within the limbic system[20] typically associated with human survival (sustenance, procreation and so forth) (Peretz, 2006) but in itself, it is not crucial to our species continued existence. Based solely on this information, it could be (erroneously or correctly) concluded, that listening to music is purely a hedonistic activity. Following this logic, it could be surmised that the ability to imagine music could be the brain's way of activating this self-rewarding past-time, particularly if the MI is involuntary. In doing so, an individual might subjectively experience a sense of satisfaction, perhaps a significant positive mood change and might describe the experience of MI as pleasant. Greater exposure to music in a person's everyday life would also augment their ability to recall music and subsequently replicate it in the mind's ear. The argument being presented is that if music is deemed to be equivalent to an addictive drug, then MI would be the proxy drug. The more the individual likes music, the more they listen to music, and the more they pay attention to music, the more likely their brain will generate the musical substitute (MI), particularly when music is not available in the immediate surroundings. Similarly, if there was also reliable and valid scientific evidence to suggest that this pattern was common in a sufficiently large proportion of other individuals, then it might be

[19] Presumably, Pinker's claim is based upon some empirical or sound neurological evidence. See Chapter 1 for an overview of argument.

[20] The limbic system is a set of set of neural structures lying underneath the neocortex including the amygdala, hippocampus, parts of the thalamus and mammillary bodies. This system is crucial for the satisfaction of the basic biological needs of the individual and is implicated in emotion, learning and memory (Peretz, 2006).

reasonable to conclude that the experience of MI is simply a neurologically generated substitute for music that serves to induce a pleasure response. Undoubtedly, this example is merely speculative, since empirical evidence may or may not disprove these claims. The idea intended to be conveyed is that in order to understand why people have the ability to imagine music, it is important to discuss what is already known about MI as well as being able to describe the everyday experience of MI. In doing so, it could unlock some answers of why music is important to humanity. It could also provide generalisable cognitive theories' regarding MI's function and its relationship to other cognitive capacities including music perception, memory and musical capabilities.

It has been speculated that the purpose of voluntary MI is to provide a cognitive strategy for trained musicians as a form of mental rehearsal (Halpern, 2003). It has also been suggested that imagining music aids musicians in improving their musical capabilities, since it is said to stimulate cerebral blood flow to the neural pathways required for the actual musical movements (Sacks, 2008; Zatorre, Halpern, Perry, Meyer & Evans, 1996). Whatever the truth and utility of these hypotheses, they do not explain the function of MI in non-musicians or in individuals who chose not to listen to music whatsoever. Moreover, literature is fairly meagre in terms of the role or utility of involuntary MI in both musicians and non-musicians.

Crowder and Pitt (1992) advocate that auditory imagery is merely a specific form of memory. Similarly, Liikkanen (2008) argues that involuntary musical imagery (INMI) is a variant of involuntary semantic memory which implies that it does not appear to have a particular purpose and may simply be a form sporadic memory recall. Given that MI is a sub-component of auditory imagery (Weber & Brown, 1986) then, following this logic, it could also simply be a particular form of memory. However, this argument is somewhat flawed because there is reasonable evidence to suggest that individuals are capable of manipulating particular elements of a voluntary musical image, such as its tempo (see Halpern 1992; and Halpern, 1988). Likewise, some research also indicates that participants are able to 'fast-forward' or 'rewind' a melody – which indicates that several people have the ability to control an imagined song's temporal properties (see Halpern & Zatorre, 1999). For that reason, it is reasonable to surmise that involuntary MI could also be influenced by the imager, even if it is rather limited. This suggests that MI (whether voluntary or involuntary in nature) cannot simply be a form of memory. Moreover, the example of Beethoven indicates that an individual can imagine and compose music even in the absence of perceiving the

corresponding sounds. Beethoven was presumably able to imagine musical compositions which he certainly could not hear.

Baddeley and Logie (1992) offer a cognitive theory of memory for understanding the processes involved in auditory imagery. Their primary assertion is that the Phonological or Articulatory Loop (derived from the Working Memory Model) plays a crucial role in auditory imagery and may possibly serve as a potential model for other forms of nonverbal imagery (Baddeley & Logie, 1992). Although this theory is not necessarily directly transferrable to MI, there are some features which could be extended to MI. Importantly, Baddeley and Logie (1992) raise the following stipulation: since the experimental paradigm has not explored phenomenological reports of imagery, the verification of their theoretical supposition remains to be directly supported by experimental evidence. Accordingly, it could be argued that it is important to investigate first-person reports of phenomena (such as MI) in order to ascertain whether hypotheses derived from experimental data adequately explain naturally occurring cognitive experiences.

A seemingly novel approach for studying everyday human cognition is 'cognitive ethology' (Kingstone, Smilek & Eastwood, 2008). The primary assertion of cognitive ethology is that it is imperative to explore and reliably document naturally occurring incidences of cognitive phenomena prior to investigating such phenomena in controlled laboratory situations (Kingstone, Smilek & Eastwood, 2008). The authors propose that investigating naturally occurring experiences would augment the validity and generalisability of hypothesis to be examined under experimental conditions. The following statement captures the central tenets of cognitive ethology (Kingstone, Smilek & Eastwood, 2008, p. 321):

> We argue that cognitive processes and behaviours that are generalizable and meaningful are most likely to reveal themselves when people are studied first under the real-world conditions where multiple variables are free to co-occur. Specifically, we argue that it is by starting with real-world observations and individual variation that one is most likely to generate subsequent research questions for investigation that may lead to general principles of cognition that have relevance to naturally occurring phenomena.

Currently, a fair proportion of experimental research has primarily investigated the neural basis for MI (see Herholz et al., 2008; Kraemer, Macrae, Green & Kelley, 2005; Zatorre & Halpern, 2005; Halpern & Zatorre, 1999; Zatorre et al., 1996) as well as the processes

involved in generating simple musical elements such as the timbre, pitch, tempo and various other components of MI (see Crowder & Pitt, 1992; Halpern, 1992; Crowder, 1989; Halpern, 1988; Weber & Brown, 1986) rather than investigating the phenomenon as it is experienced on a daily basis. Indeed, it may be erroneous to assume that MI is universally experienced on a daily basis since there is a paucity of research to confirm these claims. Furthermore, it has been asserted that even though auditory imagery is typically experienced in daily functioning, it is comparatively understudied relative to visual and spatial imagery (Hubbard, 2010). Numerous scholars have also argued that MI requires further investigation. As a sub-component of auditory imagery, it too is inadequately researched (Liikkanen, 2008; Sacks, 2008; Levitin, 2006; Halpern, 2003; Bennett, 2002; Crowder & Pitt, 1992). Nevertheless, there is certainly some neurological evidence describing some of the neural correlates of MI.

Kosslyn and colleagues' (2006) posit that both auditory perception and auditory imagery share analogous cortical structures. For example, Halpern (2003) hypothesises that the right temporal lobe plays an active role in processing both perceived and imaged pitch of familiar music, especially instrumental melodies, whilst the left temporal structures have been associated with the processing of music with lyrical content. This theory is based on evidence derived from PET studies (see Halpern & Zatorre, 1999; and Zatorre et al., 1996). Kraemer and colleagues' findings (Kraemer *et al.*, 2005) indicated that there was increased activity in the auditory association cortex (Brodmann's area 22) during gaps of silence whilst participants listened to familiar songs (both with and without lyrical content) compared to during silences in unfamiliar songs (both with and without lyrical content). Additionally, if the familiar songs contained no lyrics, then cortical activity extended into the left primary auditory cortex during the silent gaps (Kraemer et al., 2005). Thus, comparable neural systems appear to be involved in both MI and music perception.

Sacks (2008) proposes that voluntary MI activates three neural pathways – namely the auditory, motor, and frontal cortices. He indicates that some neurological research implicates the basal ganglia as a primary cortical mechanism underpinning involuntary or spontaneously generated MI experiences. Llinás (2001; as cited in Sacks, 2008) states that the basal ganglia are an essential neurological component related to all motor activities, and further explains that random samples of motor actions are constantly being generated via the basal ganglia, although not all of these patterns will be transformed into actual movement or motor actions. Llinás (2001; as cited in Sacks, 2008) posits that the experience of MI is the result of a

portion of these action-patterns moving into one's conscious awareness and as a result, the individual suddenly becomes aware of MI. Additionally, it has also been argued that the supplementary motor area (SMA) is activated during MI experiences and that the SMA might serve to mediate (involuntary) motor and vocalised responses associated with MI (for example humming) (Halpern, 2003). As noted in Chapter 1, there is some evidence to suggest that comparable neural systems are activated during both language and musical discrimination tasks (Brown, Martinez & Parsons, 2006). Furthermore, pre-motor vocal areas, particularly the SMA have also been implicated during these discrimination tasks (Brown & Martinez, 2006). The significance of the abovementioned findings is that they indicate a potential overlap between MI and music perception and perhaps even language. This premise is based upon the activation of the SMA during MI which has also been implicated during vocalisation and sub-vocalisation (Halpern, 2003) in addition to musical and language discrimination tasks (Brown, Martinez & Parsons, 2006).

Accordingly, it could be hypothesised that non-verbal perception (and by extension, non-verbal imagery) is an important antecedent to language acquisition. Equally, there is evidence to suggest that the perceptual abilities for music in pre-linguistic infants are sufficiently comparable to individuals with a number of years of informal musical exposure (Trehub, 2003). This suggests that musicality could be inherent to our species' neurology. Furthermore, Peretz (2006) argues that music is important to infants, particularly prior to the acquisition of language. There is also ample anthropological data to indicate that there is a universal tendency of infant care-givers to regularly use music as a medium to bond with pre-linguistic infants because of the capacity melodious tones embody in expressing emotion (Trehub, 2003). Since music has a powerful social function, it can be used to regulate an infant's mood, or to attract the attention of an infant (Peretz, 2006; Trehub, 2003). One of the primary distinctions between music and language is that music lacks 'semanticity' or an unambiguous meaning. As a result, it is often disregarded by scientists as an "evolutionary irrelevant artefact" (Trehub, 2003, p.669) even though music perception could precede language acquisition or prepare a pre-linguistic infant for language development (Masataka, 2007). These assertions are not presented with the intention of digressing from the current topic of enquiry. They serve to illustrate important reasons why MI ought to be viewed as an essential topic for enquiry. Nevertheless, prior to discussing contemporary MI literature in too much depth, a concise summary of historical developments within this research area will be presented.

2.1.3. Brief Historical Overview

As noted in Chapter 1, there is a still a considerable portion of information that remains to be discovered regarding the phenomenon of MI. Accordingly, it is important to examine the historical developments with regard to MI research since it serves to demonstrate some of the key gaps in current understandings of the phenomenon. By observing the historical trends in MI research, it will highlight important milestones in MI research in addition to presenting a few reasons why it is an understudied phenomenon. For example, it may explain why little is known about Beethoven's alleged capacity for MI. Presumably, as a world-renowned classical music virtuoso, his ability for composing music in the mind's ear is an important dimension of his musical talent. Perhaps his capacity for MI was not considered particularly extraordinary or maybe it was not considered important enough to document. These queries may never be resolved. Nevertheless, it signifies a gap in our historical knowledge of MI.

Galton (1880) was one of the first individuals who attempted to quantitatively investigate imagery meticulously. He devised a questionnaire which aimed to assess the primary forms of mental imagery. Galton's (1880) instrument incorporated items concerning visual imagery, such as numerical values, dates, individuals and scenery; auditory imagery, for instance explicit environmental sounds as well as one item pertaining to musical imagery; other sensory imagery such as olfactory, gustatory, touch-related sensations; and certain physiological states, for example hunger or drowsiness. However, the principal focus of Galton's (1880) analysis related to the visual aspects of imagery, with particular emphasis on the vividness and precision in which participants could voluntarily recall specific images. Likewise, Betts (1909; as cited in Richardson, 1999) developed a similar instrument titled the Questionnaire upon Mental Imagery (QMI) which intended to measure seven sensory imagery modalities. The QMI consisted of 150 items: 40 assessing visual imagery, 20 assessing auditory imagery (four items specifically related to musical imagery) and the remaining 90 items concerned olfactory, gustatory, kinaesthetic, cutaneous (sensation-based), and organic (bodily sensations, for example a pin prick) forms of imagery (Betts, 1909; as cited in Richardson, 1999).

Although these two scholars could be considered pioneers in MI research, neither purposefully focused their efforts solely on MI. It appears that MI was simply included since it is one of several modalities of mental imagery. These investigation approaches also

highlight the limited choice of research methodologies during that era. Notwithstanding these historic investigations, the rise of Behaviourism resulted in introspective methods becoming quite contested and ultimately, research on imagery declined significantly (Richardson, 1999). Moreover, mental imagery and unobservable conscious phenomena proved difficult to empirically investigate (Heavey & Hurlburt, 2008). Methodological complications and paradigmatic debates have often arisen in the pursuit of empirically-generated theory associated with mental imagery (Richardson, 1999). However, with the rise of cognitive psychology during the 1960s, research concerning imagery re-emerged (Kosslyn, Ganis & Thompson, 2006), with the principal focus of enquiry remaining on visual imagery (see Gur & Hilgard, 1975; Marks, 1973; Sheehan & Neisser, 1969; Sheehan, 1967; Start & Richardson, 1964). Similarly, Reisberg (1992) notes, in the foreword to an edited collection of chapters on auditory imagery, that there is a plethora of research, literature and theory regarding visual imagery, whereas the six other modalities have remained comparatively under-researched.

Psychological research concerning mental imagery is reasonably diverse (Richardson, 1999). Some of the methods used to investigate auditory imagery include: (i) first-person self reports; (ii) experimental studies whereby participants are instructed to perform specific tasks to activate a range of elements related to auditory imagery; (iii) neuro-imaging research; and; (iv) clinical observations where auditory imagery and/or perception have been affected (Hubbard, 2010). It has been argued that interest in auditory imagery has begun to resurface, owing in part, to the numerous technological advances in neuro-imaging techniques (Liikkanen, 2008; Kosslyn, Ganis & Thompson, 2006). Research related to auditory imagery has gained popularity in the last two decades as evidenced by Hubbard's (2010) examination of empirical findings relating to auditory imagery. Since auditory imagery has re-emerged as a topic of enquiry, there have been some notable trends over the last twenty years.

Firstly, experimental studies involving behavioural tasks emerged during the mid to late 80's as empirical methods of examining auditory imagery. Weber and Brown (1986) conducted some of the first cognitive experimental research relating to musical contour (the relative and perceptible changes in a musical excerpt over time including a combination of simple musical elements such as pitch, tempo, timbre, and so forth). The authors conducted two consecutive cognitive studies utilising a 2 x 2 factorial design for each experiment with the aim of investigating differences in imaginal and overt processing of a short musical phrases. Weber

and Brown's (1986) study is noteworthy given that it represents some of the first cognitive hypotheses concerning auditory imagery involving music. Their research is significant since it suggested that perception and imagery employ analogous cognitive strategies. It also tacitly indicates the *a priori* assumption that individuals are reasonably capable of imagining musical phrases. Similarly, Halpern (1988, p.194) performed a behavioural experiment to investigate whether perceived and imagined tempos of 19 familiar songs were significantly "similar in character and magnitude" with a sample of 20 undergraduate students. Halpern's (1988) results indicate a moderately strong and statistically significant correlation in tempo ($r = .63$; $p < .01$) between the perceptual and imagined tasks. Accordingly, behavioural experiments were proposing cognitive theories concerning the relationship between auditory imagery and perception of a musical nature but at that time, were unable to corroborate their findings neurologically.

The next apparent development in auditory imagery research appears to have been a shift toward neuro-scientific methods. . With the advent of neuro-imaging methods for studying various imagery modalities, there is some MI research which does appear to substantiate the findings of Weber and Brown (1986) and Halpern (1988). For instance, a Positron Emission Tomography (PET) investigation of MI and musical perception was conducted in a neurologically healthy sample (Zatorre, Halpern, Perry, Meyer & Evans, 1996). The primary aim was to see whether the same neurological regions are activated during imaged auditory processes and perceived auditory stimuli. Participants (n = 12) were presented with three cognitive activities: - (i) the visual baseline condition; (ii) the perceptual task; and (iii) the imagery task and acted as their own controls (Zatorre et al., 1996). Overall findings provided evidence to suggest that there were analogous cerebral blood flow (CBF) changes in identical cortical regions for the perceptual and imagery conditions once the visual baseline condition had been adjusted for (Zatorre et al., 1996). CBF increases manifested bilaterally in the temporal lobes, the frontal lobes, the parietal lobes, the supplementary motor area (SMA), and the midbrain for both the perceptual and imagery tasks (Zatorre et al., 1996). This suggests that the MI and music perception share neurological similarities since both experimental tasks demonstrated activation in comparable cortical regions (Zatorre et al., 1996). However, despite the similarities, there are also notable differences between the perception of auditory stimuli and auditory imagery and these two cognitive abilities cannot be viewed as wholly equivalent (Zatorre et al., 1996) in nature or form. For instance, Kosslyn and colleagues (2006, p.199) reviewed literature relating to auditory imagery (inclusive of

MI), and state that "auditory imagery appears to draw on most of the neural structures used in auditory perception" but suggest that there is insufficient evidence to indicate that A1 (the first auditory cortical area) is activated during auditory imagery. Neurologically, this indicates some differences between auditory imagery and auditory perception (Hubbard, 2010).

Another pertinent observation is that numerous historical studies broadly focused on auditory imagery, and MI was merely viewed as an accessible mechanism to explore this mode of mental imagery (Hubbard & Stoeckig, 1992). This is because music is an easier frame of reference for participants (particularly non-musical individuals) as compared with more abstract auditory elements such as pitch or timbre (Hubbard & Stoeckig, 1992). The most recent change in auditory imagery research is that there have been a number of studies specifically focussing on MI rather than viewing it as incidental to auditory imagery. An example of a particular neurological study examining MI across different musically trained participants follows. In a recent neurological study, magnetoencephalography (MEG) methods were employed with the purpose of examining neural differences between musicians and non-musicians during a MI task involving familiar melodies (Herholz, Lappe, Knief & Pantev, 2008). The authors conclude that trained musicians share similar neural correlates for both conditions and interpret their results as an indication of enhanced capabilities for MI processing relative to non-musicians (Herholz et al., 2008). It was emphasised that the underlying factor which underpins the interpretation of their findings is participant's musical expertise with reference to both musical training and experience.

Based on the concise historical overview described above, there are some annotations worth mentioning. Firstly, in the experimental research (behavioural and neurological) presented above, the experimental tasks rely on participants' ability to voluntarily conjure complex musical attributes either with or without auditory priming immediately prior to carrying out the task. Thus, unintentional interference with the phenomenon may have occurred (Hubbard, 2010) and this highlights the problem of demand characteristics (Hubbard & Stoeckig, 1992). Naturally occurring MI may or may not be analogous with the experimental tasks. For example, the tempo of a familiar MI tune could differ significantly to the corresponding perceived music. Thus, participants may unintentionally adapt their ordinary behaviour to produce the results that support the experimenter's hypothesis because they were able to work out the research objectives (Hubbard & Stoeckig, 1992). Accordingly, adequate control

mechanisms are required for experimenters to discern whether participants have modified their performance in reaction to the experimental task. In these instances, post-experiment interviews are one manner to control for demand characteristics (Hubbard & Stoeckig, 1992). Secondly, some neuro-imaging studies fail to use behavioural data as control mechanisms to ensure that participants are truly generating auditory and/or musical imagery and may in fact be measuring a different cognitive process than intended (Hubbard, 2010). This predicament is comparable with the issue of demand characteristics and also points toward concern of experimenter bias (Hubbard & Stoeckig, 1992). In this instance, the experimenter interprets the results to substantiate their hypothesis even if an alternate explanation might be equally applicable. For example, the experimenter might theorise something specific about the phenomenon of MI (such as its structural representation in memory see Bailes & Bigand, 2004) and inadvertently influence participants to produce behaviour which verifies the hypothesis. Accordingly, the results could simply be an experimental artefact. In this case, it would be prudent to also discuss the participants' everyday experiences of MI to ensure that the inferences which are drawn from the research are reasonably generalisable.

Lastly, as emphasised in the rationale presented in Chapter 1, a significant gap that is also highlighted by this historical overview is that research focusing on MI is typically experimental in nature. Accordingly, there is a paucity of research concerning the everyday experience of MI (Bailes, 2007). Comparatively speaking, there is a fair amount of cognitive-behavioural and neurological data pertaining to auditory imagery and MI (see for example Herholz, et al., 2008; Brown, Martinez & Parsons, 2006; Bailes & Bigand, 2004; Halpern & Zatorre, 1999; and Zatorre, et al., 1996) as well as the processes involved in generating certain musical elements such as the timbre, pitch, tempo (see Crowder & Pitt, 1992; Halpern, 1992; Crowder, 1989; Halpern, 1988; Weber & Brown, 1986) rather than investigating the phenomenon as it is experienced on a daily basis. Experimental studies are important since they provide theories regarding both phenomena. Some experimental studies (generally reliable neuro-imaging research) are also able to present evidence of the neural correlates associated with these experiences. They are also more likely to provide empirical evidence concerning MI's aetiology and function. However, it is to some extent premature to examine a phenomenon in an experimental context when insufficient research verifies its cross-cultural prevalence (Kingstone, Smilek & Eastwood, 2008) or even its everyday constancy, content, and nature. Accordingly, there is insufficient evidence to claim that it is universally experienced. This relates to the final remark concerning MI research. None of the

abovementioned studies specifically examined the everyday experience of MI as it naturally occurs. This is not to suggest that no study has done so but the majority have been conducted during the 21st Century (see for example Beaman and Williams, 2010; Wammes & Barrušs, 2009; Liikkanen, 2008; Bailes, 2007). Considering these aforesaid gaps in knowledge concerning MI, an approach proposed by Kingstone and colleagues (2008) appears to be a reasonable starting point. Their approach is advocated as a useful means for investigating everyday cognitive phenomena. By slightly extending the idea of cognitive ethology (Kingstone, Smilek & Eastwood, 2008), in line with an experience-sampling methodology, it is probable that reliably documented real-time occurrences of naturally occurring phenomena (such as MI) will be captured.

2.2. PERTINENT MUSICAL IMAGERY RESEARCH UNDERPINNING THIS STUDY

It has been argued, in this Chapter as well as in Chapter 1, that it is important to examine the nature of everyday experiences and characteristics of cognitive phenomena, such as MI (Kingstone, Smilek & Eastwood, 2008). The research presented below includes research which has focused on particular forms of MI in everyday contexts. Most of them have, to some extent, formed the basis for the current study in addition to informing the methodology. They can be classified to fall within the non-experimental paradigm and have already been briefly alluded to. However, these studies will be examined in greater detail in this sub-section.

Initially, two survey-based studies (Liikkannen, 2008; Bennett, 2002) will be discussed, then Beaman and Williams (2010) research is presented since these authors utilised two complementary methods to document a specific form of MI (earworms). Their methods included a survey and a diary-based study. Subsequently, Bailes (2007) research is considered because her method (experience-sampling) is a more reliable technique to document first-person reports of phenomena. Moreover, Bailes' (2007) study largely informed the main methodology and instrument development in the current study. An important qualification to state, at this juncture, is that Beaman and Williams (2010) research was not published at the time the present study's data was collected and analysed. Thus, their study holds some relevance to the present study but it did not, in any way, inform the instrument development, the methodology or the analysis. Brown's (2006) work is also

overviewed since it shaped the thematic analysis of the MI dimensions. Finally, Lipson (2006)'s theoretical paper is summarised as it provides a few interesting psychological hypotheses that were taken into consideration during the instrument development phase. In concluding this sub-section, the relevant research questions are presented. Therefore, this sub-section is primarily stratified according to the research methods underpinning reports regarding everyday MI.

2.2.1. Research Involving Retrospective First-Person Reports

Bennett (2002) conducted an electronic survey. The stated purpose was to investigate different modes of repetitive mental imagery with particular emphasis on Musical Imagery Repetition (denoted by the acronym MIR). The primary focus of the presented results related to MIR, rather than the other modes of repetitive imagery. Bennett (2002) distributed a 51-item questionnaire concerning MIR via electronic mail to 4000 recipients. Of the 4000 circulated questionnaires, 503 were returned. Of those returned questionnaires, only 286 were fully completed. Thus, the overall response rate was fairly poor (7.15%). The respondents were primarily from the United Kingdom as well as the United States, and the sample's ages ranged from 17 to 71 years (the mean age of the sample was 31 years). The results indicate that the most common form of repetitive imagery was music – 98.2% of the sample (n = 286) had reportedly experienced repetitive MI. The next most frequently occurring category of repetitive imagery included words, visual images or both (Bennett, 2002). The key MIR findings are discussed below.

On average, participants had previously been exposed to the music, which they experienced as MIR, at least once, either through active listening or as background auditory stimuli (Bennett, 2002). The MIR was reported to characteristically involve lyrical content (75.5%) and musical fragments (71.5%) rather than full songs. Awareness of humming or tapping (73.8%) tended to be reported to occur immediately prior to noticing MIR, and 89.7% of participants reported humming during an MIR incident (Bennett, 2002). Interestingly, participants who reported co-occurring motor manifestations (related to their MIR) experienced the phenomenon more frequently ($F(1, 236) = 13.38$; $p < .0003$).
MIR was stated to occur more frequently if the participant listened to more than 30 hours of music per week ($F(1, 98) = 11.56$; $p < .0009$) or if they were musically trained ($F(1, 277) = 4.86$; $p < .028$) (Bennett, 2002). Bennett (2002) suggests that female participants and left-

handed individuals report experiencing MIR more regularly, although both of the one-way ANOVAs presented do not suggest that there were statistically significant differences between sexes and handedness ($F(1, 279) = 3.23$; $p < .073$; and $F(1, 279) = 3.1$; $p < .079$ respectively) at a 5% level of significance. Another notable result was that there was no statistically significant difference in the frequency with which MIR began across high or low states of conscious arousal ($F(1, 226) = 0.01$; $p < .75$). In other words, the onset of MIR did not appear to be more frequent during periods of high activity levels associated with increased concentration in comparison to periods where the participant's described their mind as empty or "clear" (Bennett, 2002, p.24). Bennett's (2002) findings highlight a number of variables that may explain certain aspects of involuntary MI and require further examination. Firstly, it notes the apparent relationship between MI and the co-occurrence of motor responses. Secondly, it suggests that musical training and regular musical exposure influences the incidence of MI. Thirdly, it proposes that variables like gender, dominant handedness and level of arousal could amplify the occurrence of MI.

With the intention of investigating some of Bennett's (2002) findings in a larger sample, Liikkanen (2008) also conducted an online survey (n = 11,910). However, the primary objective was to collect data concerning involuntary MI (referred to as INMI). The findings indicate that INMI was commonly experienced in the Finnish sample. Approximately 90% of the respondents reported experiencing INMI at least once a week and 33, 2% reported that they experienced the phenomenon on a daily basis (Liikkanen, 2008). In response to the question: 'What kind of music do you hear', participants reported familiar music in the majority of cases (n = 8,566) in comparison to new music (n = 2,136). A statistically significant difference was reported between males and females (mean = 4.66 and mean = 4.78 respectively; $p < .001$) with regard to the self-reported frequency of retrospectively remembered incidences of involuntary MI. Dominant handedness was not associated with an increased frequency of INMI (Liikkanen, 2008). The following variables demonstrated a positive but relatively weak non-parametric correlation to INMI frequency (n = 11,877): active musical practice (Spearman's $\rho = 0{,}241$; $p < .001$), musical listening (Spearman's $\rho = 0{,}190$; $p < .001$), and musical education (Spearman's $\rho = 0{,}157$; $p < .001$) where participants had less than 15 years of musical training. This correlation coefficient reduced slightly when participants with more than 15 years of training were included in the calculation (Spearman's $\rho = 0{,}115$; $p < .001$). Self-evaluated musical talent indicated a moderate to weak, positive non-parametric correlation with retrospective reports of INMI (Spearman's $\rho = 0{,}235$; $p <$

.001; n = 2,977) as well as ease of learning to pronounce foreign languages (Spearman's ρ = 0,152; p < .001; n = 2,977). Liikkanen (2008) also used an ANOVA to investigate the relative contribution of each factor with regard to INMI. The presented findings highlight the following variables as the most significant contributors to the experience of INMI: active musical training ($F(2, 12418) = 377.54$; $p < .0001$; partial $\eta^2 = .0573$); active music listening ($F(2, 12418) = 208.34$; $p < .0001$; partial $\eta^2 = .0325$), and the participant's sex ($F(1, 12418) = 167.80$; $p < .0001$; partial $\eta^2 = .0133$). Taken together, both studies signify that musical activity, musical experience and musical exposure are potentially significant variables related to the phenomenon of involuntary and/or repetitive episodes of MI (Liikkanen, 2008; Bennett, 2002). In addition to helping highlight these variables, Liikkanen (2008) further advocates that future research ought to explore the prevalence of involuntary MI in other, less westernised cultures.

An important limitation of both Bennett's (2002) and Liikkanen's (2008) surveys is that they solely rely on participant's retrospective self-reports. Arguably, memory bias or inaccurate recall may have affected the information provided by participants (Bailes, 2007), particularly if they unintentionally over-reported or under-reported experiencing the relevant phenomena. Beaman and Williams (2010) take cognisance of this concern and attempt to address it by using two concomitant studies. Their first study involves a general survey which is akin to Bennett (2002) and Liikkanen's (2008) research. However, the second study aims to document the incidence of earworms in a contemporaneous manner through a diary-based technique. Both of these studies are discussed below.

Beaman and Williams (2010) two studies examined the phenomenon of earworms or 'stuck song syndrome'[21]. Data for the first study (collected in 2006) used a British convenience sample of 103 participants (64 male and 39 females) aged between 15 and 57 years (mean = 26.24; SD = 10.46) (Beaman & Williams, 2010). Their first instrument was titled the "Catchy Tunes Questionnaire" (and will be referred to the acronym CTQ). It included a mixture of open-ended questions (three) and closed-ended questions (eleven) as well as some demographic questions (for example, age, gender, musical history, and whether music was considered to be important to the participant). It investigated information regarding the

[21] To iterate, this article had not yet been published, and the respective instruments were not available, at the time data was collected for the present study. Nevertheless, the current study's primary aim was to explore everyday experiences of MI rather than examine a specific variant of MI, namely the phenomenon of earworms.

persistence, duration and perceived triggers of catchy tunes; and it included questions regarding the emotional reactions to sticky music as well as some characteristics of the tunes. The CTQ also relied on retrospective self-reports (although this is acknowledged as a methodological weakness by the authors) (Beaman & Williams, 2010). Some of the pertinent findings which were reported are overviewed below.

Similar to other studies examining involuntary forms of MI, the content of the catchy tune was predominately described as familiar to the participant (Beaman & Williams, 2010). In this study, there were no reports of novel or unfamiliar MI, but the authors suggest that the absence of such reports may have occurred owing to the phrasing used in the relevant question. Participants' named 159 song titles, of which, 12 (7.56%) were advertising jingles and 11 (6.92%) were television or movie tunes (Beaman & Williams, 2010). Additionally, almost half (45.6%) of the participants indicated that the piece of the earworm heard would generally vary, whilst 38.8% specifically mentioned that the chorus was usually the sticky part of the tune (Beaman & Williams, 2010). Likelihood ratios were calculated for some of the binary variables. These ratios indicated that participants who considered music to be important generally also reported that the duration of the earworm was longer and was more troubling to them (likelihood ratio (8) = 18.42; $p = .018$; and likelihood ratio (8) = 23.62; $p = .003$ respectively). Unlike Liikkanen's (2008) study, there was insufficient evidence to suggest a significant difference between males and females with regard to the reported experience of earworms using a Mann-Whitney U-test ($z = -0.437$; $p = .662$) (Beaman & Williams, 2010). Additionally, the authors suggest that Liikkanen's (2008) results were only statistically significant because of the large sample and this is evidenced by the small effect size (Beaman & Williams, 2010).

In their subsequent study (Study 2), data was also collected over a four-week interval during 2006 (Beaman & Williams, 2010). Originally, 25 individuals were recruited via an online advertisement and 12 participants (9 females and 3 males) submitted completed diaries after the participatory month. These attrition rates are common in research that is quite time-consuming from the participants' perspective. The diaries consisted of an identical questionnaire for each earworm episode with standardised instructions. The instrument consisted of several open-ended questions (for example: "Can you name the earworm? If so, what was it?" and "Please give a brief description of how complete the experience was, e.g., Was the music playing in your mind as a whole piece? Were you hearing a repeated fragment

of it?") in addition to two closed-ended questions concerning the perceived disruption caused as well as the emotion experienced during the earworm episode (Beaman & Williams, 2010, p.652).

Over the four-week period, 269 earworm incidences were reported, averaging 1.12 episodes per participant per week (range = 0.25 – 2.5) with a mean duration of 27.25 minutes. Approximately one third (33%) of the documented earworms involved just the song's chorus, whilst 28% were full-songs. It was also reported that 99% of the earworms could be named, suggesting that they were reasonably familiar to the respective participants (Beaman & Williams, 2010). The authors conclude that the phenomenon occurs frequently and that individual differences were evident with regard to the overall nature of the earworm (for instance, its duration, completeness, and content). They also argue that musical receptivity is likely to be the underlying dimension which could explain the observed differences, rather than musical history or training (Beaman & Williams, 2010). Although their second study's method was an attempt to address the problem of retrospective reports, the authors did not attempt to implement a control mechanism to ensure that participants were instantaneously reporting on earworms as they naturally occurred. Thus, there is no way to verify that the data collected did in fact relate to in-the-moment or real-time earworm episodes. It is quite likely that some of the reported cases were documented a significant period after the reported incident. Furthermore, some participants may not have reported every episode in the diary, particularly if they did not consider it to be noteworthy.

2.2.2. Research Involving Real-time First-Person Reports

In order to capture real-time experiences of MI, Bailes' (2007) employed a technique known as experience-sampling. Her study used mixed methods to capture real-time reports of MI. The main instrument was a predominantly closed-ended questionnaire known as the Experience-Sampling Form (ESF). Follow-up interviews were also conducted on day seven of the sampling period. Bailes' (2007) iteratively sampled for everyday MI with her instrument (the ESF) using a sample of eleven British music students (5 males and 6 females). Essentially, experience-sampling involves repetitive sampling of daily experience by means of random or semi-random prompting devices (typically an earpiece which beeps) (Spener, 2011). In Bailes' (2007) study, participants received six random telephone calls per day on their mobile/cellular telephones (which they were instructed to have on silent,

vibration mode) over a period of a week between 10H00 and 22H00 every day. In her study, she would consecutively call each participant with the time intervals between the first and last call ranging from 20 minutes to 225 minutes (Bailes, 2007). Normally, participants are expected to begin introspection upon receipt of the signal (Spener, 2011). They usually need to take notes about the last uninterrupted moment of their conscious awareness prior to the prompt having been received (Spener, 2011). Bailes' (2007) participants were expected to complete six ESFs per day and 42 per participant in total. Lastly, expositional interviews are ideally carried out by a trained researcher at 24 hour intervals during the experience-sampling process (Spener, 2011). Bailes (2007) reports that participants were interviewed at the cessation of the experience-sampling period and acknowledges that it is an adaptation of traditional forms of experience-sampling. The primary utility of this methodology is to capture data concerning the naturally occurring experience of a conscious phenomenon in an individual's day-to-day life as well as capturing contextual data surrounding the particular experience (Spener, 2011). Accordingly, Bailes' (2007) ESF included various sections considered to be important in the study of everyday MI. The first component of the ESF elicits information concerning the main activity at the time of the prompt-signal and the nature of interaction(s) with others. The second section queries whether external music is absent or present in the immediate environment. The third component of the ESF specifically investigates the phenomenon being studied (specifically naturally occurring episodes of MI).

Of the 417 completed ESFs which were returned, in 44% of the forms, music was heard from an external source at the time of completing the form (Bailes, 2007). Additionally, in 32% of the cases, music was being imagined whilst completing the respective ESF and in 21% of the completed forms, music was neither being heard nor imagined. Finally, in 3% of the documented cases, music was both being imaged and heard (Bailes, 2007). Participants were able to rate the vividness of eight dimensions[22] of their MI on a seven-point rating scale. The mean vividness scores were calculated from the seven-point rating scale where one represented the absence of the dimension in the MI episode and seven denoted that the element was 'very vivid' (Bailes, 2007, p.561). The most vivid elements of the participants' everyday MI over the seven day period were melody and lyrics, whilst dynamics and harmony had the lowest mean vividness ratings. A one-way Analysis of Variance (ANOVA) was computed to determine whether there was a significant difference across the average

[22] The eight dimensions included the following musical features: melody, lyrics, timbre, texture, expression, dynamics, harmony and the physical memory of having previously performed the song.

vividness ratings. The results suggest that mean ratings were significantly different ($F(7, 49) = 5.45$; $M = 4.16$; $SD = 0.9$; $p < .0001$).

In Bailes' (2007) results, MI was characteristically described as a repeated loop or musical fragment as opposed to imagery of the full song which is similar to Bennett's (2002) and Liikkanen's (2008) findings. The experienced-sampled MI reports were also reported to be familiar to the respective imager. Thus, out of the 107 MI episodes reported by the 11 respondents, in 83.18% of the cases (n = 89), the song title was provided by participants (Bailes, 2007). In just under half the MI cases, (45.79%; 49 out of 107) participants indicated that the MI resulted from of having heard the music prior to imagining it. In just less than one fifth of the cases (n = 21; 19.63%) the MI was reported to have occurred as a result of recent exposure arising from a musical performance and/or music rehearsal activities (Bailes, 2007). While Bailes (2007) did not specifically comment on them, these results suggest that recent exposure to a particular musical composition is likely to be an important variable underscoring everyday MI occurrences, particularly if read in conjunction with Liikkanen's (2008) and Bennett's (2002) findings. The next two most common reasons offered for experiencing a MI episode included: "Talked about the music" and "No idea" (both had a frequency of six; 5.61%). Participants typically reported being aware of their MI whilst also indicating that it was not their primary focus and, for that reason, they were not concentrating on it (Bailes, 2007). As acknowledged by Bailes (2007), a limitation of her research is that she failed to differentiate between voluntary and involuntary forms of MI in her findings. This is important because everyday MI is not a homogenous experience.

Nevertheless, the significance of Bailes' (2007) research is as follows: (i) it demonstrates the feasibility and relative merits of experience-sampling as a methodology to explore day-to-day MI incidences; (ii) it is one of few studies that empirically investigated longitudinal, real-time experiences of MI; (iii) it provides corroborating evidence for retrospective reports of everyday MI experiences; and (iv) it reveals a few of the disadvantages of closed-ended questionnaires.

2.2.3. Research Involving Self-analyses

Brown (2006) conducted a self-analysis of his own MI over a two year period and he presents four dimensions in his findings. These include the constancy, nature, content and corporeal

manifestations (Brown, 2006) and directly relate to the phenomenon of his 'Perpetual Music Track (PMT). The first dimension is the constancy which relates to the overall frequency and perpetual recurrence of MI. The nature of MI includes the following features: whether it is experienced as voluntary or not, its volume, its vividness with reference to complex musical structures (i.e. melody), the extent of its familiarity to the imager, the degree of the psychological distress or cognitive disruption it is perceived to cause, and whether different imagery tends to occur simultaneously (Brown, 2006). The content relates to the genre of MI, whether it typically involves lyrical or instrumental (or a combination of both) music, whether it is an entire song or characteristically a particular portion of the song, if it involves an original composition or a known song, and so on. Lastly, corporeal manifestations relate to the associated bodily movements and actions that tend to occur during an episode of MI (such as humming, and foot-tapping) (Brown, 2006). Brown (2006) argues that experiencing PMT is both an atypical and continuous occurrence. The four dimensions Brown (2006) describes do appear to be applicable to MI in general since the typical features of his PMT share some similarities with other research concerning MI (for example, familiar and repeated fragments of music).

In view of the fact that Brown's (2006) investigation was based on self-analysis, this raises concerns regarding the inferences he made. Moreover, he does not provide an explanation of how the "two years of continuous observation[s]" were recorded nor is there an description of the analytic procedures utilised to arrive at the conclusions which were drawn (Brown, 2006, p.44). As discussed in Chapter 1, the trustworthiness of his findings is in jeopardy owing to the seemingly private method he utilised. Nevertheless, Brown (2006) provides a reasonably comprehensive description of his MI experiences, and the four dimensions offer a practical starting point for any thematic analysis of MI as well as highlighting the individual variations concerning MI that have been noted in other studies (e.g. Beaman & Williams, 2010; Bailes, 2007). Additionally, Brown (2006) emphasises and discusses MI during dream states which is largely absent in existing literature.

Similarly, Lipson (2006) provides a theoretical paper on the meaning and function of his own MI from a psychoanalytic perspective by drawing on his clinical experiences as a psychologist. Some of the hypotheses he offers are novel and worthy of examining. Firstly, he proposes that MI serves as a companion to the imager or a remedy for periods of solitude, particularly if negative mood states are experienced in the absence of others (Lipson, 2006).

In other words, it provides an illusion that one is not alone which can be comforting. He further argues that if MI occurs persistently (similar to Brown's (2006) Perpetual Music Track), this constitutes an individual characteristic of a particular person's way of thinking (Lipson, 2006). In relation to this study, the experience-sampling instrument (SMIJ) aimed to capture whether other individuals were absent or present during an episode of MI in an attempt to determine whether MI occurred more regularly in the absence or presence of others.

The second pertinent hypothesis Lipson (2006) suggests is the idea that MI has the ability to convey unconscious emotions and thoughts to the imager and that it essentially has significance in its psychological meaning. Lipson (2006) stipulates that recently heard music and familiar music is more likely to surface as MI but its psychological meaning is related to its latent content (the feeling or thought it evokes) rather than its manifest content (for example, the lyrics) (Lipson, 2006). Thus, the current study incorporated a question concerning MI's perceived significance, from the participants' viewpoint, to determine whether this hypothesis has any merit for further empirical enquiry.

2.2.4. Summary of this study's objectives and research questions

In summary, this study aims to address the following gaps in the existing literature base. Firstly, it will utilise two complimentary methods to elicit data in order to provide a more holistic understanding of everyday MI experiences. Given that experience-sampling was advocated as a reliable technique to capture naturally occurring MI (Bailes, 2007), this ought to strengthen existing findings within the non-experimental paradigm of MI. Secondly, it will present findings for both musicians' and non-musicians' experiences of everyday MI occurrences. It will analyse and present these results in terms of four dimensions of MI deductively derived from Brown's (2006) work using two instruments specifically designed for this purpose. The primary intention is to provide a more balanced and comparative view of naturally occurring MI during participant's daily experiences. To iterate, since there is inadequate literature which directly examines MI across individual's daily lives, regardless of participant's musical expertise, this study aims to strengthen existing findings within the non-experimental paradigm of MI.

This research will purposefully analyse and present findings concerning both voluntary and involuntary variants of MI, since this distinction has not always been clear in preceding MI research. Additionally, it will clearly distinguish between the different temporal sub-sets of experience-sampled reports. In other words, it will categorise and analyse the data according to the amount of time that lapsed between the participant receiving an experience-sampling prompt and their completion of the questionnaire. This approach has not been previously presented in studies utilising experience-sampling methods. Moreover, this study will attend to the issue of cross-cultural manifestations of MI since the majority of participants in everyday MI research have included individuals from Europe, the United Kingdom or North America. It also specifically investigates the co-occurrence of simultaneous phenomena, such as motor responses associated with MI (corporeal manifestations) and the simultaneous incidence of visual imagery (Bailes, 2007; Bennett, 2002). Both have been flagged as areas for future research. It is believed that doing so ought to provide a thick description of the phenomenon with regards to everyday episodes of MI.

The primary aim of this study was to investigate the characteristic experiences of MI in everyday contexts. The more specific research questions, following the review of relevant literature, are presented below:

(1) How constant is MI over a period of time (one week)?

(2) What is the nature of the MI over time (one week)?

(3) What is the range of content of MI over time (one week)?

(4) What corporeal manifestations are reported, over time, which appear to be related to the experience of MI?

(5) What kinds of differences in the experience of MI are evident between individuals as well as between musicians and non-musicians over time (one week)?

(6) What is the individual incidence of MI reported within the sample?

In order to answer these specific research questions, first-person reports utilising experienced-sampling will be employed. However, there are two final considerations that warrant discussion prior to presenting the methods of this study. The discussion of these two issues will comprise the two remaining sub-sections of this Chapter.

Firstly, a limitation which cross-cuts the majority of research, regardless of its research design is that most tend to treat the phenomenon as one-dimensional or homogenous. As previously noted, there are a plethora of synonyms which have been employed to refer to various categories of MI. Accordingly, a taxonomy of MI is proposed with the intention of addressing this problem. Secondly, if first-person reports are the primary source of data then a discussion of general methodological concerns associated with this type of data is necessary, given that they are reasonably contested and are not infallible.

2.3. TAXONOMY OF MUSICAL IMAGERY

According to Lipson (2006, p. 859), the phrase "*tunes that come into one's head"* was initially described in an article written by Sándor Ferenczi[23] in 1909.Noticeably, in the reviewed literature, a range of MI definitions have been offered and this has resulted in a number of divergent and unconsolidated descriptions of MI. A few studies (see Herholtz, Lappe, Knief & Pantev, 2008; Halpern & Zatorre, 1999; Crowder & Pitt, 1992) have also omitted to define MI which implies that the authors considered it to be self-explanatory or perhaps tacitly understood. For these reasons, it is considered useful to methodically review extant definitions to try systematise these somewhat divergent ideas and to highlight the some of the problematic areas.

Based on the literature which has been reviewed, a noticeable limitation across the majority of the studies is that there is a failure to acknowledge the heterogeneous nature of MI or, in a sense, the phenomenon is treated as homogenous. For example, Beaman and Williams (2010) do not elucidate the various sub-types of MI. They discuss several studies (Liikkanen, 2008; Bailes, 2006 and 2007; and Brown, 2006) and regard seemingly non-identical constructs as equivalent to the earworm phenomenon. Additionally, examining the definitions provided by the respective researcher's (Liikkanen, Bailes, and Brown) their focus was not to solely investigate earworms. Few studies focusing on MI have chosen to adapt general definitions of auditory imagery. The majority produce different and overlapping definitions and this tendency creates conceptual ambiguities. Thus, it becomes difficult to compare apples with apples. For that reason, a general definition of the construct is proposed since it is an obvious starting point prior to distinguishing between different variations of MI.

[23] Sándor Ferenczi was a Hungarian born psychiatrist and psychoanalyst (1873 – 1933).

A widely accepted definition of auditory imagery (Hubbard, 2010) is offered by Intons-Peterson (1992, p.46) and she states that it is "the introspective persistence of an auditory experience, including one constructed from components drawn from long-term memory, in the absence of direct sensory instigation of that experience". Hubbard (2010) indicates that this definition is akin to definitions offered across other imagery modalities. Such a definition of auditory imagery can be easily adapted to provide a standard definition of MI: *musical imagery is the introspective persistence of a musical experience, including one constructed from components drawn from long-term memory, in the absence of direct sensory instigation of that experience.* Intons-Peterson (1992, p.46) explains that the auditory imagery definition intends to specifically exclude "just-vanished auditory stimulus" also known as "auditory after-effects". Presumably, she is referring to an experience akin to a visual after-image. Additionally, Intons-Peterson (1992) definition (and the adapted version) also explicitly distinguishes between imagery and perception.

Other extant examples of general MI descriptions include the one offered by Weber and Brown (1986, p. 411): - "the ability to imagine, amongst other things, tonal progressions"; or equally applicable, Zatorre, Halpern, Perry, Meyer and Evans (1996, p.30) who define MI as "a strong subjective experience of being able to imagine music or musical attributes". Similarly, and more recently, Halpern (2003, p.217) proposed a straightforward definition of MI: - "the experience of 'replaying' music by imagining it inside the head". The arguments in favour of general definitions are that (i) they capture the essence of the phenomenon and (ii) they could easily be presented to a sample of prospective participants for explanatory purposes.

Another general MI definition to consider is Bailes (2006, p.805) who states that MI is "the experience of having a conscious mental image of the sound of music that is not actually present". She is alluding to the idea of endogenous activation which relates to the absence of environmental stimuli (Zatorre at al., 1996). This attribute is imperative since it distinguishes MI from music perception which the three other general definitions have omitted (Halpern, 2003; Zatorre et al, 1996; Weber & Brown, 1986). Thus, one of the most important provisos that ought to be included in any imagery definition (regardless of the modality) is that it should clearly differentiate between perception and quasi-perceptual experiences. Lipson (2006, p. 860) confuses the matter by stating the following: "I use the term *auditory image* to denote all perceptions of music, whether they are internally generated or are derived from

external sensory output". This definition is an example of an ontologically misleading definition. Lipson (2006) is actually referring to auditory perception of a musical nature rather than imagery per se. However, including the word "image" is, to some extent, erroneous in view of the fact that perception and imagery are conceptually distinct constructs in cognitive theory (Kosslyn, Ganis & Thompson, 2006). Resultantly, it fails to clearly distinguish between music perception and MI. The description of the phenomenon Lipson (2006) experiences appears to be akin to Brown's (2006) experience because the predominant characteristic is it continuous nature. Accordingly, it highlights a particular form of MI – namely, perpetual MI that is not a musical hallucination. In this instance, Brown (2006) provides a clearer description of what appears to be an identical version of MI.

Brown (2006) also describes experiencing MI in such an incessant manner that he christens it as 'A Perpetual Music Track' (PMT). Brown (2006, p. 44) basically defines his PMT as "a state of constant or near-constant musical imagery". Clearly, his emphasis is on the uninterrupted and continual nature of it. In Brown's (2006) case, he experiences the phenomenon nearly continually, both in waking and sleeping states. He suggests that his MI is the equivalent of listening to an internal radio, but clarifies that he is unable to exert much control over its content or form (Brown, 2006). Thus, his PMT appears to be involuntary in nature. It is unclear whether continuous MI also occurs in non-pathological[24] imagers but it seems to partially resonate with Lipson's (2006) experience. However, Brown (2006) does not define what is meant by musical imagery. Thus, in accordance with Intons-Peterson's (1992) modified definition, a proposed definition which might capture persistent MI follows: ***perpetual*** *musical imagery is the* ***state of constant or near-constant*** *introspective persistence of a musical experience, including one constructed from components drawn from long-term memory, in the absence of direct sensory instigation of that experience*. The text in ***bold italics*** is derived from Brown's (2006) PMT definition. This example illustrates how complex the MI construct is to define, if one considers the variety of manifestations as well as individual variations.

Accordingly, a broad criticism of the abovementioned general definitions is that they are non-specific and do not illuminate the particular nuances of MI. Since MI is multifaceted, these general definitions fail to capture essential features of particular categories of MI. For

[24] In persons not afflicted with musical hallucinations.

instance, if it is assumed that MI can either be voluntary or involuntary (Sacks, 2008), then what becomes evident is that few of the definitions explicitly differentiate between voluntary and involuntary MI. Moreover, this distinction is contingent upon how imagination, intention, automaticity and involuntariness are to be defined[25]. Voluntary MI can be defined as a conscious, intentional or deliberate attempt to imagine a musical composition or mental music (familiar or novel) (Sacks, 2008) – regardless of its clarity or vividness (Intons-Peterson, 1992). Jointly, employing the standard and modified definition of Intons-Peterson (1992), voluntary MI could be defined as: *the introspective persistence of a musical experience, including one constructed from components drawn from long-term memory, in the absence of direct sensory instigation of that experience that is done* ***intentionally or deliberately****.*

Thomas (2010) states that mental imagery is generally understood to be an internal phenomenon subject to voluntary control and manipulation by the imager. Contrastingly, involuntary imagery is frequently viewed as atypical or even pathological (for example, unwanted imagery arising from a trauma; a symptom usually associated with Post Traumatic Stress Disorder). Yet, in the case of MI, involuntary imagery does not seem to be an uncommon occurrence (Beaman & Williams, 2010; Liikkanen, 2008; Lipson, 2006; Bennett, 2002). Hubbard (2010, p.323) considers the question of involuntariness with regard to auditory imagery and refers to it as "obligatory". He suggests that the notion of obligatory auditory imagery, in the strictest sense, is an involuntary experience of imagery unrelated to other cognitive activity. Hubbard (2010) also indicates that involuntary auditory imagery can occur during pathological states (specifically schizophrenia and musical hallucinations), but argues that these cases are not considered obligatory, since in the absence of the pathological cognitive activities related to these disorders, such imagery would not occur. He also states that "obligatory" MI is not a common feature of "normative auditory imagery" (Hubbard, 2010, p.323). This supposition is problematic since it is based on a review of predominantly experimental research where participants are often instructed to voluntarily imagine various elementary or complex sounds.

[25] It also tacitly points towards the issue of aetiology - perhaps voluntary and involuntary MI is generated by different neural mechanisms or cognitive schemata. Questions surrounding the aetiology of MI can only be sufficiently answered once there is a clear theoretical distinction between voluntary and involuntary episodes of MI.

Accordingly, it cannot be suggested that involuntary auditory imagery is anomalous, particularly where few studies focusing on everyday experiences of such phenomena have been assessed. To exemplify this point, Liikkanen's (2008) findings indicated that involuntary MI (INMI) was a frequent occurrence in a large Finnish sample (n = 11,904) and it was not automatically experienced as extremely intrusive – 33.2% of respondents retrospectively reported that they experience INMI on a daily basis, and only 15.1% of the time was such MI reported to be disturbing to those individuals. In relation to the standard Intons-Peterson's (1992) definition, it is non-specific enough to include both voluntary and involuntary cases of MI. However, if a study is specifically examining one or other variant, then it would be prudent to include a qualifying clause that specifically acknowledges the imager's inability to control the MI or their intention to evoke a MI.

The first category of involuntary MI mentioned in MI literature is hypothesised to result from recent or repetitive overexposure to a particular musical stimulus (Sacks, 2008). MI arising from recent, repetitive exposure is reported to be a general phenomenon that most individuals have experienced in their lifetime (Sacks, 2008). For instance, Bennett (2002) conducted an online survey (n = 503) with the intention of examining musical imagery repetition (denoted by the acronym MIR). His results indicate that the prevalence of repetitive mental imagery is highest for MI – 98.2% of the participants reported experiencing MIR. Bennett (2002, p.5) defined MIR as "previously heard music that, while consciously unintended, repeats uncontrollably and pervasively in thought". This category of MI has been classically referred to as an 'öhrwurm'- derived from German vernacular, and directly translated to connote "earworm" (Bennett, 2002). Bennett (2002, p.5) argues that the term 'earworm' is "ontologically problematic because it presupposes that music repeats in the ear and not the brain" and consequently developed the aforesaid working definition. Bennett's (2002) definition connotes, at least, the following MI components: it is involuntary, recurring, familiar, outside of the imager's control and, quite possibly, recently heard. Similarly, Beaman and Williams (2010, p.637) define earworms as "the experience of an inability to dislodge a song and prevent it from repeating itself in one's head". Again, the emphasis is on the involuntariness and the repetitive nature of the MI.

The second variety of involuntary MI is music or musical fragments that suddenly move into one's awareness and appear to have no underlying cause (Sacks, 2008). These tend to be arbitrary in the sense that they have no apparent trigger (such as recent or repetitive exposure

to a particular musical stimulus) or any obvious explanation from the imager's viewpoint (Sacks, 2008). This form of involuntary MI will be referred to as Spontaneous MI (SMI). Kvavilashvili and Mandler (2004) speculate that MI is a category of involuntary semantic memory. They define involuntary semantic imagery as images (for example, words, names or tunes) that spontaneously move into one's conscious awareness. The authors argue that these experiences are types of semantic memories because they tend to occur in the absence of contextual and autobiographical information (Kvavilashvili & Mandler, 2004). Presently, their hypothesis is unverified. Arguably, spontaneous forms of any imagery (including MI) could equally be classified as episodic memories including memories concerning "the self's experiences in subjective space and time" and typically involve recall of autobiographical information and experiences (Tulving, 1993, p.67). In direct contrast, semantic memories are linked to generic facts and knowledge about objects in the world (Tulving, 1993). Nevertheless, Hubbard (2010) suggests that future research ought to examine stimuli that trigger different facets of auditory imagery in addition to conditions which evoke episodes of involuntary auditory imagery. Investigating everyday experiences of imagery should highlight hypothetical stimulus which might activate an episode of imagery. Accordingly, this may assist with adjudicating between which form of memory could underpin involuntary forms of imagery.

Based on Kvavilashvili and Mandler's (2004) supposition, Liikkanen (2008) performed an exploratory factor analysis on the different forms of involuntary imagery reported by participants in an online survey. Liikkanen (2008) found three main categories of involuntary imagery. The three factors included the following imagery modalities: tastes and smells; images, words and sensations; and the last kind involved musical imagery. Music was reported to be the most commonly occurring mode of involuntary imagery – 59.3% of participants reported hearing musical imagery 'often'. Liikkanen (2008, p.408) specifically defines involuntary MI as "the conscious experience of music, familiar or novel, that repeatedly goes over in one's mind during normal daytime awareness". The primary emphasis relates to the awareness of MI during wakeful, conscious states and explicitly precludes MI during sleep states. It allows for both original and familiar musical content in addition to including the refractory looping described by Brown (2006). The underlying concern is that there is no mention of the phenomenon being unpremeditated or unprompted in the working definition, even though this definition purportedly relates to involuntary MI. It is not entirely clear whether Liikkanen's (2008) sample were experiencing involuntary MI

resulting from recent exposure or spontaneous MI (involuntary musical imagery with no apparent trigger whether environmental or cognitive) because it is also unclear[26] what definition was presented to the respondents and how they may have understood the term involuntary MI.

A complementary definition to the one Liikkanen (2008) proposes is "the effortless and unpremeditated experience of unconstrained mental music" (Wammes & Barušs, 2009, p.38). This definition tacitly relates to spontaneous episodes of MI given Wammes and Barušs (2009) study's aim. The use of the words "unpremeditated" and "unconstrained" connote that the MI is also involuntary especially since the latter insinuates that the imager is not wilfully exercising control over the imagery. If read in conjunction with Liikkanen's (2008) definition, the two definitions emphasise various attributes of MI but also serve to accentuate its multifaceted nature. Amalgamating these definitions provides a suitable definition of involuntary MI: - *the unpremeditated and conscious experience of unconstrained mental music (familiar or novel) during ordinary wakeful states* (Wammes & Barušs, 2009; Liikkanen, 2008). Similarly, Sacks (2008, p. 36-38) provides a definition of involuntary and spontaneous MI: - *the experience of hearing or imagining music in the absence of directly corresponding external stimuli that has not been consciously or intentionally conjured by the imager – it is experienced as an unprompted phenomenon*. This paraphrased definition is an improvement because it specifically distinguishes between perception and imagery. Moreover, it also states that involuntary MI could theoretically arise from an unknown source or could be unconsciously generated (Sacks, 2008) which highlights its spontaneous nature. Presumably, the repetitive nature or apparent 'stickiness' of involuntary MI (spontaneous and/or arising from recent priming) is another characteristic feature – also referred to as the 'stuck song syndrome' (Levitin, 2006). Following the same structure presented throughout this sub-section, by slightly modifying the standard MI definition derived from Intons-Peterson's (1992) auditory imagery definition, spontaneous involuntary MI could be defined as follows: *the introspective persistence of a musical experience, including one constructed from components drawn from long-term memory, in the absence of direct sensory instigation of that experience* ***that has not been consciously or intentionally conjured by the imager – it is experienced as an unprompted phenomenon***. Similarly, the ***bold, italicised*** text signifies

[26] The instrument is not presented in the article for the reader to peruse.

the amendment to include the unintentional and spontaneous nature of the phenomenon as described by Sacks (2008).

All of the sub-types of MI which have been presented specifically relate to daytime awareness. Thus, one final variant of MI that emerged from reviewing relevant literature is that it can occur during dream states (Brown, 2006), although there is a dearth of research on the topic. Within the literature, MI during dream states tends to be alluded to in passing. Snyder (1970; as cited in Hubbard, 2010) investigated dream content in adult participants (635 reports were collected) immediately after awakening from rapid eye movement (REM) sleep. The results indicated that the majority of these reports related to verbal imagery whilst a minority (13%) involved non-verbal auditory imagery[27] (Snyder, 1970; as cited in Hubbard, 2010). Heynick (1983) had participants report the last sentence recalled from their dream upon waking in order to investigate the Freudian model of dream generation. Generally, the reported sentence was described as spoken by the character, within the respective participant's dream, representing them self. It was also expressed by the participants that it was a sentence they might say or hear during wakeful states (Heynick, 1983). These ideas demonstrate that it might be possible to examine the presence (or absence) of MI upon waking even if participants are not aroused during REM sleep. However, reports concerning MI upon waking would also not necessarily indicate that MI was in fact present during a dream state. Currently, there is no definition of MI during dream states and since it is not a focus of the current study, it is not essential to provide one. However, the modified MI definition (derived from Intons-Peterson's (1992) auditory imagery definition presented earlier) appears to be broad enough to incorporate MI during dream-states, and would certainly cover what could be called 'musical imagery on waking'.

One final remark and significant caveat is that all variants of MI should also be distinguished from musical hallucinations. Musical hallucinations share similar characteristics to MI but typically entail a specific medical complaint (for instance, focal brain lesions, acquired deafness, epilepsy, schizophrenia, and so forth) (Evers & Ellger, 2004). Consequently, any study purporting to examine MI ought to screen and exclude participants suspected of experiencing musical hallucinations. Both the screening and the subsequent exclusions

[27] Without access to the initial text, it is unclear whether the non-verbal auditory imagery consisted of MI.

should be done, in part, on ethical grounds. Doing so would also serve to exclude possible extraneous variables which may confound the results relating to MI.

Based on the taxonomy which has been presented, the definition presented below is an attempt at amalgamating all the significant features of MI, as derived from the literature, with the intention of creating a comprehensive definition including important characteristics of MI. *MI is a subjective and conscious experience of internally generated or imagined musical, tuneful or melodious sounds (with or without lyrical content) whether prompted or spontaneous, involving full compositions or incomplete fragments, and is primarily in the absence of a directly corresponding sound stimulus from the immediate or peripheral environment*. Since the proposed working definition is fairly complex, albeit inclusive of the inherent components discussed in preceding research, it was important, for the purposes of this study, to propose a taxonomy of definitions for each of the MI categories.

A diagrammatic representation (see Figure 1 below) of the various MI categories follows. Figure 1 illustrates that MI can be considered a sub-domain of auditory imagery (Weber & Brown, 1986). Figure 1 is a basic model of the various forms of MI which have emerged from the literature. However, it also simplifies the phenomenon by employing some degree of abstraction from the details discussed above, and does not exhibit all of the conceptual ambiguities that became apparent whilst reviewing the relevant literature. Consequently, central features and associated definitions for the specific MI sub-sets have already been presented to highlight the nuances of MI and to address definitional ambiguities.

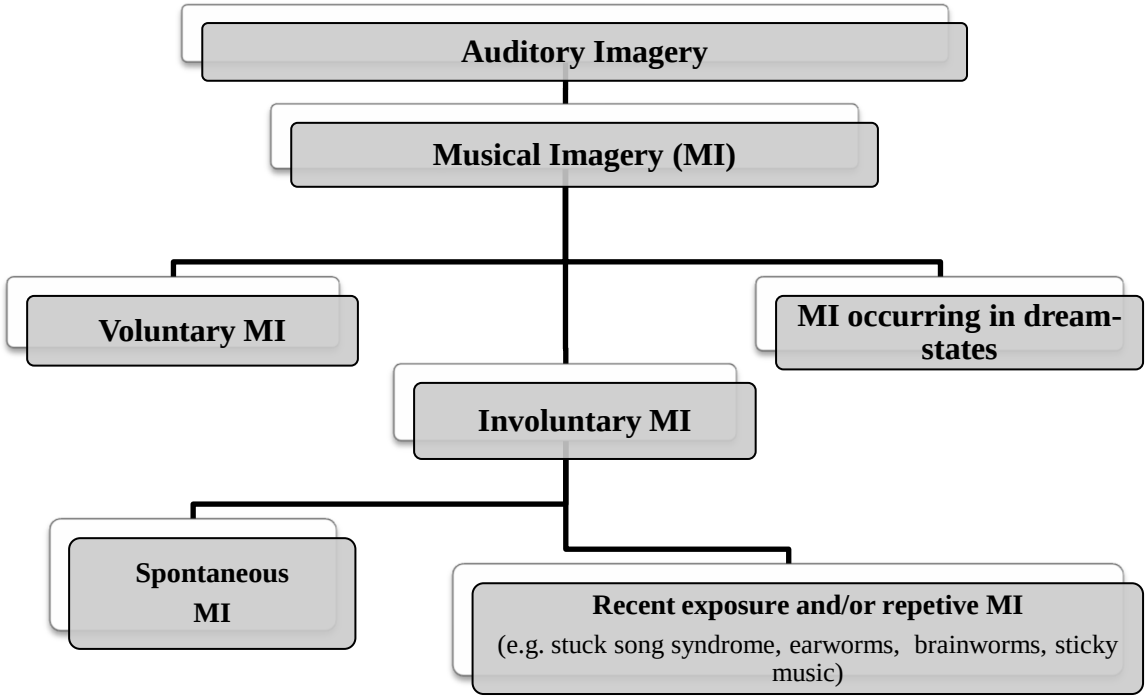

Figure 1. Diagrammatic Representation of Musical Imagery Categories

To summarise, there are two main categories of MI during waking states: voluntary and involuntary episodes. The latter can be further subdivided into spontaneously generated MI or MI resulting from recent priming or repetitive auditory stimuli. Arguably, both categories of involuntary MI could range from continual to occasional experiences and might also depend on the imager's particular musical attributes (Beaman & Williams, 2010). As previously argued, first-person reports are a valuable source of data since all forms of MI are not observable to others. Consequently, the last section discusses some pertinent considerations related to first-person reports.

2.4. GENERAL METHODOLOGICAL CONSIDERATIONS CONCERNING FIRST-PERSON REPORTS

The various imagery modalities are, to some extent, difficult to investigate empirically, particularly if first-person phenomenological reports are the primary source of data, since there is a long history of debate concerning the reliability of introspective methods (see Piccinini, 2003; Wilson, 2003). Chapter 1 highlighted that in this study, first-person events are defined as "the lived *experience* associated with cognitive and mental events" (Varela & Shear, 1999, p.1). This definition is contingent upon how the notion of consciousness is defined. It was made clear in Chapter 1 that, for the purposes of this research, consciousness

indicates that "the subject knows about, is informed about, or in other words is aware of, the phenomenon" (Varela & Shear, 1999, p.4). This is not to suggest that consciousness is easily defined or that that it is homogenous (see Barušs, 1992 for a meta-analysis of definitions).

Valentine (1999, p.536) affirms that there is significant conceptual ambiguity and suggests that "consciousness may be viewed as a term not to be defined but a construct to be traced through its uses". Similarly, Marks (1999) also argues for an experiential perspective with regard to understanding the function of consciousness and mental imagery. Accordingly, in this study, the perspective that is operational is one of phenomenal consciousness – "what it is like to be or to experience something" (Valentine, 1999, p. 536). This is in direct contrast to a "computational, functional information-processing consciousness (a scientific account in objective terms)" (Valentine, 1999, p.536). This position does nevertheless allude to the epistemological gap between subjective (first-person) and objective (third-person) perspectives (Valentine, 1999). To reiterate, a key assumption in this study is that lived or conscious experience cannot solely be derived from the third-person (external) perspective (Varela & Shear, 1999) because, if data involving first-person (internal) events is absent, then lived experiences are imprecise or are in some manner incomplete since an important viewpoint has been ignored (Varela & Shear, 1999).

Valentine (1999) argues that the epistemological gap can be bridged through theoretical constructs and suggests that phenomenal experience can progress to psychological theory even if the epistemological gap remains intact. A criticism often levelled against first-person reports is that they are not viewed as objective or inter-subjective (in other words, that general or public consensus concerning private observations has been reached) (Valentine, 1999). However, inter-subjectivity with regard to internal mental states can be evidenced by verbal reports of experience, behavioural data and neuro-physiological measures (Marks, 1999; Valentine, 1999). Piccinini (2011) restates the issue as a debate between whether first-person reports are essentially generated through private or public methods[28]. Piccinini (2011, p.105) defines the two concepts in direct contrast to one another as follows:

[28] It is not within the scope of this report to comprehensively discuss this debate; however, it is important to acknowledge that it remains to be a significant issue in literature and research concerning consciousness (Piccinini, 2011).

> A method is public just in case different investigators can apply the method to answer the same questions and, when they do, they obtain the same data. Otherwise, a method is private.

Piccinini (2011) further illustrates this point, with instructions to observe auras as an example of private methods. It is suggested that where the same methods are followed by different investigators, to answer the same questions and where different results are obtained (not everyone will be able to perceive an aura regardless of how closely they follow the procedure), then the method is private (Piccinini, 2011). However, this argument has been qualified as follows: for the method to be considered public, the study must be repeatable and the data must be empirically reproducible, which does not mean that every investigation ought to generate the same results. Piccinini (2011) disputes that first-person data are fundamentally different to other legitimate scientific methods, but that if the methods are private, then they ought to be rejected since they are invalid. Thus, the primary premise is that first-person data are scientifically valid if the method in which such reports are generated is public.

Additionally, Wilson (2003) states that introspective techniques which rely on data derived from self-reports are regularly employed in the following research domains of psychology: personality, emotion, attitudinal assessment, memory and developmental studies. He argues that self-report data has yielded valuable results in these areas, and has demonstrated substantial predictive validity. Similarly, Marks (1999) indicates that verbal reports are critical for doctors and other health professionals to reliably diagnose individuals' medical conditions, particularly if they are recorded whilst a person is experiencing a medical complaint (for example, pain). This is not to say that first-person reports are ideal. They rely heavily on the individual's ability to express, with some precision, their inner experience. This capacity is linked to language, reliable recall, memory, self-awareness, individual motivations, along with a variety of other significant factors. It has been suggested that using introspective techniques assumes that participants are self-aware and able to describe their inner experience (Hurlburt, 2009). This alludes to the question of when is it appropriate to use self-report methodologies.

Aligned with this concern is what Piccinini (2003) describes as the *process reliability* of introspective observations. Essentially, this means that "raw data must correlate with a genuine phenomenon and must not be an experimental artefact" (Piccinini, 2003, p.150).

Accordingly, it is problematic if the instrument or method of enquiry inadvertently alters the phenomenon. Alternately, it is also a concern if participants are unable to consciously access the construct being measured. Wilson's (2003) primary premise is that through clearly defining the boundaries of what content is consciously accessible to participants, one would be logically able to infer when to employ self-report techniques, as opposed to other methods of studying internal phenomena. Equally, Piccinini (2011) states that public methods relying on private data are scientifically legitimate and emphasises that the method of descriptive experience sampling (DES) meets this criterion. Presumably, a participant is able to access the internal phenomenon when it occurs (e.g. the experience of pain, as discussed by Valentine (1999)).

Methods (such as DES) which use repetitive, real-time reports of phenomena may circumvent some of the abovementioned concerns. Iterative reports are said to capture the essence of a naturally occurring experience because they provide numerous perspectives on the same phenomenon in addition to its idiosyncrasies (Piccinini, 2011; Hurlburt, 2009). Additionally, training participants in introspective techniques has also been advocated as a potential manner to facilitate the acquisition of reliable first-person phenomenological reports (Schwitzgebel, 2004). Traditional introspective training (as proposed by Titchener during the early 20th Century) has been argued as a method for reducing bias regarding first-person reports since the subject gains introspective expertise (Schwitzgebel, 2004). Moreover, the practiced observer will acquire the requisite skills to provide uniform accounts of conscious experience through repetition (Schwitzgebel, 2004). Similarly, Hurlburt (2009) suggests that iteratively sampling the same person's lived experience (for instance through DES) provides the individual with sufficient introspective practice. Accordingly, the quality of their introspective reports is stated to improve through this technique and is equivalent to training even if the skill is tacitly acquired (Hurlburt, 2009). Nevertheless, Schwitzgebel (2004) states that traditional introspective training methods are fraught with problems and suggests that these issues are not easily resolved. One example is the question of whether first-person reports suitable for the topic of enquiry (Schwitzgebel, 2004). Restated, is the focus of the enquiry accessible to the trained observer and if it is, how can errors regarding mental phenomena be reduced? Schwitzgebel, (2004) notes the usefulness of experience-sampling methods as a mechanism to address specific introspective biases arising from first-person reports of conscious phenomena.

Accordingly, if first-person reports are deemed to be suitable methods, then it is also imperative to decide the following: *when is it the most appropriate time to ask the subject?* As such, the various forms of introspective data depend on the time in which they are recorded by the subject, for instance, real-time reports or retrospective reports (Piccinini, 2003). Since temporal factors influence cognitive mechanisms underpinning the subject's ability to reliably recall and describe the experience, (such as attention, memory, language), the question of when to ask the subject is imperative. It is also necessary to mention that the use of the "generic term 'introspective reports' blurs important distinctions between different kind of reports" (Piccinini, 2003, p.155). In-the-moment and retrospective reports are not necessarily equivalent and may necessitate separate analysis considering that each kind is intrinsically linked to different methodological concerns (Piccinini, 2003). Thus, experience-sampling that excludes reports after a particular time-period has elapsed between the signal-prompt ought to improve the overall reliability of the data. Moreover, if these reports are separately analysed, then inferences regarding phenomena will demonstrate improved ecological authenticity (Piccinini, 2003).

Although introspective methods are often viewed as controversial and problematic (Hurlburt & Akhter, 2006; Hurlburt & Heavey, 2004), their use was regarded as reasonable for the scope of this research owing to the overarching research question. Hurlburt and Akhter (2006) suggest that novel introspective methods (such as DES) can offer resolutions to the reliability concerns which have historically plagued orthodox methods of introspective inquiry. They argue that these methods offer an intimate glance at bona fide private thoughts, feelings, inner experiences, and mental states which are fundamental to understanding people (Hurlburt & Akhter, 2006). According to Piccinini (2003), introspective reports are a valuable method for studying particular aspects of consciousness owing to their informative and illuminative nature. It has been noted by Kane (2011, p. 155) that "DES not only has the potential to contribute generalizable, scientific knowledge about consciousness (and individual differences therein), but it already has!" However, this does not indicate that first-person reports are reliable (see Schwitzgebel, 2004, for a discussion of their fallibility). In view of that, another difficulty with this method of analysis is that it cannot determine the truthfulness of the information provided (Elliott, 2005). Thus, trusting the subject becomes an additional avenue for concern.

Depending on the nature of the enquiry, the social desirability of responses also becomes an underlying problem (Wilson, 2003). If the research topic is construed as contentious by the participant (for example, prejudice), the participant may not answer truthfully and may intentionally distort their response to questions concerning the topic of enquiry. Intons-Peterson (1992) notes that demand characteristics need to be addressed in research concerning mental imagery. In this instance, she is referring to what participants perceive as being expected from them, whether communicated explicitly by the researcher or indirectly through nonverbal communication. To pose the problem as a question: *is the introspective report truthful or genuine?* Piccinini (2003, p.142) argues that the truthfulness of introspective reports cannot be assumed to be wholly unverifiable, nor should it be presumed that they are "true at least most of the time". Instead, it is suggested that such data ought to be weighed against "two relevant bodies of evidence: our beliefs about people and their circumstances and our beliefs about the specific person and circumstance that generated the reports" which is thought to be a commonsense strategy people often use in everyday contexts (Piccinini, 2003, p.143). Using this approach is anticipated to assist in the adjudication of whether an introspective report is, for the most part, truthful.

Accordingly, the present study distinguishes between the various forms of introspective data – specifically real-time and retrospective reports – to address the issue raised by Piccinini (2003). Consequently it separately analyses and reports experienced-sampled reports on the basis of the time lag between the signal-prompt and the introspective-descriptive task. This approach is not typically presented in previous studies utilising experienced-sampled data related to internal phenomena such as MI. Since the primary method is a derivative of Descriptive Experience Sampling, this study employs iterative reports of experience but does not cyclically interview participants. Experience-sampling without subsequent interviewing has also been advocated as equally beneficial to examining lived experience (Klinger, 2011). Experience-sampling allows for the development of specific instruments aimed at measuring a variety of conscious experience, and it is very flexible as a result (Klinger, 2011). Bailes (2007) certainly advocated that it was a reliable method for examining MI. DES has been argued to be a suitable public inter-subjective method (Piccinini, 2011) that addresses the epistemological gap between first-person and third-person reports. It is presumed that experience-sampling shares enough similarities with DES that it could also be classified as a public method even though it also relies on first-person reports. It is also sensible to ask participants to introspect and then report on MI (where applicable) during everyday activities,

since this is expected to capture naturally occurring experiences that are more likely to be accessible to the individual. Accordingly, it would circumvent some of the concerns concerning mental phenomena falling outside of the individual's awareness (Wilson, 2003). Certainly there are limitations to this methodology (see Spener, 2011, for a critical review). Nonetheless, it was deemed to be the most suitable manner to begin to explore experiences of MI given the restricted scope and resources available for this study.

CHAPTER 3

METHODS

3.1. RESEARCH DESIGN

There were essentially two stages of exploratory observation used in this study. Both were non-experimental in nature (Patton, 2002). The grouping of participants in terms of musical experience or training was based on participants' self-ratings in response to a question contained in the demographics questionnaire[29]. The research design utilised naturalistic inquiry given that the primary methodology (a variation of Descriptive Experience-Sampling – hereafter referred to as **DES**) endeavours to observe and document individual's everyday experiences of a particular phenomenon within their natural environments (Hurlburt & Akhter, 2006).

This study can also be considered exploratory in nature. It employed mixed methods through the use of quantitative and qualitative data (Patton, 2002) in order to describe various characteristics of the phenomenon. It did not seek to predict behaviour but rather to describe the everyday dimensions of Musical Imagery (MI), as captured by first-person reports. It is exploratory because it seeks to investigate internal occurrences of MI over a seven day period and it aims to illustrate what has been reported via emergent characteristics and themes (Babbie, Mouton, Vorster & Prozesky, 2004).

The first method of observation (Stage One) involved a survey based study that was cross-sectional, non-experimental, and relied on retrospective self-report data. It utilised a short demographics questionnaire developed by the researcher (please see **Appendix A** for a duplicate of the questionnaire). Stage Two of the research was essentially longitudinal since it used repeated measures (iterative sampling technique) over a seven day period. Given that the two categories of independent variables (musicians and non-musicians) were pre-existing, no manipulation occurred, merely the use of an electronic signal (short text messages transmitted via cellular telephones) to prompt both introspection (at a time controlled by the researcher, unlike typical diary-based studies) and completion of a Spontaneous Musical Imagery Questionnaire (SMIQ) – please refer to **Appendix B** to view a sample of the SMIQ. If

[29] Two individuals were re-assigned from the 'non-musician' category to the 'musician' group given that they reflected musical training or experience in their musical history.

compliance was one hundred percent, twenty one SMIQs were completed by each participant (three experience samples per day). The pilot study was also longitudinal since there were three observations per day (over two days) with a total of six observations per person where compliance was one hundred percent.

3.2. SAMPLE AND SAMPLING METHOD

The choice of participants relied on their availability and willingness to participate in the study. Thus, non-probability sampling (Babbie et al., 2004) was utilised. Participants included second and third year psychology students from the University of the Witwatersrand.

It has been posited that volunteers in psychological research are more likely to display the following set of qualities: "younger, brighter, friendlier, less conventional or authoritarian, but with a strong need for approval" (Rosenthal, 1956 as cited in Parker, 1994, p.7). Parker (1994) suggests that a strong need for approval may have ramifications owing to the implicit problem of demand characteristics within the sample. Demand characteristics relate to participant's desire to conform to their perception of the anticipated outcome of the study. Thus, participants may display elevated levels of engagement in the research and this may resultantly, and unintentionally, lead to over-compliance (Parker, 1994). Owing to the methodology utilised in this study, high levels of compliance over the course of the study was an important requirement for the success of the study and as such, was deemed desirable rather than necessarily problematic.

The two-fold inclusion criteria for Stage Two participation were: (a) individuals who reported experiencing MI at least two or three times per week and (b) persons who were in possession of a working cellular telephone. Additionally, such individuals also needed to report, in the original demographics questionnaire, that to their knowledge, they have never been afflicted with any of the following medical conditions: (i) neurological trauma; (ii) epilepsy; or (iii) moderate to severe hearing loss. The reason why criteria (i) to (iii) have been included is because all three have been implicated in musical hallucinations (Evers & Ellger, 2004). Thus, it was important that persons who reported experiencing regular and persistent episodes of MI were distinguished from those that could possibly be experiencing musical

hallucinations. Any individuals who reported even one of these medical conditions were not included in the analysis.

In total, six individuals (6 out of 93 – 6.45%) were excluded[30] from the Stage One analysis and were unable to participate in Stage Two of the study. Four of these six exclusions reported having experienced severe head injuries, and two of the six reported significant hearing loss. No individual reported having epilepsy. Of the six exclusions, four individuals rated themselves as musicians and the remaining two had no musical experience or training. Their self-reported experiences of MI ranged from 'once a week' (2 out of 6) to 'Many (4 or more) times every day' (2 out of 6). The remaining two individuals rated their MI experiences as '2 to 3 times a week' and '6 to 7 times a week' respectively. Consequently, the Stage One sample was comprised of 87 participants (including the pilot sample) once these six exclusions were made.

3.2.1. Demographic Characteristics of the Samples

The table below (Table 3.2.1.1) will display the general demographic information for each sample as well as the respective frequencies and percentages. Summary statistics will also be displayed with respect to the ages of each sample group (please refer to Table 3.2.1.2.).

Table 3.2.1.1. Summary statistics relating to Gender and Musical Training for each sample group

Sample Group	**Gender**[31] ***Frequency*** **(percent)**		**Musician** ***Frequency*** **(percent)**		**Sample size (N)**
	Female	**Male**	**Yes**	**No**	
Stage One	*58* (67.44%)	*28* (32.56%)	*36* (41.38%)	*51* (58.62%)	87
Stage Two	*9* (56.25%)	*7* (43.75%)	*8* (50%)	*8* (50%)	16
Pilot	*6* (75%)	*2* (25%)	*5* (62.5%)	*3* (37.5%)	8

[30] Owing to these self-reports it is feasible that the six individuals may have been experiencing musical hallucinations. As a result, they were excluded from the study.

[31] One individual failed to respond to the item on gender in the demographics questionnaire. Thus, the sample statistics for gender of Stage One participants are only provided for 86 participants.

Table 3.2.1.2. Summary statistics of Ages for each sample group

Sample Group	Age Range	Mean	Standard Deviation	Mode (Frequency)	Sample size (N)
Stage One	19 – 34 years	21.21 years	2.64 years	20 (29)	87
Stage Two	19 – 27 years	21.56 years	2.45 years	20 (4)	16
Pilot	19 – 34 years	23.75 years	4.46 years	22 (3)	8

The Stage Two sample is reasonably balanced in terms of gender and musical training, even if there is a slight bias toward female participants. The modal age is slightly higher for the pilot relative to the other two groups – this was expected given that the sample utilised postgraduate students. The Stage One participants' ages ranged from 19 to 27 years, along with two individuals aged 34, but there were no individuals aged between 28 and 33 years. The majority (80.46%; n = 70) of the Stage One participants were aged between 19 and 22 years.

South Africa has eleven official languages, two of which are essentially of European origin (English and Afrikaans); and nine of which are indigenous languages (with differing dialects across geographical regions) (Heuchert, Parker, Stumpf & Myburgh, 2000). Considering that English is not necessarily the typical first language of South African participants, it was reasonable to assess potential participant's English proficiency given that the main methodology relied upon both written descriptions and accurate completion of each journal entry in English. Results relating to self-reported English proficiency are tabulated (see Table 3.2.1.3.) below.

Table 3.2.1.3. English Proficiency Ratings for each sample group

English Proficiency ratings	Sample Group		
	Stage One *Frequency* **(Percent)**	**Stage Two** *Frequency* **(Percent)**	**Pilot** *Frequency* **(Percent)**
Excellent	*50* (57.47%)	*14* (87.5%)	*6* (75%)
Good	*34* (39.08%)	*2* (12.5%)	*2* (25%)
Adequate	*3* (3.45%)	*0* (0.00%)	*0* (0.00%)
Column Totals:	**87**	**16**	**8**

These self-ratings suggest that the majority of individuals were confident that they were able to understand and express themselves using English. The questionnaires of the three individuals who rated their English proficiency as "Adequate" were treated cautiously. However, the responses in their demographics questionnaire were similar to the other participants and none of their answers suggested a potential language bias. It appeared that all three participants (who self-rated their English proficiency as Adequate) demonstrated a general understanding of all the questions in the demographics questionnaire. No individual participating in Stage Two or the pilot rated their English proficiency as only "Adequate". Given this observation, two presumptions were made: (i) each participant had a satisfactory grasp on the use of the wording utilised within the instruments; and (ii) each individual was able to express their daily MI experiences with sufficient clarity.

3.3. DATA COLLECTION METHODS

3.3.1 Instruments

The two primary data collection instruments included the demographic questionnaires and the Spontaneous Musical Imagery Journals (SMIJ). However, the researcher can also be considered an instrument. In view of the fact that the design employed mixed methods, a succinct report related to the researcher's self-reflexivity has been attached in the appendices (please refer to **Appendix C**) since this is important in the context of any qualitative analysis of data.

Demographics Questionnaire

This survey-based instrument contained three sections. Section A relates to general demographic information and included three questions pertaining to the exclusionary criteria. Since Liikkanen (2008) and Bennett (2002) found MI to be more prevalent in females than males, it was determined that gender was a necessary variable to consider during analysis and consequently, it was included in the instrument. It was also established that age was related to the experience of MI in Liikkanen's (2008) Finnish sample. Thus, age was also incorporated in order to determine whether it has any bearing on the experience of MI.

Section B relates to musical history of the participant. Brown (2006) suggested that future research should also investigate musical background, musical activities, musical skill, and involvement with music since he postulated that these factors may be associated with the

experience MI. Liikkanen (2008) found that there was a weak positive correlation (Spearman's rho = 0.157) between INMI (Involuntary Musical Imagery) and musical education in years. However, if musical experience exceeded fifteen years then, on average, fewer episodes of INMI were reported (Liikkanen, 2008). Thus, the current study took these recommendations into account.

Finally, Section C solicits information pertaining to the perceived frequency MI. The principal function of the instrument was to ascertain which participants could be invited to assist in the second stage of the study. The subsidiary purpose of the instrument was to establish an overall estimate of the prevalence of MI within the larger sample group.

Spontaneous Musical Imagery Journal (SMIJ)

The SMIJ contained twenty-one copies of the Spontaneous Musical Imagery Questionnaire (SMIQ). The SMIQ[32] was developed by the researcher specifically for this. The SMIQ was piloted prior to implementing it as the primary data collecting method in the second stage of this study. The pilot is discussed in detail later on in this Chapter. The SMIQ attempted to synthesise Bailes' (2007) Experience-sampling Form (ESF), Wammes & Barušs' (2009) MIQ, and Brown's (2006) MI characteristics in order to construct a comprehensive instrument intended for investigating various dimensions of the MI in a manner analogous with experience-sampling methods.

Section A assesses the absence or presence of a MI episode at the time of receiving an experience-sampling prompt (signal via their cellular telephone). If the participant replied in the affirmative, Section A explored the content and nature of the MI using a combination of open-ended and closed-ended questions. It also addressed contextual information relating to familiarity, personal association, and presence of other imagery. Section A of the SMIQ, includes two additional questions to be answered by participants upon receiving the first signal of the day. The two questions relate to the presence and content of MI upon waking. After the pilot was conducted, it was decided that these two questions would be included in Section A of the SMIQ. The underlying rationale was that experience-sampling signals did not occur before 08H00. Thus, the researcher was interested in uncovering whether MI was present upon waking, even if this relied upon retrospective reporting since neither the ESF

[32] The SMIQ was developed in consultation with the researcher's supervisor.

(Bailes, 2007) nor the MIQ (Wammes & Barušs, 2009) contained questions to investigate MI upon waking.

Section B specifically investigates the co-occurrence and nature of corporeal manifestations. If MI was absent at the moment of experience-sampling, participants were instructed to move directly on to Sections C and D. These two sections were to be completed for every journal entry regardless of the presence or absence of MI.

Section C contained control questions pertaining to the simultaneous presence of external music, its source, and whether it was identical to the MI. These questions were included in order to adjudicate whether participants were possibly describing music perception instead of experiences of MI. Lastly, Section D related to the principal activity engaged in immediately prior to the signal, and the presence of others. It also afforded participants with the opportunity to report the occurrence of MI between journal entries. Thus, the constancy of MI was indirectly assessed in terms of the rates of MI occurrence across the respective sampling periods. These questions were included with the aim of collecting contextual data concerning the participant's natural environment – the elicited responses were intended to function as proxies of naturalistic observations.

Although there are some similarities between Bailes' (2007) ESF and the SMIQ, it was decided that the ESF was inappropriate for this research since it did not consider co-occurring phenomena (specifically corporeal manifestations and visual imagery), and because it was too technically worded for non-musical participants. Similarly, Wammes & Barušs'(2009) MIQ was also deemed to be inappropriate since it failed to distinguish between voluntary and involuntary MI, and had not been designed for purposes of experience sampling. The current study aimed to explore both forms of MI in addition to incorporating non-musical participants in the sample.

Question (13 or 14[33]) of Section A employs a similar format to a question in Bailes' (2007) ESF. It was included since Bailes (2007) found that Melody and Lyrics were the two most vivid components of MI in her sample. These elements were incorporated in the SMIQ in order to compare findings. Additionally, Bailes (2007) suggested that further research should

[33] It is numbered as Question 14 in the first SMIQ for each day since an additional question regarding MIOW was included in the first SMIQ for each day.

also include the element of Rhythm since it may possibly be a significant component of MI. It was unsuitable to utilise the other elements Bailes (2007) incorporated into her ESF (harmony, texture, timbre, dynamics and expression) because this vocabulary was deemed to be too technical for non-musicians. Question (13 or 14 in the case of the first SMIQ for each day) employs an identical design to the ESF since it was a coherent layout to facilitate responsiveness and it enables contrasts to be drawn. All three musical elements (melody, lyrics and rhythm) in the SMIQs included definitions beneath them because it was expected that respondents may not automatically understand these terms.

Question (14a or 15a[34]) and (14b or 15b) of Section A have been included to assess whether visual imagery (or other modes of imagery) were simultaneously present during an episode of MI. The motivation for this was because Bailes (2007) established that multimodal aspects of MI were expressed by her sample but the ESF did not specifically explore this facet of MI. Bailes (2007) therefore suggested that future research should include methods to assess the presence of other imagery. The SMIQ addressed this suggestion.

Another set of questions similar to Bailes' (2007) ESF are Questions (1), and (2a) of Section D. These relate to the main activity participants were engaged in immediately prior to receiving the signal (Question 1) and whether or not participants were alone at that particular time (Question 2a). The justification underlying their inclusion is because Bailes (2007) asserted that MI was frequently prevalent when individuals were in the company of others. She also observed that activities reported to be mechanical or automatic appeared to be associated with more frequent episodes of MI (Bailes, 2007). Contrastingly, Lipson (2006) hypothesised that the incidence of MI would be more prevalent in the absence of other people. Thus, it seemed logical to include these two questions in order to further examine the two opposing positions.

The central objective during the development of the two measures was to collect extensive data regarding MI experiences without being excessively time-consuming from a potential participant's perspective. Additionally, the instruments were intended to be user-friendly and comprehensive enough to allow for reports of pertinent contextual data in order to facilitate thick descriptions of the phenomenon as it was experienced in a naturalistic setting (Hurlburt

[34] Similarly, for the first SMIQ of the day, there is an additional question pertaining to MIOW, accordingly, the numbers increase by one in Section A.

& Heavey, 2004). Indeed, it was difficult to develop a questionnaire that perfectly struck a balance between achieving rich, descriptive data and was also not too time-consuming for participants.

Given the exploratory nature of the study, the primary objective was not to ascertain the two instruments psychometric properties. Accordingly, reliability and some measure of convergent validity (using Bailes (2007) ESF) were not established. However, the two instruments both appear to demonstrate reasonable content validity (*prima facie* evidence of the measurement of a construct) (Murphy & Davidshofer, 2005) since they were reviewed by the researcher's supervisor and two individuals affiliated with the Human Research Ethics Committee for the School of Human and Community Development[35]. Since these individuals were not prospective participants and they all have some degree of psychometric expertise, it could be argued that this indicates some measure of content validity. All parties were satisfied with both instruments, and the overall feedback suggested that the instruments were satisfactory in terms of the purposes of the current study.

Although both instruments attempt to explore specific facets of the construct of MI, they also document several contextual features of participant's experiences. Thus, the SMIQ includes questions to probe various characteristics of MI aimed at providing idiographic descriptions of the phenomenon (Hurlburt & Akhter, 2006) rather than being predictive in nature. Another objective of the two instruments was to evaluate the validity of MI characteristics posited by Brown (2006). Both are tailored instruments designed not as comprehensive and fully validated measures of MI in general. For that reason, they are bespoke instruments suitable for the intended sample group, the procedure and methods of this study, and both endeavour to address the research aims and main research questions. Accordingly, these instruments appear to be reasonably aligned with the overarching research objectives.

3.3.2. Rationale for using Experience-Sampling Methodology

Stage Two of this research employed a variant of Descriptive Experience Sampling (DES) as the primary technique to gather data concerning everyday MI experiences. In both Chapters 1 and 2, both offer a few justifications for this methodology. This section presents the remaining explanations which underpin the choice to employ experience-sampling. DES is a

[35] Both individuals were acting on behalf of the University of the Witwatersrand in Johannesburg, South Africa.

particularly useful and appropriate technique for collecting first-person experiences through non-experimental methods because it is a robust way of conducting research centred on individuals' everyday experiences (Sloboda, O'Neill, & Ivaldi, 2001). It is also helpful in reducing bias in recall relating to self-report data because it relies on a real-time data collection strategy. It is valuable because data generated through DES methods are less susceptible to various sources of error that are intrinsic to retrospective reports (Trull & Ebner-Priemer, 2009). Additionally, it allows for observation of a phenomenon over specified intervals of time (Sloboda, O'Neill, & Ivaldi, 2001) since it incorporates iterative sampling into the general procedure. It is advocated as a valuable methodology for obtaining accurate reports concerning awareness and it is a systematic form of data collection appropriate for naturalistic observation given that it does not use situational or experimental manipulation (Hurlburt & Heavey, 2004). DES is designed to capture transitory phenomena naturally fluctuating over varying temporal periods – for instance, mood states, behaviours, and thoughts (Trull & Ebner-Priemer, 2009). According to Stone and Shiffman (1994, as cited in Trull and Ebner-Priemer, 2009, p.457), Ecological Momentary Assessment methods (such as DES), typically involves the following four activities:

> (a) collection of data in real-world environments; (b) assessments that focus on individuals' current or very recent states or behaviours; (c) assessments that may be event-based, time-based, or randomly prompted (depending on the research question); and (d) completion of multiple assessments over time.

These four steps make this method reasonably suitable for investigating inner experiences in day-to-day environments. The conventional DES procedure and the associated benefits of DES methods are outlined below.

DES methods traditionally require participants to wear beepers – most are earpieces worn by the participant that clearly beeps directly into their ear. Beeper-signals (which are typically random) prompt participants to begin introspection and to note down important elements of their conscious experience (Hurlburt & Akhter, 2006). However, owing to fiscal constraints, beepers could not be acquired. Moreover, since the sample of university students attended classes over the course of the study, it was deemed unethical to disrupt their lectures. This

research thus relied on participants' being in possession of a working cellular telephone to receive quasi-random[36] prompts.

DES aims to maximise awareness of details pertaining to a specific phenomenon and reduce retrograde recall biases associated with introspective methods (Hurlburt & Heavey, 2004). Since the signals are independent of the participant's internal and external states, it allows for the examination of a wider array of mental phenomena (Hurlburt & Heavey, 2004). DES places emphasis on conspicuous incidences of mental states (i.e. the presence or absence of an event – MI in this study) rather than focusing on the fundamental cognitive processes underpinning awareness (Trull & Ebner-Priemer, 2009; Hurlburt & Heavey, 2004). Although this task may be relatively straightforward for participants to master, it is assumed that the iterative nature of the method tacitly teaches participants to become more proficient at the DES task (Hurlburt, 2011). Nevertheless, the accuracy of DES reports is not necessarily guaranteed.

DES aims to gather a series of idiographic experiences (documenting within-subject responses) (Trull & Ebner-Priemer, 2009) thereby promoting a nomothetic objective – analysing multiple documented experiences to examine the salient features between-subjects or across the sampled responses (Hurlburt & Akhter, 2006). Since the current research aimed to achieve a balance between the depth and breadth of the descriptions of MI, DES appeared to be the most apposite method of inquiry given the internal nature of MI experiences.

Trull and Ebner-Priemer (2009, p.458) suggest that retrospective data is often subject to the following cognitive biases:

> ...individuals are more likely to recall or report experiences that seem more personally relevant (*personal heuristics effect*), that occurred more recently (*recency effect*), that stand out as significant or unusual (*salience* or *novelty effect*), or that are consistent with their current mood state (*mood-congruent memory effect)*; (e.g., Gorin & Stone, 2001; Hufford, Shiffman, Paty, & Stone, 2001).

[36] From the participant's point of view, the SMS-prompt was random since participants were not told when they would receive the SMS but that it would occur three times a day over the seven day period during a specified time-frame. It was not considered ethical to transmit random prompts given that the sample was derived from a student population. Accordingly, prompts were not to occur during lecture periods.

Accordingly, interviews, focus groups, and comparable methodologies relying on retrospective reports were deemed to be unsuitable for studying the characteristics of MI, as the reliability of responses was deemed to be comparatively unreliable. Additionally, it appeared improbable that such methods would be capable of "catching" individual(s) during the real-time experience of a MI episode. Moreover, similar research endeavours advocated the use of DES as a reliable method for the study of music-related phenomena (Bailes, 2007; North, Hargreaves & Hargreaves, 2004) and other forms of everyday inner experiences (Heavey, & Hurlburt, 2008).

North, Hargreaves and Hargreaves (2004) conducted research on the uses of music in everyday life, utilising a variation of traditional DES methodology – one questionnaire was completed by each participant per day over a period of fourteen days. The reported compliance rate was 96.72%. Similarly, Bailes (2007) conducted a study using DES in order to investigate MI. Her sample consisted of eleven music students who reported their everyday experiences of both voluntary and involuntary MI. Her aim was to uncover when it occurs and how it is experienced (Bailes, 2007). Her response rate (90.26%) was also deemed to be satisfactory. Bailes (2007) experienced-sampled six times per day over seven days (in theory, 462 questionnaires) and she suggested that DES was an effective method for exploring MI in everyday contexts. Based on these aforementioned compliance rates, it was decided that DES appeared to be an effective methodology for exploring the characteristics of MI.

The current study's method can be viewed as an adaptation of conventional DES procedures. It is most closely aligned with Bailes' (2007) research[37]. Given the scope of the study, it was not feasible to implement DES methodology in a traditional sense primarily owing to time constraints. Since it was essential to survey students in order to select a suitable sample for the experience-sampling phase of the study, this was done at the expense of expositional interviews. It was considered too resource intensive for one researcher to capture and analyse three different kinds of data without assistance. Accordingly, expositional interviews were not conducted. Nevertheless, it is stated that because the expositional interviewer repeatedly asks the interviewee the same questions during the course of the sampling period, the DES participants become more proficient at recognising important[38] aspects of their consciousness

[37] Her procedure has already been noted in Chapter 2.
[38] Important in the sense that DES participants recognise, take note of and immediately write-down specific aspects of their consciousness the researcher is most interested in (Hurlburt, 2011).

during the course of their research involvement (Hurlburt, 2011). Consequently, it is proposed that with the careful construction of the SMIJ and the narrow focus of the present study (specifically investigating a particular element of everyday awareness, namely MI), participants would also presumably learn which elements of MI to focus their attention on during the experienced-sampling task. This assumption is made since the participant was not simply expected to take notes after the experience-sampling prompt was received, they were instructed to complete the corresponding SMIQ within their SMIJ. Moreover, every SMIQ included identical questions for each of the sampling days and it was supposed that the instrument was sufficiently analogous with traditional DES expositional interviewing. Thus, the SMIJ was also assumed to be adequately comparable with the iterative nature of conventional DES methods even if it is a modified version. Correspondingly, Kane (2011, p.154) makes a similar argument:

> My claim, then, is that simple — even simple-minded — probes of people's ongoing conscious experiences can provide incredibly convincing and useful data, both descriptively and theoretically. Time- and labour-intensive DES procedures are simply not necessary to learn *some* important things about people's inner experiences.

Thus, even though this study employed a modified version of DES, it also offers valuable data concerning the everyday experience of MI.

Despite the aforesaid complications (and those outlined in Chapter Two), this study utilised experience-sampling in order to reliably capture individual descriptions and dimensions of MI. Given that a subsidiary aim of the study was to offer suggestions relating to the development of a reliable and valid instrument to measure MI, real-time introspective methods were considered an appropriate point of departure.

3.4. RESEARCH PROCEDURE

After the mandatory ethical clearance was obtained (Ethics Protocol Number **MPSYC/09/001 IH –** refer to **Appendix D**), the requisite permission was acquired from the appropriate Psychology Department representatives (please refer to **Appendix E**), and piloting was completed, the data collection process was undertaken and completed during 2009.

3.4.1. Stage One Research Procedure

Short presentations were made to classes of undergraduate Psychology students from the University of the Witwatersrand, inviting them to participate in the study. The presentations were made immediately prior to the start of their lectures. The researcher explained the purpose of the study and what was meant by the term MI (referred to as spontaneous MI in the two instruments).

The researcher made clear that participation was entirely voluntary, and requested that any persons interested in participating in the study show their interest by raising their hands. The researcher handed out the demographic questionnaires to interested parties, which also included the Participant Information Sheet (1) (please see **Appendix F**). Upon completion, participants were asked to submit it directly to the researcher or to a sealed, marked box in room U211 which is located on the second floor of the Umthombo Building at the University of the Witwatersrand. Additionally, they were asked to create a unique identification code in order for their journal responses to be anonymously matched to their demographic questionnaires.

Preliminary analyses were conducted on the demographic questionnaires[39] in order to ascertain, per individual, whether the inclusion criteria had been met. Those who do not meet the criteria were sent a letter of thanks electronically for their time, if they provided an electronic mail address[40]. Individuals who were identified as having met the inclusion criteria were contacted via electronic mail or telephonically explaining the next stage of participation. Participants were informed that the second stage was also completely voluntary and if they wished to withdraw they could do so at any point. Additionally, an electronic mail was sent out a few days prior to the start of the second stage which contained a second Participant Information Sheet (2) (refer to **Appendix G**) and instructions for the journal (see **Appendix H**). The SMIQ was also piloted on a small sample of students prior to the second phase of data collection having been implemented.

[39] The collected demographic questionnaires will be destroyed, in order to meet ethical protocols, once the research report is finalised.
[40] Most individuals from Stage One of the study did not provide any contact details if they were not willing or interested in participating in Stage Two.

3.4.2. Piloting of the SMIQ

The researcher piloted the SMIQ in order to troubleshoot any unforeseeable problems whether practical or methodological. The researcher approached post-graduate psychology students to assist in this regard. Short presentations were only conducted once permission had been granted by the corresponding post-graduate course co-ordinator. All six pilot participants returned their journals and there were no withdrawals from the pilot. Pilot participants were required to complete six SMIQs over a two day period. Each SMIQ was to be completed as soon as it was reasonably feasible after receiving the relevant signal. One difficulty identified during the pilot related to the layout and printing of the journal. Since the Stage Two journal was greater in volume (107 double-sided pages), it was decided that landscape printing was necessary. The journal needed to be portable and single-sided printing may have made it both bulky and overwhelming.

The pilot journals included SMIQ completion times in order to assess the average time taken to complete each journal entry. The mean completion time was approximately eleven minutes if MI was present. When MI was absent during experience-sampling, the average completion time was roughly seven minutes (presumably, in part, because less questions were required to be answered). The second participant information sheet was amended accordingly. The completion times suggested that once participants began to become familiar with the SMIQ, they were able to complete the task more rapidly unless the activity they were engaged in prevented immediate compliance. Additionally, it appeared that no training was necessary since all individuals were able to accurately complete their SMIJs.

The original seven participants demonstrated a 97.62% compliance rate (41 SMIQs completed out of a possible 42). This suggested that the SMIQ was straightforward enough for participants to complete timeously and that it was a suitable instrument for the experience-sampling task. However, once participant H (the eighth participant from Stage Two of the study) was included in the pilot, the overall compliance rate dropped substantially to 79.37% (50 completed journal entries out of 63 available SMIQs). Of the 50 completed SMIQs, 40 were done within the requisite time-frame – thus, the timeous compliance rate was even lower at 63.49%. Seven SMIQs were completed after the 30 minute cut-off period and the remaining three had partially completed the three time slots. Two of the three SMIQs

reflected MI to be present and were classified as DESI entries given that both participants failed to fill-in all three time slots information.

3.4.3. Stage Two Research Procedure

After piloting the SMIQ, journals (SMIJs) and pens were made available for collection by participants at room U211. The day before the commencement of the second stage of data collection, participants were sent an SMS reminding them to keep both their journals and cellular telephones on their person for the following seven days for participation purposes.

Originally the researcher anticipated that Stage Two would be all inclusive and could be conducted over a single sampling period. However, the researcher had to offer four different sampling periods in order to suit participants' needs. Thus, four smaller groups participated in Stage Two of the study during a five week interval. The first group (Group A) consisted of seven under-graduate students and five returned their journals. Accordingly, attrition in Group A was two students. One of the five students who returned their journal completed less than half of their SMIQs. It was decided that this particular journal should be analysed in conjunction with the pilot study (Participant H). Group A was the only group who participated during a University Study break, the other three Stage Two groups participated during the last quarter of the University semester. The second group (Group B) had four participants and the fourth group (Group D) had six participants. All ten of these journals were returned. Thus, there was no attrition for either of these groups. Group C (n = 2) originally consisted of three participants but one tacitly withdrew by failing to return their SMIJ. Altogether twenty SMIJs were taken by potential participants, while only 85% (n = 17) were returned. Three individuals were considered to have tacitly withdrew from the study (attrition was 15% i.e. 3 of 20). This was despite the researcher's efforts to allow for late journal returns. The marked box was accessible for at least two weeks after the final Stage Two group had completed the process.

From the commencement dates for each of the four Stage Two Groups (A to D), participants were sent three text messages via their cellular phones per day. The manner in which MI was experienced-sampled, in this study is outlined, particularly since it is important to highlight how it differs from conventional DES methods. This research transmitted short text messages (SMSes) to participating individual's cellular telephones three times per day. The SMS

served the same primary purpose as the traditional DES beeper since it notified the participant (in words and perhaps even through sound) to begin the experience-sampling task. In this study, the SMS signified to participants that the corresponding SMIQ needed to be completed. The reliability of SMS-signal delivery was chronicled by the researcher in log books. On average, signals were usually received by all participants' cellular telephones within two minutes of the signal transmission. All SMS-signals were sent from the researcher's personal cellular telephone. A typical SMS prompt would state the following: *"Please fill in the SMIQ labelled Day One (No. 1) on page 2 of your Journal. Many thanks, Bronwyn."*

The rationale behind using three questionnaires per day is that this seemed to be the least intrusive number of observations. More than three per day may have placed potentially unreasonable demands on participants' time, thus possibly interfering with their studies and discouraging compliance. Reduced signalling was done in order to foster active participation in the sample Traditional DES methods typically collect between 25 and 50 experience-samples per participant (Hurlburt & Akhter, 2006). The current study aimed to gather 21 SMIQs per participant which is slightly lower than the norm for DES[41]. Signals occurred at quasi-random time intervals over the seven days any time between 08H00 and 21H00. As soon as practically possible, after reading the message, participants were requested to fill in the appropriately marked SMIQ.

Another recognised challenge to DES methodology is a lack of commitment to the task(s) to be performed (Conner Christensen, Feldman Barrett, Bliss-Moreau, Lebo & Kaschub, 2003) and it is exacerbated where remuneration or incentives are prohibited by ethics committees. In terms of the current research, no incentives were used. Participants were not provided remuneration or any additional rewards owing to University ethical protocols. In order to circumvent lack of overall compliance, the inclusion criterion of experiencing MI at least "2 to 3 times per week" was applied. The underlying motivation was that participants who reported fewer MI episodes were more likely to lose interest in the SMIJ or fail to attend to SMS-prompts three times per day especially if they were not consistently experiencing MI over the sampling period.

[41] However, during the process of adhering to University protocols for ethical clearance, the methods reader felt that 21SMIQs per day was an excessive volume of data. Despite this, the researcher chose to experience-sample three times per day over the seven day period.

After the full sampling period, participants were sent a message requesting that they deliver their journals to the sealed, marked box located at room U211. In consultation with the research supervisor, it was decided that continuing to repeatedly sample students could possibly introduce confounding variables. Thus, sampling was discontinued after 20 journals had been collected by participants, regardless of whether they were returned. Once the majority of the SMIJs had been returned to the researcher, data analysis commenced.

3.5. DATA ANALYSIS

The primary analysis for the SMIJs was a combination of descriptive statistics[42] and content analysis. Krippendorff (1980, p.21) defines content analysis as "a research technique for making replicable and valid inferences from data to their context". Thus, he places significant emphasis on the reliability of the techniques and conventions used to code data. Additionally, he also suggests that such procedures should be rigorous enough to be applied in different contexts and reproduce the same results over time (Krippendorff, 1980). In essence, his emphasis is on the replicability of coding methods rather than the replicability of research findings. The current research primarily focused on the manifest (*prima facie*) content of the participant's responses. Given that the fundamental aim of the research was to document the everyday occurrence of MI, it did not endeavour to be overly interpretive.

In accordance with these definitions, content analysis therefore requires a standardised coding procedure (Neuendorf, 2002). Braun and Clarke (2006) explicitly elucidate the six phases to be employed during the analysis process. The preliminary phase is to immerse oneself in the data in order to become familiar with the overall content of it (Braun & Clarke, 2006). The second phase involves a procedure of "generating initial codes" (Braun & Clarke, 2006, p. 88). The researcher will start identifying and locating themes, labels, and tags to the descriptive information in order to compress it. This technique facilitates the organisation of the data into meaningful units of analysis (themes) (Tuckett, 2005 as cited in Braun & Clarke, 2006). This technique is especially useful for open-ended questions, as it facilitates the process of identifying trends in the text (Neuendorf, 2002).

[42] All statistical calculations (whether descriptive or inferential) were computed utilising SAS version 9.1.4. unless stated otherwise.

In line with content analysis guidelines, an initial coding frame was developed based on the four central characteristics Brown (2006) posited in addition to the specific sections of the SMIQ. Thus, the coding process was predominantly theory-driven at the outset (Braun & Clarke, 2006). This preliminary coding frame was revised during the process of data analysis and once sufficient immersion with the data had occurred (Braun & Clarke, 2006). Every completed SMIQ was coded regardless of whether MI was present of absent at the time of the signal. All identified categories were assigned numerical values and were individually defined in the coding scheme (Lindlof & Taylor, 2002). The allocated numerical values were essentially categorical or nominal rather than being indicative of any magnitude (Murphy & Davidshofer, 2005; Howell, 1997).

Categories were established both deductively (*a priori*) and inductively (as they emerged from the data) (Patton, 2002). The characteristics of MI were mainly deductively derived and were established in consultation with relevant literature (Patton, 2002) during the development of the SMIQ. Main characteristics and their related qualities were primarily based on descriptions of MI offered by Bailes (2007) and Brown (2006). Thus, categories for the closed-ended questions were predetermined prior to the commencement of the study. Open-ended questions within the SMIQ allowed for some characteristics to emerge in a more inductive manner once immersion with the data had occurred (Patton, 2002). Thus, participants were given the opportunity to describe aspects of MI they believed to be meaningful and salient rather than being limited to standardised response-sets (Patton, 2002). In general, participant responses to open-ended questions were relatively short in nature.

The third phase explicated by Braun and Clarke (2006) involves a process of analysing the coding frames for prospective themes. This phase can be completed via a myriad of methods – for example, utilising diagrammatic depictions or in terms of tabularised techniques (Braun & Clarke, 2006). During this stage, no data is eliminated, all information will be classified into broad topics that typically consist of subsidiary themes (Braun & Clarke, 2006).

Given that the content analysis employed in this research operated within a predominantly quantitative content analysis framework, data was condensed into both absolute frequencies (incidences within the sample) and relative frequencies (percentages) (Krippendorff, 1980). One-way frequency tables were computed for particular variables so that patterns and relationships between variables could be identified (Krippendorff, 1980). This is suggested to

be an appropriate means of summarising both qualitative and quantitative data (Howell, 1997; Krippendorff, 1980). Thus, reported frequencies for the closed-ended questions were analysed using frequency counts and were converted to percentages where applicable. Statistical tests of association between certain relevant variables (Pearson Chi-squared, Fisher-Freeman-Halton tests, and Odds Ratios) were computed in order to establish whether significant relationships were apparent.

However, in terms of the open-ended questions, and in instances where themes were emergent, rather than *a priori*, the findings have been reported by means of a fairly qualitative and thematic manner using direct quotations of participant's responses (Stemler, 2001). With regards to the demographics questionnaire, some descriptive statistics (means, standard deviations, ranges, modes, and percentages) were calculated in order to illustrate characteristics of the sample (for example, age, gender, musical history). The musical activities of the sample were also analysed using descriptive statistics.

Braun and Clarke (2006) stipulate that the fourth phase of the analysis involves a systematic reviewing process. They posit that themes should be sufficiently distinct from one another and that sub-themes ought to be coherently organised in a cohesive manner (Braun & Clarke, 2006). Initially, this process should be undertaken by analyzing each consecutive theme and its associated sub-themes. Subsequently, this process should be recommenced except in a more holistic manner whereby the analyst evaluates the overall coherence of the intact data set (Braun & Clarke, 2006). Once this has been accomplished, the respective analyst may begin to refine, reorganize, re-code and reduce the data in a cyclical process (Braun & Clarke, 2006). The authors provide the following caveat: "when your refinements are not adding anything substantial, Stop!" (Braun & Clarke, 2006, p. 92); otherwise, this cyclical procedure is likely to become incessant.

The fifth phase concerns the allocation of names to the respective themes and providing working definitions for these identified variables (Braun & Clarke, 2006). This process requires the analyst to extract the quintessential feature underpinning the themes. This step often involves assigning exemplary narratives that are illustrative of the core topic to the respective themes. This should be done in a systematic and organized manner (Braun & Clarke, 2006). The current study incorporated both stages four and five into the third phase of

the analysis owing to its principally quantitative approach. Thus, themes were reviewed, re-examined and refined during the tabulation and coding process.

The final phase described by Braun and Clarke (2006) relates to the write-up of the report in whichever format is necessary. The primary aim is to dually present the complexity and intricacies of the findings in a manner which demonstrates the validity of the analysis (Braun & Clarke, 2006). These findings should be presented in a logical, non-duplicative and coherent style. The findings should also facilitate a rejoinder to the underlying research questions (Braun & Clarke, 2006). In accordance with the six aforementioned phases, the current study's method of analysis aimed to utilise and sufficiently satisfy each of the criteria in a contextually apposite manner.

An important caveat to note is that prior to the analysis if the experienced-sampled data, each completed journal entry time was compared with the researcher's log books. In general, the times documented by participants fell within a reasonable time-frame approximation[43]. There were some time entries which were only partially completed and a few which did not correspond to the log books. This highlights a latent concern: researchers cannot be certain that DES tasks were in fact completed at the time of the prompt, unless an online, computerised journal is used, thus, it is feasible that participants could "back-fill" their diary (Trull & Ebner-Priemer, 2009). "Fortunately, studies show that participants using electronic diaries show high rates of compliance at the time of the scheduled prompt" (Trull & Ebner-Priemer, 2009, p. 458). Presumably, such findings imply that retrospectively completed journal entries are not made frequently during DES studies. Moreover, it might be expected that participants would be more likely to "back-fill" journals in studies where incentives (especially financial gains) have been offered for completed journal entries or where daily expositional interviews are held. This was not the case in the current study and as such, participants were given the benefit of the doubt in ambiguous cases.[44]

In accordance with literature, the researcher chose to apply the thirty minute response window (Bailes, 2007; Scollon, Kim-Prieto & Diener, 2003). Since experience sampling aims

[43] Participants did not synchronize their cellular telephone time with the researcher. Thus, it was assumed that times within a few minutes of the log entry were reasonably accurate.
[44] One participant's journal times were consistently an hour behind the time log but it was decided that it was possible that their time-piece may have been incorrect. This did not apply to all their entries, merely for six consecutive entries over the seven day sampling period.

to document an individual's particular experiences using repeated measures and within their natural environment, the quality of this methodology is compromised by excessive time lags between signalling and participants' responses (Scollon, Kim-Prieto & Diener, 2003). Delayed responses are subject to memory biases and other heuristics which essentially defeat the purpose of this methodology. Thus, there is a trade-off between analysing every completed entry and demarcating a reasonable response period. This highlights the practical limitations of this methodology – namely, the indistinct border between what is classified as an in-the-moment experience and one which is regarded as a retrospective reconstruction of an experience (Scollon, Kim-Prieto & Diener, 2003). To partially address this issue, the experienced-sampled data was categorised into experienced-sampled data and retrospective reports of MI.

3.6. ETHICAL CONSIDERATIONS

This research was done in accordance with basic ethical principles of informed consent, anonymity[45], and confidentiality as set out by the Health Professions Council of South Africa (HPCSA). Additionally, clearance was granted by the Human Research Ethics Committee for the School of Human and Community Development acting on behalf of the University of the Witwatersrand in Johannesburg, South Africa. The clearance certificate was issued on the first day of June in 2009 (please see **Appendix D**).

Participation in both stages of this study was voluntary. Participants were informed of this during the brief presentations and by way of the Participant Information sheets. Conner-Christensen and colleagues (2003) stipulate that the time taken for an experience-sampling task to be completed should be kept to a minimum. Resultantly, the signalling periods were set in accordance with the University timetable so that the prompts were not disruptive to lecture attendance. Additionally, participants were advised that they were under no obligation to complete any question(s) they did not wish to answer and they could do so without any consequence arising (Devlin, 2006). Moreover, no coercion was used. All participants who submitted their demographic questionnaire and/or their SMIJ were considered to have tacitly consented to participate in the study. Thus, the requirement of informed consent was met (Devlin, 2006).

[45] This statement is qualified below.

Participants were able to withdraw from either stage of the study at any point with no disadvantage (Devlin, 2006). This was made clear to participants during the short presentations and it was explicitly stated in the Participant Information Sheets. Thus, failure to submit demographic questionnaires or journals was considered withdrawal from the study. Consequently, the requirement of participant's right to discontinue their involvement at any point without consequence was also met (Haslam & McGarty, 1998).

This study did not use deception and there were no potentially foreseeable harmful outcomes (Bless, Higson-Smith & Kagee, 2006). However, it seemed reasonable to provide a reference to specialist services to address any emotional distress that a participant may have encountered (Devlin, 2006). The Participant Information sheets provided relevant information in this regard and this appeared to be adequate for purposes of the study. Thus, the protection and welfare of participants was catered for despite the study being a relatively innocuous in nature (Haslam & McGarty, 1998).

All information collected was kept strictly confidential. Participants were informed of the researcher's responsibility via the Participant Information Sheets (Devlin, 2006). Participants have not been identified by name in this report and if the results are published elsewhere, no identifying information will be shown. (Bless, Higson-Smith & Kagee, 2006). Only the researcher and her immediate supervisor have had access to the submitted questionnaires and journals. At this juncture, only the researcher has actually accessed the raw data. Additionally, the researcher has stripped the reported data of any identifying information.

Not all the participants were entirely anonymous to the researcher (a few participants were contacted in person after the short presentations, through telephonic correspondence and via electronic mail). However, the researcher did not ask for names and has only used the identifying codes that participants created in order to match demographic questionnaires with journals. Additionally, findings of the study have been reported in an anonymous manner. Consequently, the requirements of confidentiality and anonymous reporting have also been met (Haslam & McGarty, 1998).

Once the research has been officially finalised, a short summary of findings will be posted on an electronic forum (see http://sherriffmusicalimagery.blogspot.com/) to inform participants of the findings. An electronic communication will be sent to participants to direct them to the

appropriate Uniform Resource Locator **(**URL**)**. This should meet the requirement of participant debriefing (Bless, Higson-Smith & Kagee, 2006).

CHAPTER 4

RESULTS

4.1. INTRODUCTION

The general aim of this research was to explore the everyday experience of MI using experience-sampling methodology. The dimensions of MI were mainly deductively derived (Patton, 2002) and were established during the development of the SMIQs. Main characteristics and their related qualities were primarily based on descriptions of MI identified by Bailes (2007) and Brown (2006). Open-ended questions within the SMIQs allowed for some characteristics to emerge in a more inductive manner once immersion with the data had occurred (Patton, 2002). Brown's (2006) four dimensions served as the basis for the development of the SMIQs. Consequently, the reported results will be displayed in terms of these four main themes since they underpinned the organisation of the analysis and the SMIJ. The results will initially display the musical activity of the Stage One sample in order to provide a background to the Stage Two sample. The four main dimensions and the corresponding qualities will then be elucidated. Contextual data will also be presented in an attempt to provide a thick description of the phenomenon (Patton, 2002) of MI.

Stage One of the research involved a demographic questionnaire which was also used for screening purposes. The analysis of Stage One of the study that shall be presented will highlight music-related activities of the sample. This should help provide a milieu for the population from which the Stage Two sample was drawn. The Stage One group (including the pilot participants) had a total of 87 participants. A concise overview of these individuals' music related activity will initially be given.

4.1.1. Musical Activity of the Stage One Participants

91.95 % (80 out of 87) of the Stage One participants reported listening to music every day[46]. The remaining six (6.90%) stated that they did not listen to music every day. One of these individuals stated that they chose not to voluntarily listen to music at all.

[46] One individual did not complete this question or any other questions relating to their musical activity. They did however report the frequency for which they experienced MI which was 'Many (4 or more) times every day'.

Table 4.1.1.1. Overview of Stage One Sample's Musical Exposure

Daily Musical Exposure	Frequency	Percent	Rank
None	6	6.90%	3.5
One to three hours	52	59.77%	1
Four to six hours	18	20.69%	2
Seven to nine hours	6	6.90%	3.5
More than nine hours	4	4.60%	5

More than half (58.62%; 51 out of 87) of the participants reported no previous musical training. Of the 36 individuals (hereafter referred to as 'musicians') who reported a history of playing an instrument (singing was included as an 'instrument'), only 25 practiced their instrument(s) every week.

The summary statistics for weekly practice hours are reported in Table 4.1.1.2. "Formal training" was not defined in the questionnaire. It was left open to interpretation by the participants and the corresponding summary statistics are also reported in Table 4.1.1.2.

Table 4.1.1.2. Musical Background of the Musician group[47]

Musical Background of the Musicians	Mean	Standard Deviation	Range
Weekly Practice Hours	± 1.18 hours (71 minutes)	±2.6 hours (156 minutes)	1 – 14 hours
Years of Formal Training (Primary Instrument)	± 2 years and 7 months (2.61 years)	± 2 years and 10 months (2.81 years)	0 – 12 years
Years of Formal Training (Secondary Instrument)	± 2 years and 3 months (2.23 years)	± 2 years and 7 months (2.60 years)	0 – 8 years
Years of Formal Training (Tertiary Instrument)	± 1 year and 8 months (1.70 years)	± 1 year and 10 months (1.86 years)	0- 4 years, 6 months

Participants were not asked to rate their general proficiency on the instruments they listed. Table I (please refer to **Appendix I**) displays the kinds of instruments listed and the corresponding frequencies. The modal class instrument was Piano (frequency of 15), followed by Voice/Singing (frequency of 13) and subsequently Guitar (frequency of 10) out of the 52 instruments which were listed.

[47] Only one individual listed four different instruments that they were able to play but had no formal training on their fourth instrument (bass guitar).

One participant described themselves as a professional singer who was still undergoing professional voice training and had released two full length albums. No other participant described their musical activity as a professional endeavour. 27 of the 36 musicians (75%) had performed in public on their instrument. Table II (please see **Appendix I**) indicates the number of self-reported times the musicians rated having performed their instrument(s) in public. The modal class for public performances was one to five times with a frequency of 16 (58.26%). Thus, the musical activity of the Stage One participants may, at the very least, indicate an interest in music[48] and for some participants, a passion for it.

4.1.2. Reported Musical Imagery Constancy of the Stage One Participants

Data on reported frequency of MI are summarised in Table 4.1.2.1. The reported experiences of MI related to a question contained in the demographics questionnaire. In Section C, participants were asked the following: "How often do you hear music or pieces of music 'in your head' (that is, in the absence of any external source)?" The response format was closed-ended and the choices ranged from "Once a month" to "Many (4 or more) times every day".

Table 4.1.2.1. Stage One frequencies of self-reported experiences of Musical Imagery

Frequency of MI (MI)	Frequency (Percent)	Musician	Non-musician	Female	Male
Once a month	1 (1.15%)	0	1	0	1
Once a week	3 (3.45%)	2	1	2	1
2 to 3 times a week	27 (31.03%)	12	15	22	4
4 to 5 times a week	10 (11.49%)	3	7	9	1
6 to 7 times a week	4 (4.60%)	1	3	2	2
A few (1 to 3) times everyday	28 (32.18%)	11	17	15	13
Many (4 or more) times everyday	14 (16.09%)	7	7	8	6
Column Totals	**87**	**36**	**51**	**58**	**28** *

The modal frequency for reported experience of MI was "A few (1 to 3) times every day" (28 out of 87 participants – 32.18%). This was closely followed by "2 to 3 times per week" (27

[48] Except, perhaps, for the one individual who stated that they did not chose to actively listen to music.

* The missing frequency relates to one participant who failed to complete their gender in the demographics questionnaire.

out of 87 participants – 31.03%). This suggests that there may possibly be a bi-modal distribution. One participant reported only experiencing MI once a month, while 14 (16.09%) reported MI occurring "Many (4 or more) times every day". The demographics questionnaire did not specifically ask for the frequency of involuntary MI but rather the occurrence of any MI in the absence of an external source. Resultantly, the reported frequencies in Table 4.1.2.1. do not differentiate between voluntary or involuntary experiences of MI.

A Pearson's Chi-squared test of association could not be done to test whether any association existed between the self-reported experience of MI and musical history since the expected cell frequencies did not meet this test's requirements (50% of the cells had expected counts less than five) (Howell, 1997). Instead, a Fisher-Freeman-Halton test was utilised. This test is usually suitable for undersized samples (less than 30), where Pearson's chi-squared is inapplicable and can also be applied where expected and observed cell counts are small (Freeman & Halton, 1951).

For this test and all other tests in the current study, the sample was treated as random and independent[49]. The test result was not significant ($p = .8638$). This probability suggests that there is an 86.38% chance of getting a stronger table by sampling when the sample size and distribution of the observed table is given. Therefore, there is insufficient evidence to suggest that there is an association between self-reported MI experiences and musical training, in this sample, at a 5% level of significance.

A Pearson Chi-squared test of association could not be calculated between gender and self-reported experiences of MI since 57% of the cells had expected counts less than five (Howell, 1997). Thus, a Fisher-Freeman-Halton test was done yielding a significant p-value ($p = .04$). As a result, there is evidence at a 5% level of significance to suggest that there is a statistical association in self-reported MI experiences and gender in this sample. Cramer's Phi was 0.3667 which suggests that 13.45% of the variance is accounted for by the relationship between gender and self-reported frequencies[50]. This effect size is weak to moderate. In terms of the Fisher-Freeman-Halton test's requirements, all were satisfied except for the assumption

[49] According to Wickens, (1989, p.28) "In practice, the assumption of independence is usually reduced to the principle that each observation comes from a different subject...the separate-subject rule is coupled with a second clause that no subject should be omitted from the table." Given the aforementioned principle along with its conditional statement, this test is applicable since both requirements were satisfied.

[50] The percent of variance explained was calculated by squaring Cramer's Phi and then multiplying the squared value by 100.

of fixed marginals (Howell, 1997) owing to the fact that the study employed convenience sampling.

Participants were also given the opportunity in Stage One to report upon when the occurrence of MI typically occurred. Table 4.1.2.2. displays these findings along with the respective rankings for each category.

Table 4.1.2.2. Self-reported MI periods

MI Periods	Total Frequency	Rank	Musicians	Non-Musicians	Females	Males
Early morning	43	2	20	23	31	12
Mid-morning	35	3	14	21	20	14
Afternoons	52	**1**	19	33	30	21
Evenings	31	4	13	18	21	9
Late night	16	5	10	6	6	9
Total	**177**		**76**	**101**	**108**	**65**[*]

In general, the differences between the musicians and non-musicians were less than ten observations per category. However, the difference between the two groups for 'Afternoon' periods was 14 counts in favour of non-musician group. Additionally, this group tended to have greater frequencies than the musician group for every MI period except in response to the 'Late night' category. However, there were only 36 musicians as opposed to 51 non-musicians and this may account for some of the differences observed in table 3.1.2.2.

4.2. STAGE TWO RESULTS

4.2.1. Introduction

An overview of the findings for Stage Two of the study will be shown according to three categories. Firstly, results will be presented pertaining to the overall sample (Stage Two sample) as well as the pilot. Secondly, results related to Experience-Sampled Imagery (referred to from here on as **ESI**) will be presented. Lastly, results relating to retrospective reports of MI (referred to hereon as **RMI**) will be presented. An explanation of what is meant by RMI will first be elucidated in order to provide sufficient clarity.

[*] The four missing frequencies belong to the participant who failed to report their gender. They chose the following MI periods: – mid-mornings, afternoons, evenings, and late night periods.

The primary division of MI reports into ESI and RMI is based on a distinction between SMIQs completed within a reasonable period[51] after having read the experience-sampling SMS-prompt. SMIQs completed within 30 minutes qualified as ESI reports, versus cases of MI where the relevant SMIQ was filled in more than half-an-hour after having first read the trigger SMS. The latter type has been termed Delayed Experience-Sampled Imagery (**DESI**), and were analysed separately along with other cases of RMI.

In addition to DESI, two other categories of RMI experiences have been noted: MI on Waking (**MIOW**)[52]; and Last Recalled Imagery (**LRI**). Reports of MIOW were based on questions included in the journals at the start of each day's set of SMIQs. Table 4.1.2.2. displays that the frequency data above for early morning MI seems to support this idea given that the self-reported early morning episodes of MI was the second most commonly occurring category with a frequency of 43 and a rank of 2. This suggested that it was a potential area related to the phenomenon that the SMIQ ought to attempt to capture.

LRI reports relate to reports of MI that were documented in Section D of the SMIQs as having occurred between journal entries. Since that the probability of "catching" an individual during the experience of MI using experience-sampling was unknown. Accordingly, the researcher aimed to collect as much subsidiary data on the experience of imagery between journal entries as well. However, participants were instructed to complete these two questions only if they were not experiencing any MI at that time. Within the abovementioned categories (ESI, DESI, MIOW and LRI) findings will be presented that relate to the constancy, content, nature and corporeal manifestations of MI.

4.2.2. Overview of the Stage Two Results

Tables 4.2.2.1. (Stage Two sample) and 4.2.2.2. (pilot sample) present the overall experienced-sampled findings in an idiographic manner. The two tables display the breakdown of the total cases of MI per participant over their total period of participation in addition to each individual's gender, musical history, and the number of SMIQs they completed in relation to their total MI experiences. The participant numbers (Stage Two

[51] As indicated in Chapter Three, the time frame was 30 minutes.
[52] This is not applicable to the pilot sample since the SMIQs were amended after piloting the journal. The Stage Two sample's journals included two additional questions to assess whether MI was present upon waking. If a participant responded in the affirmative, they were asked to provide additional information in relation to the content of such imagery.

sample) and participant letters (pilot sample) displayed in tables 4.2.2.1. and 4.2.2.2. were randomly assigned to each participant by the researcher. They do not, in any way, reflect the self-assigned codes each participant created.

Prior to presenting the two aforementioned Tables, it is important to clarify a few things regarding the Column Totals presented in the last rows of the respective Tables. Given that 336 SMIQs (16 participants by 21 questionnaires) were theoretically available for completion by Stage Two participants and their compliance rate was 92.86% (312 completed SMIQs of a possible 336). This is reasonably high rate and it is comparable with other DES studies (for example, Bailes' (2007) compliance rate was 90.26%). Twenty nine of the 312 SMIQs were completed more than half an hour after the SMS was read. Of these 29 entries, 11 (37.93%) included reports of MI and were classed as Delayed Experience-Sampled Imagery (DESI). The other 18 entries (62.07%) reflected an absence of MI at the time of completing the entry. Only 275 of the Stage Two SMIQs were completed within the thirty minute period. Thus, the timeous compliance rate was 81.85% which is approximately 11% lower than the overall compliance rate. Individual compliance rates ranged from 62 to 100 percent. There were eight residual entries (of the 312 SMIQs) that did not have all three time slots fully completed (time of SMS, time the participant filled-in the SMIQ and time the participant finished the SMIQ). Only one of these individuals reported MI at that particular juncture. This entry was included in the Experience-Sampled Imagery (ESI) analysis[53]. Theoretically, there were 112 (16 participants by seven days) opportunities for Stage Two participants to describe Musical Imagery Upon Waking (MIOW) and 91.96% of these questions were completed (103 out of 112). As previously noted, the pilot samples' overall compliance rate was 97.62% (41 SMIQs completed out of a possible 42). The rate dropped to 79.37% once participant H was included in the sample (50 completed journal entries out of 63 available SMIQs). These rates are reported with the purpose of clarifying some of the Overall Column Totals in the two Tables presented below.

[53] Two of the three time slots were completed in that SMIQ, with no time-difference between them, the researcher assumed that this fell within the realm of ESI. The participant was given the benefit of the doubt since it was decided that it was possible that this individual may have forgotten or accidentally overlooked the last time slot during the completion of the entry.

Table 4.2.2.1. Synopsis of MI frequencies for the Stage Two sample over a seven day period

PT	Gender	Musician	Number of Completed SMIQs^	Total ESI	Involuntary ESI	DESI	Involuntary DESI	LRI	Total SMIQs with MI	Completed MIOW questions	MIOW	Total MI including MIOW	Total Retrospective MI (RMI)
1	F	*YES*	21 (100%)	11 (52.38%)	10 (47.62 %)	1 (4.76%)	1 (100%)	6 (28.57 %)	18 (85.71 %)	7 (100%)	5 (71.43%)	**23**	*12*
2	M	NO	21 (100%)	3 (14.29%)	0 (0.00%)	0 (0.00%)	0	2 (9.52%)	5 (23.81%)	7 (100%)	2 (28.57%)	**7**	*4*
3	F	NO	21 (100%)	8 (38.10%)	5 (23.81%)	0 (0.00%)	0	7 (33.33%)	15 (71.43%)	7 (100%)	4 (57.14%)	**19**	*11*
4	F	*YES*	14 (66.67%)	4 (28.57%)	4 (28.57%)	0 (0.00%)	0	2 (14.29%)	6 (42.86%)	4 (57.14%)	1 (25.00%)	**7** *	*3*
5	F	NO	19 (90.48%)	3 (15.78%)	3 (15.79%)	1 (5.26%)	1 (100%)	3 (15.79%)	7 (36.84%)	6 (85.71%)	2 (33.33%)	**9**	*6*
6	F	NO	19 (90.48%)	2 (10.53%)	1 (5.26%)	0 (0.00%)	0	1 (5.26%)	3 (15.79%)	6 (85.71%)	0 (0.00%)	**3** •	*1*
7	M	*YES*	19 (90.48%)	6 (31.59%)	4 (21.05%)	0 (0.00%)	0	5 (26.32%)	11 (57.89%)	6 (85.71%)	1 (16.67%)	**12**	*6*

^ The percentages in this column indicate DES compliance. The same applies for the MIOW column. The row percentages reflect the relative percentage of each category in relation to the total number of completed SMIQs. The Column Total (percentages) below reflects percentages relative to the corresponding category totals of MI.

*Four journal entries were excluded from Participant Four's total MI experiences: these exclusions consisted of two ESI reports, one MIOW and one LRI report in terms of the totals reflected in table 3.2.2.1. These journal entries were viewed as problematic and the author was primarily unable to determine whether the descriptions provided by the participant were of music emanating from an external source or whether these descriptions were, in fact, of MI. Please refer to **Appendix N** for the full explanation relating to these specific exclusions.

• Similarly, one journal entry was excluded for Participant Six. The author was also unable to adjudicate whether this individual was describing music from an external source instead of MI. Please refer to **Appendix K** for a thorough justification concerning this particular SMIQ exclusion.

Table 4.2.2.1. continued													
PT	**Gender**	**Musician**	**Number of Completed SMIQs^**	**Total ESI**	**Involuntary ESI**	**DESI**	**Involuntary DESI**	**LRI**	**Total SMIQs with MI**	**Completed MIOW questions**	**MIOW**	**Total MI including MIOW**	**Total Retrospective MI (RMI)**
8	M	*YES*	21 (100%)	3 (14.29%)	3 (14.29%)	0 (0.00%)	0	5 (23.81%)	8 (52.38%)	7 (100%)	3 (42.86%)	**11**	*8*
9	M	NO	18 (85.71%)	4 (22.22%)	3 (16.67%)	3 (16.67%)	3 (100%)	7 (38.89%)	14 (77.78%)	6 (85.71%)	5 (83.33%)	**19**	*15*
10	F	*YES*	13 (61.90%)	7 (53.85%)	5 (38.46%)	1 (7.69%)	1 (100%)	1 (7.69%)	9 (69.23%)	5 (71.43%)	2 (40.00%)	**11**	*4*
11	F	NO	21 (100%)	13 (61.90%)	12 (57.14%)	0 (0.00%)	0	5 (23.81%)	18 (85.71%)	7 (100%)	2 (28.57%)	**20**	*7*
12	M	*YES*	21 (100%)	7 (33.33%)	7 (33.33%)	0 (0.00%)	0	10 (47.62%)	17 (80.95%)	7 (100%)	3 (42.86%)	**20**	*13*
13	F	NO	21 (100%)	6 (28.57%)	4 (19.05%)	3 (14.29%)	3 (100%)	2 (9.52%)	11 (52.38%)	7 (100%)	1 (14.29%)	**12**	*6*
14	M	*YES*	21 (100%)	10 (47.62%)	10 (47.62%)	0 (0.00%)	0	4 (19.05%)	14 (66.67%)	7 (100%)	5 (71.43%)	**19**	*9*
15	M	*YES*	21 (100%)	14 (66.67%)	14 (66.67%)	0 (0.00%)	0	3 (14.29%)	17 (80.95%)	7 (100%)	6 (85.71%)	**23**	*9*
16	F	NO	21 (100%)	4 (19.05%)	4 (19.05%)	2 (9.52%)	1 (50.00%)	3 (14.29%)	9 (42.86%)	7 (100%)	2 (28.57%)	**11**	*7*
Column Totals: (Percentages)[54]**			**312 of 336 (92.86%)**	**105 of 312 (33.65%)**	**89 of 105 (84.76%)**	**11 of 121 (9.09%)**	**10 of 11 (90.90%)**	**66 of 121 (54.54%)**	**182**	**103 of 112 (91.96%)**	**44 of 103 (42.72%)**	**226**	**121 of 226 (53.54%)**

[**54] The Column Total Percentages (in the last row of the above Table) reflects percentages relative to the corresponding category totals of MI.

Table 4.2.2.2. Synopsis of MI frequencies for the Pilot sample over a two day period

PT	Gender	Musician	Number of Completed SMIQs	Total ESI	Involuntary ESI	DESI	Involuntary DESI	LRI	Total SMIQs with MI	MIOW	Total Retrospective MI (RMI)
A	F	NO	6 (100%)	4 (66.67%)	4 (66.67%)	0 (0.00%)	0	2 (33.33%)	6 (100%)	N/A	*2*
B	M	*YES*	5 (83.33%)	1 (20.00%)	1 (20.00%)	0 (0.00%)	0	2 (40.00%)	3 (60.00%)	N/A	*2*
C	F	*YES*	6 (100%)	3 (50.00%)	3 (50.00%)	1 (16.67%)	1 (100%)	2 (33.33%)	6 (100%)	N/A	*3*
D	F	*YES*	6 (100%)	2 (33.33%)	2 (33.33%)	0 (0.00%)	0	4 (66.67%)	6 (100%)	N/A	*4*
E	M	*YES*	6 (100%)	4 (66.67%)	3 (50.00%)	1 (16.67%)	1 (100%)	1 (16.67%)	6 (100%)	N/A	*2*
F	F	NO	6 (100%)	3 (50.00%)	3 (50.00%)	0 (0.00%)	0	2 (33.33%)	5 (83.33%)	N/A	*2*
G	F	NO	6 (100%)	3 (50.00%)	3 (50.00%)	0 (0.00%)	0	3 (50.00%)	6 (100%)	N/A	*3*
H ^•	F	NO	9 (42.86%)	5 (55.56%)	3 (33.33%)	2 (22.22%)	2 (100%)	N/A*	9 (100%)	2	4
Column Totals:			**50 of 63 (79.37%)**	**25 of 50 (50.00%)**	**22 of 25 (88.00%)**	**4 of 22 (18.18%)**	**4 of 4 (100%)**	**16 of 22 (72.72%)**	**47 of 50 (94.00%)**	**2**	**22 of 47 (46.81%)**

^• Participant H was originally from the Stage Two sample. However, they only completed the first three days of their journal. Thus, it was decided that this participant should be included in the pilot group. This was owing to the fact that they had completed the first nine journal entries and did not complete any other SMIQs within the journal. Thus, their results appeared to be most suitably comparable with the pilot sample rather than the Stage Two group.

* Participant H also failed to complete Sections C and D of their SMIQs. It appears that they misunderstood the instructions within the journal.

4.2.3. Gender and Musical Training as Predictors of Musical Imagery

Given that both gender and musical training have been implicated as factors pertaining to MI, two binary logistic regressions were computed in an attempt to determine whether either variable plays a predictive role on the experience of MI. These statistics were performed on the 299 MI cases from the Stage Two experienced-sampled questionnaires using Stata Version 8.0 (College Station, Texas, USA). Thus, the 299 observations did not include pilot data. This figure consisted of the following experienced-sampled data: the 312 completed SMIQs, less the 11 DESI cases (in other words, n = 301). Subsequently the two ESI cases, that were excluded from all analyses (from *Participant Four's* journal – see **Appendix K**) were also removed from the experienced-sampled data. Accordingly, these two observations were deducted from the 301 completed experienced-sampled questionnaires to leave the remaining 299 reports from which the binomial logistic regression was computed. The outcome variable was the presence or absence of an MI episode. Thus, all experienced-sampled data was included regardless of whether MI was present or not. The independent variables (gender and musical training) were coded into binary variables. Given the findings in both Liikkanen (2008) and Bennett's (2002) studies (MI is more prevalent in females than males), gender was considered a predictor variable in this analysis especially since the Fisher-Freeman-Halton test (presented above) indicate that there was an association between gender and MI. Accordingly, females were coded as ones and males as zeros. Similarly, musicians were coded as ones and non-musicians as zeros considering the premise that musicians are more likely to experience MI episodes (Liikkanen, 2008; Brown, 2006) even though the Fisher-Freeman-Halton test concerning MI and musical training indicated that there was insufficient evidence at a 5% level of significance ($p = .8638$) to indicate a significant association between the two variables.

There were no missing values in the aforementioned computations. Binary logistic regressions reporting odds ratios were then run for each predictor paired with the outcome variable using 95% confidence intervals. Finally, a multivariate binary logistic regression was run for all the predictors (two additional predictors are reported in subsequent sections of this Chapter) in order to cross-check the adjusted odds ratios with the unadjusted odds ratios as well as to ascertain the total percentage of outcome variance explained by the predictors and to check for any interactions amongst the predictors (Meyers, Gamst & Guarino, 2006).

Multivariate binary analyses conduct separate models for the relationship between the outcome variable and the predictor variables as well as for the association between pairs of predictors (Meyers, Gamst & Guarino, 2006). Please refer to Table I in Appendix J for the complete results of the multivariate binary logistic regression analysis. The summarised results of this analysis demonstrate that Pseudo R^2 is 0.0571 once all four predictors are included. This suggests that 5.71% of the total variance in the occurrence of an MI episode can be explained by the predictor variables if they are simultaneously present. This means that MI would be more likely to occur if the individual is a female, musician who was by herself at the time of the MI well as there being an absence of any externally generated music. However, this Pseudo R^2 is a fairly low and it illustrates that a variety of other factors are likely to predict the occurrence of MI episodes.

The binomial logistic regression results pertaining to gender were not statistically significant ($\chi^2 = 0.19$; *d.f.* = 1; p = .660) which suggests that there is insufficient evidence to suggest that there is an association between gender and MI episodes at a 5% level of significance[55]. The corresponding odds ratio for gender (OR 1.113; CI .691 – 1.793) implies that females were 11% more likely to experience MI than males in this study. However, the Pseudo R^2 (0.0005) suggests that approximately 0.05% of the variance (Meyers, Gamst & Guarino, 2006) in MI episodes was explained by gender. This is an exceptionally small percentage of the total variance and it indicates that the predictor variable (gender) does not explain a large percent of the gender differences in MI episodes.

In relation to the musical training predictor variable, there was a significant association between the outcome variable and musical training ($\chi^2 = 6.35$; *d.f.* = 1; p = .012) at a 5% level of significance. The odds ratio can be interpreted to suggest that in this research, musicians had an 85% higher probability of experiencing MI than non-musicians (OR 1.848; CI 1.143 – 2.992). In addition to this, the Pseudo R^2 suggests that 1.64% of the variance in the outcome variable (Meyers, Gamst & Guarino, 2006) can be explained by whether or not the individual has had musical training. However, a significant caveat relating to this finding is that, in this study, the distinction between musicians and non-musicians was not particularly stringent and if stricter criteria were to be applied, these results may not have been as significant.

[55] Theoretically, the odds ratios should not have been calculated since there was no association between the two variables (gender and MI). However, literature indicates that it is an important factor in MI experiences and for this reason, it was included in the analysis.

However, the unadjusted musical training odds ratio increased once gender was added to the multivariate binomial logistic regression. Similarly, the odds ratio pertaining to gender also increased during the analysis of MI in relation to gender and musical training. The large increase in both these odds ratios (see Table II in Appendix J for the adjusted ratios) suggests that there is an interaction between the two predictor variables on the outcome variable (MI). Thus, there is an increased likelihood of an episode of MI occurring if the individual is a female with musical training. In this model (where only gender and musical training were added as predictors), the Pseudo R^2 (0.0252) suggests that 2.52% of the variance in MI can be explained by these two factors. These results indicate other predictor variables may be more relevant to the experience of MI. Accordingly, some contextual data is presented to examine whether these had any potential connection with everyday experiences of MI.

4.3. CONTEXTUAL DATA

Given that this research utilised triangulated methods, contextual data shall be presented in order to provide a backdrop to the overall findings. Contextual data refers to the following: (i) whether or not the imager was alone or in the presence of others – Bailes (2007); (ii) the type of activity engaged in whilst experiencing imagery – Brown (2006) and Bailes (2007); and (iii) the presence or absence of external music (Brown, 2006) along with the source of it. The contextual data will be presented in terms of both ESI periods in addition to the absence of MI.

4.3.1. Presence of Others as a Predictor of Musical Imagery

Just under half the time (48.57%), participants were in the presence of other people rather than being alone when MI occurred (please see Table I in **Appendix L**). Again, there were vast individual differences across the sample since the range was 0 to 100 percent. Nine participants (56.25%) were in the presence of others for at least half of their ESI episodes. Five participants (31.25%) were in the presence of others between 25 and 43 percent of their ESI cases and two (12.5%) were alone during their ESI periods.

The total percentage difference between MI periods and non-MI periods, where the presence of others was reported (for the Stage Two sample), is 8.13% in favour of periods where no MI was reported. This may suggest that individuals were slightly more inclined to experience MI during periods where other individuals were absent. These percentages are not truly

comparable owing to the different denominator values (see **Appendix L**). However, there is some variation between individuals in terms of this pattern. For instance, *Participant 14* was alone during completion of every SMIQ. No individual was present during their ESI periods as well as during periods of no MI. *Participant 1* displayed an inverse pattern. They were in the presence of others for twenty of their twenty one journal entries. Such large individual variations make it difficult to decide whether the presence or absence of other people is a predictive factor.

Thus, in order to adjudicate between the hypotheses regarding the presence of others, a binary logistic regression was performed on the 299 experienced-sampled cases using Stata Version 8.0 (College Station, Texas, USA). The outcome variable was the presence or absence of an MI episode during the Stage Two study. The independent variable was coded into binary variables. Thus, presence of others was coded as one, whilst the absence of others were coded as zero. The results were non-significant ($\chi^2 = 1.81$; *d.f.* = 1; p = .179) which suggests that there is insufficient evidence to determine whether there is a significant association between the two variables[56]. However, the odds ratios[57] (OR .721; CI .448 – 1.162) suggests that in this study, there was a 27.88% chance that MI would be experienced in the absence of others rather than in their presence. However, only 0.47% of the variance (Pseudo $R^2 = 0.0047$) in the outcome variable (the experience of an MI episode) is explained by this particular predictor variable. These findings appear to corroborate the descriptive statistics concerning the presence of others.

It is important to clarify that it cannot be determined whether participants were alone or in the presence of others at the precise moment the MI moved into their conscious awareness since the SMIQs did not ask participants to reflect on this. All that can be ascertained from the completed journal entries is the reported presence or absence of others at the time the entry was completed. Table II (refer to **Appendix L**) reflects the results for the pilot sample.

The table reflects that the pilot sample were in the presence of others more than half (55%) of the time during a MI episode. It is also evident that there were large variations between

[56] Theoretically, the Odds Ratios should not have been calculated since there was no association between the two variables. However, literature indicates that it is an important factor in MI experiences and for this reason, it was included in the analysis.

[57] Given that the Odds Ratio was below 1, this indicates that the likelihood was in favour of the outcome variable coded with a zero (Meyers, Gamst & Guarino, 2006); in this case, the absence of others.

individuals since the results ranged from 0 to 100 percent. The percentage differences for the total pilot sample between periods where MI was present or not is 5%. Thus, the presence of others tends to be more common in periods of no MI. However, these percentages are not directly comparable owing to the differing denominator values. Given the small number of observations for the pilot, a binary logistic regression was not performed for this data.

4.3.2. Kinds of Activities Engaged in During ESI Periods

Another contextual aspect related to MI concerns the activity engaged in at the time of the experience-sampling signal. These activities reflect the participants' main activity at the time of reading the trigger SMS, rather than anything about activities at the onset of any instance of MI. The activities are listed in Table III (see **Appendix L**) along with the frequencies of their occurrence for episodes of ESI and episodes of no MI.

The three most common activities listed during an ESI episode were studying, driving, and eating. The top three activities participants were engaged with during non-MI periods included watching television or a movie, studying and socialising or interacting with others. Thus, the only common activity between the two scenarios is 'studying'. The least common activities that were engaged in during an ESI episode included shopping, cleaning (one's house) and leisure activities (excluding watching television or movies). It is noteworthy that none of the participants listed listening to music as the primary activity engaged in during an ESI episode even if they reported hearing music from an external source. However, since the SMIQ specifically enquired as to whether external music was simultaneously present, participants may have felt that it was redundant to mention it.

4.3.3. Presence of an External Source of Music as a Predictor of Musical Imagery

Documenting the presence of external music was originally envisaged as a control mechanism. However, it also provides some contextual information surrounding the experiences of MI. Table IV (see **Appendix L**) displays the frequencies of the presence of external music for the Stage Two sample both in the presence and absence of MI whilst Table V displays the pilot data (refer to **Appendix L**).

Table IV suggests that the presence of external music has a relatively low incidence across the sample (20.95%). Of these 22 instances, results will be displayed showing the type of external music and where it originated from.

Table 4.3.3.1. Type of external music for Stage Two sample

Kind of External music	Frequency	Number of observed values	Percent
Same as the MI	6	22	27.27%
Different to the MI	16	22	72.73%

Table 4.3.3.2. Source of external music (Stage Two)

Source of external music	Frequency	Number of observed values	Percent
Radio	6	22	27.27%
Computer	4	22	18.18%
Television	6	22	27.27%
Portable music device or Hi-fi system	4	22	18.18%
Another individual	1	22	4.55%
Unknown location	1	22	4.55%

The most common activities engaged in during MI episodes where external music was present include: eating (frequency of 4); watching television or a movie (frequency of 3); a leisure-based activity (frequency of 3); interacting with others, self-maintenance activities and computer-based activities each had frequency of two. The remaining six activities all had a frequency of one. Thus, it appears that there was no noteworthy trend in these findings.

The presence of external music during non-MI periods is also relatively low. However, overall, it appears to have a higher incidence than the ESI periods (35.05% as compared to 20.95%). However, these denominators are different and it is not entirely clear whether they are, in fact, statistically different.

In order to adjudicate between the relevance of the absence (or presence) of external music during an MI episode, a binary logistic regression analysis was calculated (as previously described) which reported odds ratios. The predictor variable (external music) was coded in the following manner: absence of external music was assigned a zero whilst the presence of it

was assigned a one. To iterate, there were no missing values and this analysis utilised the 299 observations relating to the experienced-sampled data. The results of this variable were statistically significant ($\chi^2 = 6.67$; *d.f.* = 1; p = .012) which suggests that there is an association between the outcome variable (experience of an MI episode) and the predictor variable (external music) at a 5% level of significance. Pseudo R^2 was 0.0172 which suggests that 1.72% of the variance in the outcome variable can be explained by external music (Meyers, Gamst & Guarino, 2006). Furthermore, the odds ratio (OR .491; CI .282 - .855) implies that individuals (in this study) were 51% more likely to experience MI in the absence of external music rather than in its presence.

Given that the only two significant predictors in the binary logistic regressions were musical training and external music, a combined model was computed. Please refer to Table III in **Appendix J** for the complete results. The analysis suggested that Pseudo R^2 increased to 3.83% if these two predictors were to occur simultaneously. Thus, it suggests that in this study, MI was more likely to be prevalent during periods where no external music was present as well as if the individual had prior musical training.

Below are the tables pertaining to the nine cases of external music within the pilot sample in terms of the type of external music and where it originated from. Notably, there were too few cases to utilise in a binomial logistic regression.

Table 4.3.3.3. Type of external music for the pilot sample

Kind of External music	Frequency	Number of observed values	Percent
Same as the MI	1	9	11.11%
Different to the MI	8	9	88.89%

Table 4.3.3.4. Source of external music (pilot)

Source of external music	Frequency	Number of observed values	Percent
Radio	3	9	33.33%
Computer	2	9	22.22%
Television	1	9	11.11%
Portable music device or Hi-fi system	1	9	11.11%
Another individual	1	9	11.11%
Unknown location	1	9	11.11%

In terms of the pilot data, the top two activities engaged in during MI episodes whilst external music was present involved cooking and driving (both with a frequency of 2). The remaining five observations involved a variety of activities (eating, relaxing, non-university work and so forth) each with a frequency of one. No apparent pattern appears to be evident when the activities are read in conjunction with the Stage Two results.

Similar to the Stage Two group, the pilot also displays higher incidences of external music during no MI periods (60% versus 45% during ESI episodes). Although this may suggest that external music is more likely to be heard during non-MI periods, the same caveat is reiterated: the denominators are dissimilar and may have created a false sense of increased prevalence.

4.4. CONSTANCY OF MUSICAL IMAGERY

4.4.1. Stage Two Results

The constancy of MI, for the purposes of this research, relates to the frequency of MI experiences over the sampling period. Thus, in essence, the constancy refers the relative incidence of the phenomenon for each individual. It does not specifically relate to the constancy of the characteristics of MI over different intervals. Rather, it refers to whether or not MI was absent or present at particular points in time. The rates of MI experiences for each of the Stage Two participants have been reported in Table 4.2.2.1. These rates are reflected as percentages and are shown in brackets below each frequency. They were calculated, per individual, as proportions of the number of individually completed SMIQs.

As per the analysis that was conducted, it is apparent that the following trends for the Stage Two sample emerged (refer to Table 4.2.2.1. for the tabulated results). Firstly, the total within group frequency of MI ranged from 3 to 23 incidences of reported MI over seven days and there were 226 reports of MI in total. Secondly, 105 of these cases (46.46%) were cases of ESI. The within sample range of ESI was 2 to 14 incidences of reported MI. Of the 105 cases, 89 (84.76%) were classified as involuntary in nature.

There were 121 cases of RMI. Thus, 53.54% of the total MI reports were considered to be *ex post facto* reports of imagery experiences. More than half (54.55%) of these retrospective

reports fell within the realm of LRI – retrospective reconstructions of MI between journal entries. 36.36% were instances of MIOW and 9.09% were DESI cases.

Across each category of MI, the individuals with the highest incidences were as follows. In relation to Total ESI, *Participant 15* (male, musician) had 14 cases in total and all of their cases were involuntary in nature. In terms of Total RMI, *Participant 9* (male, non-musician) documented 15 incidences. *Participant 15* also had the most cases of MIOW – they reported MIOW six of the seven mornings of sampling (85.71%). *Participant 12* (male, musician) reported 10 cases of LRI. The two individuals with the most reported experiences of MI within a seven day period were *Participants 1* and *15*. Both documented 23 incidences that were captured by the use of the SMIJs. Both participants are musicians (professional singer and a drummer respectively) but they are not of the same gender (female and male respectively).

The lowest incidences of MI across each category will also be reported. Firstly, *Participant 6* (female, non-musician) had 2 cases of ESI, of which only one was involuntary. *Participant 6* also had the lowest Total RMI – one case of LRI within the seven day period. They had no cases of MIOW (although Day One, journal entry number One was not completed). However, despite having been the lowest scorer across all the categories, their MI reporting was consistent with their self-rated frequency of MI (based on their response in their demographics questionnaire) – '2 to 3 times per week'.

The constancy of Stage Two participant's self-reported MI, as captured in the demographic questionnaire, is presented in Table 4.4.1.1. below.

Table 4.4.1.1. Self-reported MI of Stage Two sample

Participants' Ratings of MI	Frequency (Percent)	Participants
2 to 3 times a week	4 (25.00%)	***2, 6, 8, 14***
4 to 5 times a week	3 (18.75%)	***4, 5, 16***
A few (1 to 3) times everyday	7 (43.75%)	***3, 7, 10, 11, 12, 13, 15***
Many (4 or more) times everyday	2 (12.50%)	***9, 1***
Column Totals	**16**	

In general, the Stage Two results suggest that the experience of MI was fairly regular over the twenty-one sampling periods. However, there are moderate variations between individuals. It is also apparent that MIOW was also a relatively consistent phenomenon within the sample. Similarly, there are within group variations for MIOW.

Figure 2 below exemplifies the variations in everyday constancy of MI episodes across the Stage Two participants. Each participant's total documented reports of MI have been averaged across the seven day sampling period. This figure is also helpful in determining whether participants' self-ratings of MI frequency was reasonably accurate

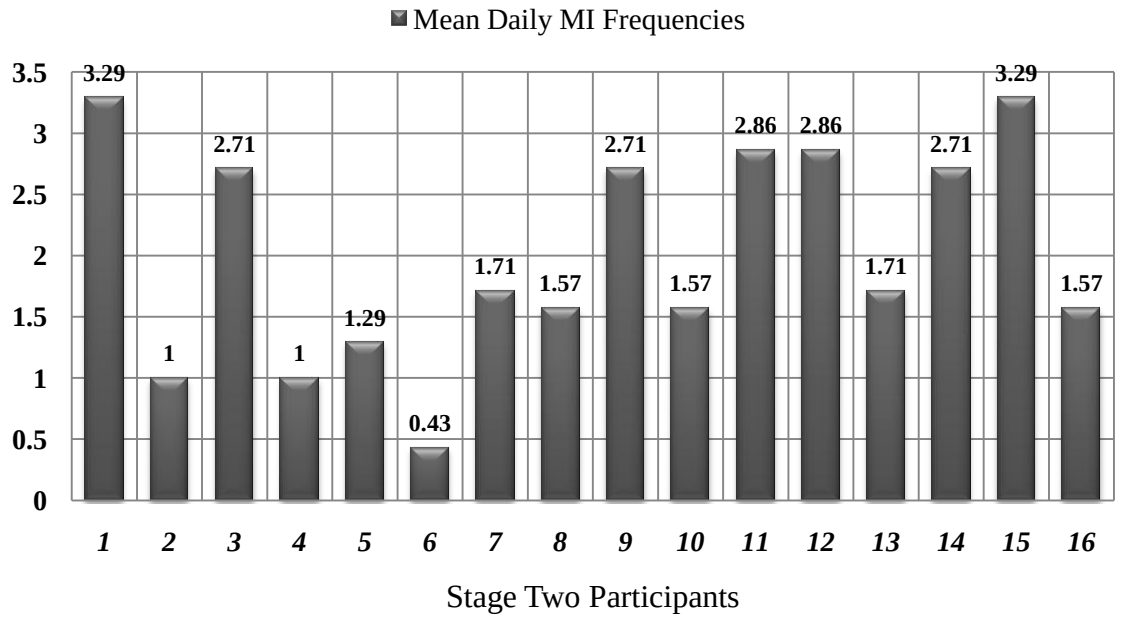

Figure 2. Average Individual Daily MI Frequencies across Stage Two Participants

4.4.2. Pilot Results

In terms of the analysis conducted relating to the pilot sample, the following patterns emerged (refer to Table 4.2.2.2.). The total within group frequency of MI ranged from three to six incidences of MI over the period of two days. Over a three day period (*Participant H*) recorded a total of nine MI experiences. Across the two days, there were a total of 47 incidences of MI. More than half of these instances (25 out of 47 – 53.19%) fell within the realm of ESI. The within sample range of ESI was one to five incidences of MI over two days. Of these 25 cases, (88%) were classified as involuntary in nature.

There were 23 cases of retrospective reports of MI. Thus, almost half (47.92%) of the total MI reports were RMI cases. More than two thirds (72.72%) of the RMI reports fell within the realm of LRI – *ex post facto* MI experiences between journal entries and 18.18% were DESI reports. Only *Participant H* had questions pertaining to MIOW and this phenomenon was recorded to have occurred two of the three mornings (66.67%) of their participation.

In relation to each category of MI, the individuals with the highest incidences across the two days were as follows. *Participants A* (female, non-musician) and *Participant E* (male, musician) both reported four involuntary cases of ESI. *Participant D* (female, musician) had four instances of LRI which was the highest incidence of total RMI. There were six participants with Total MI Experiences of at least six incidences or more (nine in the case of *Participant H*). Thus, 100% of the pilot sample reported at least one episode of MI on one of the two days. Overall, there is a relatively consistent incidence of MI over the sampling period regardless of whether any musical training has been undertaken. However, these percentages include both Experienced Sampled Imagery (ESI) and Retrospective MI (RMI).

4.5. CONTENT OF MUSICAL IMAGERY

The content of MI refers to its predominant features such as whether it is predominantly instrumental and/or vocal, and its overall similarity to the original musical composition. Specifically, the following aspects of MI content were coded for:

(a) Instrumental or vocal MI – Brown (2006) and Bailes (2007)
(b) Full songs, part songs or repeated loops – Brown (2006) and Bailes (2007)
(c) Voluntary or involuntary MI – Brown (2006) and Bailes (2007)
(d) The kinds of involuntary MI that were reported (such as spontaneous MI and sticky MI)
(e) Whether the MI had been recently heard from an external source – Brown (2006)
(f) The genres of music evident in the episodes of MI (Bailes, 2007).

Characteristics labelled (a) to (f) will be presented for both sample groups. These results will relate to ESI incidents since only a small number of RMI cases had sufficient information relating to the content of it (except with respect to the genre of the MI).

4.5.1. Content Results

Table 4.5.1.1. Content of the ESI for the Stage Two sample

Content of MI		Frequency	Total number of observations	Percent
(a)	**Vocal**	58	105	**55.24%**
	Combination of vocal & instrumental music	32	105	30.48%
	Instrumental	15	105	14.29%
(b)	**Repeated loop of a musical fragment**	59	105	**56.19%**
	Full song	19	105	18.10%
	Part of a song	26	105	24.76%
	Not specified	1	105	0.95%
(c)	**Involuntary imagery**	89	105	**84.76%**
	Voluntary imagery	15	105	14.29%
	Not specified	1	105	0.95%

Table 4.5.1.2. Content of the ESI for the pilot sample

Content of MI		Frequency	Total number of observations	Percent
(a)	**Vocal**	15	25	**60%**
	Combination of vocal & Instrumental music	5	25	20%
	Instrumental	5	25	20%
(b)	**Repeated loop of a musical fragment**	16	25	**64%**
	Full song	5	25	20%
	Part of a song	4	25	16%
(c)	**Involuntary imagery**	22	25	**88%**
	Voluntary imagery	3	25	12%

Thus, the common trends within both samples were that the MI tended to be comprised of a repeated loop of a musical fragment that predominantly consisted of vocal content and tended to occur involuntarily.

Tables 4.5.1.3. and 4.5.1.4. present a cross-tabulation of (c) the type of MI experienced in addition to (d) the kind of involuntary MI, as well as (e) the relative recency of exposure to the MI song from an external source. The category titled ‘Not specified’ concerned MI episodes that were either unfamiliar to the participant or where participants were unable to recall the last exposure to the song as typified by statements such as “I don’t know” or “I can’t remember”.

The types of involuntary MI were also coded according to descriptions provided by the participants. The descriptions were in response to a question in Section A which asked "Did the music just 'pop into your head', or would you say you thought about or chose the music? Please explain". Themes related to this question were inductively derived and a few pertinent and descriptive quotes will be presented below for each category.

(a) The MI 'popped' into conscious awareness:

> *"Pop in. There were no cues to remind me of the song yet it is suddenly going in my head."*
>
> Participant 3

> "*This song just popped into my head. I have no idea of the train of thought that lead me to singing this song in my head."*
>
> Participant 11

> *"Just popped in my head. Don't even know the song. No I couldn't have chosen it and its* [sic] *not the kind of music I listen to."*
>
> Participant 16

(b) Recent exposure to an externally heard source of music caused the participant to continue to generate the MI *ex post facto* despite no apparent wish to do so:

> *"Got stuck in my head after playing the game."*
>
> Participant E

> *"After I heard this song in my car, I just kept hearing it in my head."*
>
> Participant 5

> *"I didn't choose the music – I heard it on the radio about 15 minutes ago, and it just got 'stuck' in my head."*
>
> Participant 12

(c) A particular word or textual cue triggered a distinct case of MI:

> *"Just popped into my head while reading a text relating to one of my subjects."* Participant C

"*The song popped into my head as a result of a friend's status update on facebook, which used a single line from the song."*

Participant D

"Was reading something, read the words 'push it' in a sentence. That Salt 'n Pepper song popped into my head and lasted for a while. Kept popping back in even hours later."

Participant 14

(d) A specific thought catalysed an associative reaction in the form of MI:

"Popped into my head because of an association with someone that makes my blood boil."

Participant 7

"*I'd say I thought about it first, and then it started playing."*

Participant 12

"Well...[sic] *I was thinking about this stupid person. The word 'stupid' must have* [set] *it off...*[sic] *and then it just popped in and stuck."*

Participant 14

The voluntary cases of MI were described as chosen to be internally generated by the participants typically because the song was viewed as enjoyable or for purposes of rehearsal. In a few instances no particular reason was provided. A few illustrative quotes are presented below in order to demonstrate these themes.

"I chose to keep the song in my head by singing it all the time."

Participant H

"Well, I have been practicing this particular part of the song because its [sic] *quiet* [sic] *difficult."*

Participant 1

"A few minutes before I had to sing a song. I was rehearsing it in my head."

Participant 4

"I am playing the music, I chose it."

Participant 2

"I chose it, because I like it"

Participant 10

Table 4.5.1.3. Recency of exposure to the MI song from an external source grouped by type of MI for the Stage Two sample

Type of MI	Kind of Involuntary MI	Frequency (Percent)	Last Recalled Exposure	Frequency	Percent
Voluntary	Not applicable	**16 (15.24 %)**	**Same day**	**11**	**68.75%**
			Previous day	1	(6.25%)
			Within the last week	2	(12.50%)
			Within the last month	1	(6.25%)
			Not recently heard	1	(6.25%)
			Not specified	*0*	*(0.00%)*
Involuntary	(a) 'Popped' into awareness	**41 (39.04%)**	**Same day**	**12**	**29.27%**
			Previous day	8	(19.51%)
			Within the last week	7	(17.07%)
			Within the last month	*0*	*(0.00%)*
			Not recently heard	10	(24.39%)
			Not specified	1	(2.44%)
			N/A – the MI was an original tune	3	(7.32%)
Involuntary	(b) Got 'stuck' in memory after recent exposure	**37 (35.24%)**	**Same day**	**34**	**91.89%**
			Previous day	0	(0.00%)
			Within the last week	1	(2.70%)
			Within the last month	*0*	*(0.00%)*
			Not recently heard	*0*	*(0.00%)*
			Not specified	*0*	*(0.00%)*
			N/A – the MI was an original tune	2	(5.40%)
Involuntary	(c) A particular word triggered the MI	**3 (2.86%)**	Same day	*0*	*(0.00%)*
			Previous day	*0*	*(0.00%)*
			Within the last week	*0*	*(0.00%)*
			Within the last month	*0*	*(0.00%)*
			Not recently heard	**3**	**(100%)**
			Not specified	*0*	*(0.00%)*
Involuntary	(d) A specific thought triggered the MI	**8 (7.62%)**	Same day	*0*	*(0.00%)*
			Previous day	2	(25.00%)
			Within the last week	**5**	**62.5%**
			Within the last month	*0*	*(0.00%)*
			Not recently heard	*0*	*(0.00%)*
			Not specified	1	(12.5%)
COLUMN TOTAL:		**105**			

Table 4.5.1.4. Recency of exposure to the MI song from an external source grouped by type of MI for the pilot sample

Type of MI	Kind of Involuntary MI	Frequency (Percent)	Last Recalled Exposure	Frequency	Percent
Involuntary	(a) 'Popped' into awareness	**11** **42.31%**	**Same day**	**3**	**27.27%**
			Previous day	2	(18.18%)
			Within the last week	2	(18.18%)
			Within the last month	1	(9.10%)
			Not recently heard	2	(18.18%)
			Not specified	1	(9.10%)
Involuntary	(b) A particular word triggered the MI	**2** **7.69%**	Same day	0	(0.00%)
			Within the last week	1	(50.00%)
			Not recently heard	1	(50.00%)
Involuntary	(c) MI on waking from day-time sleep	**2** **7.69%**	Same day	1	(50.00%)
			Within the last week	1	(50.00%)
Involuntary	(d) A specific thought triggered the MI	**3** **11.54%**	Same day	*0*	*(0.00%)*
			Within the last week	1	(33.33)%
			Within the last month	1	(33.33%)
			Not recently heard	1	(33.33%)
			Not specified	*0*	*(0.00%)*
COLUMN TOTAL:		**26** [58]			

It is clear from Tables 4.5.1.3. and 4.5.1.4. that the most frequently occurring kinds of involuntary MI in both samples were apparently spontaneous[59] MI ('popped into awareness') and imagery resulting from recent exposure. Some participants suggested that a specific song "got stuck in their head after hearing it" or that they had heard the music recently and it "popped in" at a later stage, typically on the same day of exposure.

4.5.2. Genres of Musical Imagery

The genres of the MI varied quite widely across both groups. Genres of the MI specifically mentioned by participants in their SMIJs include the following categories: Pop (Popular Music), Indian Pop Music, Indian Music, Hip Hop, Trip Hop, Blues, Jazz, Rhythm and Blues (R 'n B), Acid Jazz, Trance, Dance, Soft Rock, Rock, Indie-rock, Screamo, Metal, Gospel,

[58] This value includes both involuntary ESI cases (n =22) as well as DESI cases (n = 4).
[59] Reporting that MI was spontaneous cannot be straightforwardly equated with actual spontaneity. This is especially so since the experience sampling did not necessarily catch the moment of MI starting, so reports of where the MI came from have to considered with due caution, owing to the fact that these are self-attributions.

Classical, Instrumental, and finally television theme-songs. These genres were either listed in response to one of the following two questions: (i) "If **Yes**, please describe in as much detail as possible what you are hearing. You may include the song name if you know it" or (ii) "If **No**, how would you describe it – style and genre it sounds similar to?" With respect to television series theme-songs and movies, the known and familiar titles listed by participants from both groups are elucidated in Table 4.5.2.1.

Table 4.5.2.1. MI involving Television and Movie Theme songs

Title	Type of MI	Last Recalled Exposure	Volume	Musician	Participant's Gender
The United States of Tara	Involuntary MI – A specific thought triggered it	Within the last week	Soft	YES	Female
Flight of the Conchords	Involuntary MI – A specific thought triggered it	Not specified	Soft	YES	Female
Will and Grace	Involuntary MI – Got 'stuck' in memory after recent exposure	Same day	Soft	NO	Female
Spiderman (Zulu version)	Involuntary MI – A particular word triggered it	Not recently heard (2004)	Soft	YES	Male
Seinfeld	MIOW	Not specified	Not specified	NO	Male
Gummi Bears	MIOW	Not specified	Not specified	YES	Male
The Simpson's "Itchy and Scratchy Show"	LRI	Not specified	Not specified	YES	Male
Frosty the Snowman	MIOW	Not recently heard	Soft	YES	Male
Coupling	MIOW	Previous day	Soft	YES	Male
"School of Rock" soundtrack	LRI	Same day	Not specified	NO	Female
"Mouse Hunt" – orchestral composition	Involuntary MI – Got 'stuck' in memory after recent exposure	Same day	Soft	YES	Male
'Hercules" soundtrack	Involuntary MI – Got 'stuck' in memory after recent exposure	Same day	Moderate	YES	Male

Other similar music listed by participants included music for a beer advert on television, the television / computer game theme-song for 'Mario Brothers' (familiar and heard the same

day) and a television advert for Vodacom South Africa (a few participants listed the advert and the recency of when it was last heard which ranged from: 'the same day' to 'not recently heard'). In a few other instances participants recognised music from television but failed to list any identifiable features – it was merely described as "music from T.V." in these cases.

Some of the more unusual cases of MI included the following categories: The British National Anthem (familiar but not specified when last heard), an Afrikaans folk song (familiar but not recently heard), a medley of songs (heard within the last month), Brazilian soap opera music (heard the same week), a cellular phone ring-tone (heard the same day) and lastly, original music composed by the imager.

Original Musical Imagery

Of the MI that was listed as original in nature, a few interesting cases emerged. Firstly, in the pilot group, one participant described a repeated loop of a tune stuck in their head upon waking (MIOW). The song was about a girl called Lorraine. It was not familiar to the participant (female, non-musician) and they stated that they do not know of anyone called Lorraine. Since this entry was filled in terms of Section D and related to LRI, no additional information was provided.

The second case of original MI was a participant (male, non-musician) from Stage Two who reported making a rhyme in their head using the words "everybody bores me" (which fell within the LRI category). The same participant also reported the third case – an original instrumental rhythm – this was part of their MI on a separate day. This instrumental piece was described as "*alternative instrumental*" which was reported to have a soft volume and popped into their head spontaneously. The imager was alone at the time of completing the SMIQ.

The fourth and fifth cases of original MI involved two separate instances by the same individual (male, musician). Their original imagery consisted of a set of words being sung repeatedly in their head. The first tune included the words "*come and get into my wooden boat*" and on a separate day, "*You know you drive, welcome to the machine*". The same individual also reported the sixth case of original MI. They described an instrumental melody (involving a penny whistle and drums) whereby the tempo increased over time.

Lastly, the seventh incident of original MI was a full composition created by the participant's band. This participant (male, musician) described this MI as voluntary and suggested that the song had personal significance to him and that is why he chose to conjure the MI.

Recurrent Musical Imagery Trends

The musical artists recurring across both groups of participants included Beyoncè (especially the song "All the single ladies" [November 2008] which, at the time of the research, was being used for a Vodacom television advertisement in South Africa), a song titled "Bulletproof" by La Roux (most participants only quoted the song title not the artist), David Guetta (various titles), Nickelback (also referred to as the Supersport jingle), Tool (this band was only quoted by two participants from the Stage Two sample but the song titles were different), Soulja Boy – "Kiss me Through the Phone" (featuring Sammie), Muse, Kings of Leon, Devil Driver, and lastly Beethoven. The recurring trends of MI across participants might possibly indicate that the properties of the songs are inherently 'sticky', or it may imply that aspects of auditory processing could be contributing to these trends. The notion of 'sticky tunes' has been discussed in Chapter 2 of this report.

Three participants reported experiencing recurring imagery of the same band or artist over the sampling period. Table I (please refer to **Appendix M**). displays the recurrent MI for the three individuals as well as providing some additional data pertaining to the MI itself (where specified). Table I suggests that there is some consistency and/or persistence of certain MI over time.

Residual Commentary Related to Musical Imagery Genres

In approximately one third of the ESI cases (42 out of 130 – 32.31%), participants were unable to provide a song title or artist name and often merely expressed the genre of it or described a few aspects of the content of the MI. The results suggest that there are some cases where MI intersects across groups of people but each individual tended to have imagery more specific to their tastes and exposures since occasionally, participants remarked that some songs were certainly not within their musical taste. For example, one individual stated the following in response to a Celine Dion song:

> "*Woke up with it on the brain – I DEFINITELY did NOT chose* [sic] *it."*
>
> Participant 15

The subsequent quote made by a different participant iterates similar sentiments:

> *"I can't remember exactly what song it was, but I remember it was a song I heard on the radio prior to noticing it* [the MI]. *Damn pop songs!"*
>
> Participant 12

The aforementioned quote implies, in part, that the 'stickiness' of the tune might also play a role in this MI experience. Unfortunately, the demographics questionnaire did not investigate individual musical preferences and resultantly little can be discussed on the topic of musical taste in association with MI.

4.6. NATURE OF MUSICAL IMAGERY

4.6.1. Introduction

The nature of MI refers to various aspects of its conscious form. This dimension was deductively derived from Brown's (2006) study. The results listed below are grouped according to sub-characteristics both Brown (2006) and Bailes (2007) elucidated in their respective studies. The qualities relating to the nature of MI (as captured by the SMIJs) include the following:

(a) Whether a personal association existed with the imagery (Bailes, 2007)
(b) Familiarity with the MI (Brown, 2006)
(c) The reported internal volume of the imagery (Bailes, 2007; Brown, 2006)
(d) The clarity of the melody, lyrics and rhythm of the imagery (Bailes, 2007; Brown, 2006)
(e) The simultaneous presence of visual imagery (Bailes, 2007; Brown, 2006)
(f) The level of distraction it was causing – Brown (2006)

Each characteristic will be reported separately for both sample groups. Since no additional data was collected in relation to the nature of RMI experiences, the reported results will only be applicable to ESI experiences and DESI experiences.

4.6.2. (a) Awareness of a Personal Association

The first sub-theme relates to whether participants believed they had any personal association with the MI they were hearing. The Stage Two sample's results are reflected in Table I and the pilot results are displayed in Table II (see both Tables in **Appendix N**).

In terms of Table I, ten participants (62.5%) reported a personal association with one or more (up to six) of their MI. However, overall, the total incidence of personal associations was relatively low (22.41% for both ESI and DESI cases). For 77.59% (90 out of 116) of the cases, participants reported having no awareness of a personal association with their MI.

Table II suggests that half the pilot sample (50%) reported having at least one instance of a personal association with their MI. However, only 24.14% (7 out of 29) of the total cases were reported to involve a personal association with the MI. Thus, 75.86% (22 out of 29) of the cases had no personal association of which the individuals in the sample were aware.

4.6.3. (b) Familiarity with the Musical Imagery

Familiarity with the MI related was rated by the participants based on a closed-ended question within each journal entry. Below (see Tables 4.6.3.1. and 4.6.3.2. respectively) are the results relating to both ESI and DESI experiences for each sample.

Table 4.6.3.1. Familiarity of the MI for the Stage Two sample

Familiarity of MI		Frequency	Total number of observations	Percent
	MI is familiar	109	116	93.97%
	MI is unfamiliar	7	116	6.03%

Table 4.6.3.2. Familiarity of the MI for the pilot sample

Familiarity of MI		Frequency	Total number of observations	Percent
	MI is familiar	28	29	96.55%
	MI is unfamiliar	1	29	3.45%

The majority of MI incidences (93.97%) were familiar to the Stage Two sample. Similarly, the pilot sample group were also familiar with their MI (96.55%). Familiarity with MIOW was also coded for in Stage Two, based on the descriptions participants provided. Table 4.6.3.3. summarises these results, which are comparable to the preceding results. The table below shows that in 88.64% (39 out of 44) cases of MIOW were familiar to Stage Two participants.

Table 4.6.3.3. Familiarity of the MIOW for the Stage Two sample

Familiarity of MIOW	Frequency	Total number of observations	Percent
MI is familiar	39	44	88.64%
MI is unfamiliar	1	44	2.27%
Familiarity of MI was unspecified	4	44	9.09%

Table 4.6.3.4. Familiarity of the LRI for the Stage Two sample

Familiarity of LRI	Frequency	Total number of observations	Percent
MI is familiar	49	66	74.24%
MI is unfamiliar	3	66	4.55%
Familiarity of MI was unspecified	14	66	21.21%

Table 4.6.3.5. Familiarity of the LRI for the Pilot sample

Familiarity of LRI	Frequency	Total number of observations	Percent
MI is familiar	12	16	75%
MI is unfamiliar	1	16	6.25%
Familiarity of MI was unspecified	3	16	18.75%

As evident in Tables 4.6.3.4. and 4.6.3.5, LRI also tended to be familiar or known to participants within both sample groups.

4.6.4. (c) Internal Volume of the Musical Imagery

Below is a summary of the results relating to the internal volume of MI for both sample groups – refer to Tables 4.6.4.1. and 4.6.4.2. respectively.

Table 4.6.4.1. Frequencies of the internal volume of the MI – Stage Two sample

Volume Level	Frequency	Percent
Soft	62	53.45%
Moderate	23	19.83%
Loud	29	25%
Volume changes over time	2	1.72%
Column Totals	**116**	**100%**

In terms of the experience of the internal volume of MI, the samples tended to report that it was comparable to background music coming from an external source. Thus, the MI was predominantly soft in nature (58.62%), and participants frequently remarked that one needed to concentrate on it in order to hear it clearly. Two participants explicitly noted that while they were engaged in other activities, the volume became soft and when they were not actively engaged with a task, the volume of the MI would typically increase.

Table 4.6.4.2. Frequencies of the internal volume of the MI – pilot sample

Volume Level	Frequency	Percent
Soft	17	58.62%
Moderate	7	24.14%
Loud	5	17.24%
Column Totals	**29**	**100%**

Read in conjunction with one another, Tables 4.6.4.1. and 4.6.4.2. suggest that more than half the time, MI tended to have a soft internal volume. The moderate volume level was termed by participants as equivalent to internal dialogue or speech. It was also suggested that at this volume level, interaction with others was possible since the MI was not excessively overpowering. If the volume level was reported as loud, participants stated that their MI could impede interactions with others.

Although participants were not always alone during periods of loud MI. The top five activities participants were engaged in during loud episodes of MI include: studying (frequency of 6); interacting with others (frequency of 4); driving, walking and eating which all had a frequency of three. The remaining activities each had a frequency of one or two.

4.6.5. (d) Clarity of the Musical Imagery

The participants' clarity ratings of the melody, lyrics and rhythm of the ESI will be reported for each sample below. The participants were able to use a seven-point rating scale to represent how clear each of these features was in relation to their MI. '1' represented an absence of this quality and '7' represented very clear audibility of this characteristic. Below are the summary statistics for the Stage Two group in relation to how they rated these elements of their ESI.

Table 4.6.5.1. Summary Statistics of ESI Clarity Ratings for Melody, Lyrics, and Rhythm – Stage Two sample

	Clarity Ratings			
Component	**Mean**	**Standard Deviation**	**Range**	**Total Observations**
Melody	5.019	1.676	1-7	105
Lyrics	5.143	2.054	1-7	105
Rhythm	4.952	1.740	1-7	105

These mean ratings are all quite similar and they suggest that all three elements were relatively clear. There is no evidence to suggest any systematic differences in clarity ratings across the three elements of MI. All three standard deviations suggest greater variability in rating responses especially relative to the pilot.

Table 4.6.5.2. shows the summary statistics of these three elements for DESI. The reason why these have been reported separately to the ESI statistics for this sample is because there were eleven cases (the pilot only had four) and this was a large enough response-set to determine whether any emergent patterns relating to retrospective recall of the MI clarity were evident.

Table 4.6.5.2. Summary Statistics of DESI Clarity Ratings for Melody, Lyrics, and Rhythm – Stage Two sample

	Clarity Ratings			
Component	**Mean**	**Standard Deviation**	**Range**	**Total Observations**
Melody	4.545	1.753	1-7	11
Lyrics	3.545	1.508	1-6	11
Rhythm	4.545	1.864	1-7	11

All that is apparent from these results are that the average ratings of the three elements are slightly lower than the ESI ratings. The ‘Lyrical’ element appears to be lowest given that it has the lowest mean and a slightly smaller range. No participant rated ‘Lyrics’ as ‘very clear’ within a DESI journal entry. The standard deviations are sufficiently similar suggesting that all three aspects of MI show comparable variability.

Table 4.6.5.3. Summary Statistics of ESI Clarity Ratings for Melody, Lyrics, and Rhythm – pilot sample

	Clarity Ratings			
Component	**Mean**	**Standard Deviation**	**Range**	**Total Observations**
Melody	6.069	0.961	4-7	29
Lyrics	5.448	1.956	1-7	29
Rhythm	5.310	0.281	2-7	29

In general, the pilot group tended to hear all three elements of their MI quite clearly. On average, the clarity of the 'Melody' was rated as the most vivid element. The standard deviation for 'Lyrical' clarity is larger than that of 'Melody' or 'Rhythm' suggesting that the way the pilot participants rated the clarity of the 'Lyrics' tended to show greater variability over time and across different instances of ESI.

4.6.6. (e) The Simultaneous Presence of Visual Imagery

Table III (refer to **Appendix N**) suggests that the presence of visual imagery along with MI tended to be a relatively common phenomenon. The Stage Two sample appeared to have visual imagery co-occur just below half the time (48.28%). It is uncertain which imagery might have been the predecessor of the other, if at all, since no information was asked by the researcher in this regard. Of course, individual differences were present since some individuals (3 out of 16) reported no visual imagery during any MI episodes, whilst others simultaneously experienced visual imagery with every MI episode (two participants).

Table IV (please see **Appendix N**) displays the frequency of dual imagery for the pilot sample. Table IV suggests that within the pilot sample, the two simultaneously occurred just more than half of the sampling period (51.72%). Individual variations in the dual occurrence of musical and visual imagery were also apparent.

Tables 4.6.6.1. and 4.5.6.2. show the types of reported visual imagery for each sample group that were simultaneously experienced with MI. Participants had the option of expressing more than one kind of visual imagery that was co-occurring with the MI. Thus, the total frequency (Column total in Table 4.6.6.1.) in this table is higher than the number of episodes. Three of the eight participants reported at least two separate kinds of visual imagery co-occurring with their MI.

Table 4.6.6.1. Types of visual imagery for the Stage Two sample

Kind of Visual Imagery	Frequency	Rank
Music Video	22	2
Musical score or musical notation	1	5
Imagery relating to dancing to the music	10	3.5
Imagery relating to playing the music on an instrument	10	3.5
Other imagery	27	1
Column Total	**71**	

Table 4.6.6.2. Types of visual imagery for the pilot sample

Kind of Visual Imagery	Frequency	Rank
Music Video	7	2
Musical score or musical notation	0	5
Imagery relating to dancing to the music	4	3.5
Imagery relating to playing the music on an instrument	4	3.5
Other imagery	8	1
Column Total	**23**	

It is evident that 'Other imagery' and Music Videos were the two highest ranked response categories. Table 4.6.6.3. displays the general categories of 'Other' imagery that were present across both samples. Only one participant (a musician) across both samples reported visual imagery of a musical score or notation. The inductively derived categories shall be displayed along with their respective rankings in Table 4.6.6.3.

Table 4.6.6.3. Types of 'Other' Imagery for both samples

Kind of 'Other' Imagery	Frequency	Rank
Imagery related to the lyrical content of the MI	4	4
Imagery of a particular individual	5	3
Imagery of a particular scene or setting associated with the MI	20	1
Imagery of a personal nature	6	2
Column Total	**35**	

Imagery related to a particular scene or setting was the most commonly reported kind of 'other' imagery. These descriptions typically involved a scene from a movie or television[60]

[60] Some examples of this theme was illustrated by *Participant 11*, who wrote "Just the opening [scenes] of the soap opera [unnamed]" and *Participant C* who wrote "the scenes from the TV show intro [United States of Tara]".

programme or a scene that was in some way cognitively associated with the MI[61] by a particular participant.

4.6.7. (f) Reported Distraction Levels of Musical Imagery

The last sub-theme relating to the nature of MI was the degree of distraction participants felt it caused. Brown (2006) generally found his involuntary imagery to be quite disruptive. He states, "…it is quite a distraction most of the time, the kind of thing I wish I could turn off." (Brown, 2006, p.49). Contrastingly, Beaman and Williams (2010) found that Of the 269 earworm episodes, only 33.1% were reported to be unpleasant whilst 50.6% of the episodes were reported as pleasant. The participants in this study were able to rate the distraction the MI caused on a four-point scale ranging from 'Not distracting at all' to 'Severely distracting'. The results for each group are presented in **Appendix N** (see Tables V and VI).
As is evident from Tables V and VI, both sample groups tended to rate the MI as 'Not distracting at all' (Stage Two: 58.10% and Pilot: 48%). Additionally, the top three activities engaged in during an MI incidence, in order of their respective rankings, which were rated as 'Not distracting at all' were self-maintenance (dressing, bathing etc) activities, watching television/movies and lastly eating.

The rating of 'Severely distracting' was not a commonly reported (Stage Two: 4.76% and Pilot: 0%) during the sampling periods. In four of these five cases where the MI was rated as 'Severely distracting', the internal volume was ranked as 'Loud'. The fifth case was ranked as 'Moderate'. The activities that were engaged in during severely distracting MI episodes included: eating, reading, cleaning their house, studying, and a leisure-based activity. Three of these cases were in the absence of others and the other two cases were in the presence of others (specifically one other individual and three other people respectively).

4.7. CORPOREAL MANIFESTATIONS RELATED TO MUSICAL IMAGERY

The final dimension of MI identified by Brown (2006) relates to an unconscious motor response linked to the experience of MI which he termed a corporeal manifestation (hereafter referred to by the acronym CM). Given that there were scarce references to motor

[61] A few examples include the following quotes: *Participant 15* wrote, "image of the album cover and vague images of the singers' mouth forming the words!" *Participant 11*, wrote "I am think [sic] of the place where I heard this song once – and what it meant to me" and *Participant14* wrote "Alice Cooper's face, singing it. I know...it's cheesy."

manifestations within the literature, an inductive approach to categorising CM content was taken. Although the general theme of CM was deductively derived, some of the sub-themes were emergent and they were coded after immersion in the journal data (Braun & Clarke, 2006). The results relating to the frequency, nature, and kinds of corporeal manifestations for each sample will be displayed first. Subsequently, the perceived relationship the participants believed may have existed between their MI and their CM will be indicated thereafter.

4.7.1. Frequency, Nature and Types of Corporeal Manifestations

Table 4.7.1.1. Nature and Type of Corporeal Manifestations for Stage Two sample

PT	Musician	Frequency of ESI	Frequency of CM (Percent %)	Voluntary CM (Percent %)	Involuntary CM (Percent %)
1	*Yes*	11	3 27.27%	0 0.00%	3 100%
2	No	3	0 0.00%	0 0.00%	0 0.00%
3	No	8	0 0.00%	0 0.00%	0 0.00%
4	*Yes*	4	1 25.00%	1 100%	0 0.00%
5	No	3	0 0.00%	0 0.00%	0 0.00%
6	No	2	0 0.00%	0 0.00%	0 0.00%
7	*Yes*	6	2 33.33%	1 50.00%	1 50.00%
8	*Yes*	3	0 0.00%	0 0.00%	0 0.00%
9	No	4	2 50.00%	2 100%	0 0.00%
10	*Yes*	7	0 0.00%	0 0.00%	0 0.00%
11	No	13	3 23.08%	0 0.00%	3 100%
12	*Yes*	7	1 14.29%	0 0.00%	1 100%
13	No	6	1 16.67%	0 0.00%	1 100%
14	*Yes*	10	4 40%	0 0.00%	4 100%
15	*Yes*	14	1 7.14%	0 0.00%	1 100%
16	No	4	1 25.00%	0 0.00%	1 100%
Column Totals		**105**	**19** **18.10%**	**4** **21.05%**	**15** **78.95%**

While the overall incidence of CM in the Stage Two sample was low (18.1%), 62.5% of the participants (10 out of 16) reported CM accompanying their MI on at least one occasion over the experienced sampling period. Of these ten participants, six were musicians (60%) and four were non-musicians (40%). The pattern in the above table suggests that CM experiences were reported to be predominantly involuntary (78.95%).

The table that follows (labelled Table 4.7.1.2.) gives overview of the types of CM that participants experienced. Foot-tapping and humming were the most commonly reported kinds of motor manifestations reported by the Stage Two sample.

Table 4.7.1.2. Kinds of Corporeal Manifestations reported by the Stage Two sample

Types of Corporeal Manifestations	Voluntary Corporeal Manifestations	Involuntary Corporeal Manifestations	Total	Rank
Whistling	0	1	1	7
Humming	2	5	7	**2**
Head bopping	3	3	6	**3**
Foot-tapping	1	7	8	**1**
Singing	1	1	2	5
Swaying	1	2	3	4
Finger clicking	1	0	1	7
Pretending to conduct orchestra	0	1	1	7
Column Totals	**9** **31.03%**	**20** **68.97%**	**29**	

A noteworthy observation relating to CMs is that fairly frequently, more than one CM was simultaneously reported for each documented ESI episode. Accordingly, the totals for the two tables do not entirely correspond with the total ESI frequency – there were a total of 19 ESI episodes with a total of 29 kinds of CMs. Similarly, the same remark is equally applicable to the pilot data. The pilot sample tended to report a greater number of simultaneously occurring CMs. The results regarding the frequency, nature, and kinds of corporeal manifestations of the pilot sample follow.

Table 4.7.1.3. Nature and Type of Corporeal Manifestations for the pilot sample

PT	Musician	Frequency of ESI	Frequency of CM (Percent %)	Voluntary CM (Percent %)	Involuntary CM (Percent %)	Both Voluntary and Involuntary CM (Percent %)
A	No	4	3 75.00%	3 100%	0 0.00%	0 0.00%
B	*Yes*	1	0 0.00%	0 0.00%	0 0.00%	0 0.00%
C	*Yes*	3	3 100%	1 33.33%	0 0.00%	2 66.67%
D	*Yes*	2	1 50.00%	0 0.00%	1 100%	0 0.00%
E	*Yes*	4	3 75.00%	1 33.33%	2 66.67%	0 0.00%
F	No	3	0 0.00%	0 0.00%	0 0.00%	0 0.00%
G	No	3	0 0.00%	0 0.00%	0 0.00%	0 0.00%
H	No	5	4 80.00%	2 50.00%	2 50.00%	0 0.00%
Column Totals		**25**	**14** **56%**	**7** **50%**	**5** **35.71%**	**2** **14.29%**

Five of the eight participants (62.5%) documented CMs occurring simultaneously with their MI. The ratio for these motor expressions was three musicians (60%) to two non-musicians (40%). Half of these were classified by the participants as voluntary (50%). One individual (participant C) chose to classify their CM as both voluntary and involuntary. They explained that smaller movements felt involuntary and tended to occur if they were occupied with another activity whilst the bigger movements (dancing was given as an example) felt voluntary. Additionally, participants tended to report multiple kinds of motor manifestations occurring simultaneously in their journal entries. Table 4.7.1.4. will display the types of CM responses reported by the pilot sample.

Table 4.7.1.4. Kinds of corporeal manifestations reported by the pilot sample

Types of CM	Voluntary CM	Involuntary CM	Both Voluntary and Involuntary CM	Total	Rank
Humming	6	2	0	8	**1**
Finger-tapping	4	2	0	6	**3**
Foot-tapping	4	3	1	7	**2**
Head bopping	1	1	1	3	6
Dancing	2	0	2	4	5
Singing	3	0	2	5	4
Breathing in time with the music	0	1	0	1	7.5
Imitate playing an instrument	1	0	0	1	7.5
Column Totals	**21**	**9**	**6**	**36**	

The two most commonly reported actions were humming (rank of 1) and foot-tapping (rank of 2). Generally, these actions were viewed as voluntary in nature.

4.7.2. Self-report Accounts of the Relationship between Corporeal Manifestations and Musical Imagery

This particular aspect of the analysis combined responses from both sets of participants since CMs did not manifest too frequently in this study. The sub-themes that have emerged are inter-related and they attempt to facilitate a comprehensive description of the perceived relationship between the two main themes. A coding frame was developed during immersion in the data. The unit of analysis in this case, was the phrase or sentence written in response to Question 2 in Section B – "How would you describe the link or connection between the music and the bodily movements?" Once it was apparent that saturation had been attained, the sub-themes were linked together as both complementary and subsidiary ideas within an over-arching theme (Patton, 2002).

Firstly, when a motor reaction was experienced as involuntary, it was often viewed as an automatic response to the experience of MI. Thus, participants expressed the idea that movements such as foot-tapping, humming, or head bopping were unconscious reactions to the imagery they were experiencing. The participants implied that MI acted as a catalyst for their motor actions. However, they also suggested that once these motor responses moved into their realm of awareness, then they described a shift in the nature of the movements to becoming more voluntary. No one suggested that these motor responses were completely

uncontrollable or as extreme as Brown's (2006) experience of involuntary CM. A few suggested that CMs were evoked by the MI or were experienced as involuntary or unconscious responses as demonstrated by the subsequent quotes.

> "*The more upbeat the song, the more bodily movements occur."*
>
> Participant 1

> *"The music evokes these movements, it's a feel good song."*
>
> Participant 4

> *"The music has a lot of control over my mind, which in turn creates an undesirable urge to move to motion or singing with it."*
>
> Participant 7

> "[They are] *unconscious movements, an extension of the music."*
>
> Participant 14

> "[The] *Movements were induced by [the] rhythm and melody of the music."*
>
> Participant 15

One individual attempted to explain the relationship with humour by writing:

> "*I'm possessed. Hahaha…* [sic]"
>
> Participant 14

This entry occurred near the end of the individual's SMIJ. It seems probable that if no explanation could be offered, a tongue-in-cheek remark was perhaps a sufficient response from their point of view.

No descriptions were given of what may have caused participants to become aware of their involuntary reactions or when the shift in the nature of CMs occurred. By virtue of filling in the corresponding journal entry, participants were asked to focus on their actual experiences at that moment. This self-reflective action may have caused some individuals to notice their motor reaction and to take control of them. Following this interpretation, a few illustrative quotes are presented which appear to imply that once the participants became conscious of their movements, they were able to exercise control over them if wished to do so.

> *"When I'm not actively listening to the song in my head but doing a different task, it's involuntary BUT obviously when I'm dancing around, it's voluntary because I'm consciously engaging in it."*
>
> Participant C

"At first the body movements were involuntary, but once I became aware of it I just carried on."

Participant 12

"*As much as I am doing the bodily movements without thinking, it can be stopped if I wanted."*

Participant E

The participants also consistently suggested that these motor responses appeared to express an aspect of the content of their imagery whether it was auditory or visual. Thus, the second inter-related theme was that these motor manifestations were an expression of what was being heard. For instance, humming tended to be a manifestation of the melody of the MI. Singing was often an expression of some of the (usually familiar or known) lyrical content of the imagery or it was an expression of the melody of the MI. Foot-tapping, finger tapping and head bopping were usually expressions of the rhythmic components of the MI. A few quotes taken from various journal entries illustrate this sub-theme.

"Literally making aloud what's going on inside my head."

Participant A

"Humming feels like expressing the song in my head"

Participant D

"I'm tapping my feet and bopping my head according to the tune and the beat."

Participant H

"*I'm keeping time with the rhythm and beat of the music."*

Participant 12

The third sub-theme was that corporeal manifestations could be an expression of dual imagery (musical and/or visual co-occurring). The following cases demonstrate a dynamic interplay between participants MI, the corresponding visual imagery and their associated CMs. For example, one participant documented that they were experiencing visual imagery (imagining how they would dance to the music in their head in addition to imagery of the actual choreography for the Ballet to the song) and they were also simultaneously dancing. For this participant, dancing seemed to be linked to visual imagery co-occurring with the MI although this was not explicitly stated. The description of their visual imagery suggested that dancing, as a motor manifestation, was an expression of their visual imagery as evoked by the

MI they were hearing. This individual also articulated that they are a dancer and despite not having had any musical training, they expressed that the two activities were intricately linked.

> *"The music makes me want to dance immediately."*
>
> Participant C

Similarly, another example of how CM could be an expression of both MI and visual imagery relates to a participant who reported CMs similar to conducting an orchestra. At that time, they described simultaneously experiencing visual imagery of an orchestra performing the corresponding MI.

Although CMs were not a dominant characteristic of MI, there is a particularly fascinating relationship that exists. The sub-themes which have been elucidated could quite possibly be extended to instances of CM related to music from an external source. Future research could investigate the CM association with MI as well as external music in order to better understand this relationship.

CHAPTER 5

DISCUSSION

5.1. CONSTANCY OF MUSICAL IMAGERY

The Stage One findings imply that, in general, the experience of MI was a relatively common phenomenon amongst the participants. The cumulative frequencies suggest that at least once a week or more regularly, 98.85% of Stage One participants reportedly experienced MI. Additionally, in terms of these cumulative frequencies, 31.03% of the sample reported experiencing MI '2 to 3 times a week' and approximately one third (32.18%) of the Stage One sample reported hearing MI 'A few (1 to 3) times every day' (28 out of 87 participants). Additionally, 16.09% of Stage One participants reported hearing music 'in their heads' more than four times per day which suggests that MI is experienced regularly and Stage One participants were rather familiar with the phenomenon. The previous percentage (16.09%) is slightly lower than Liikkanen's (2008) research findings, but these two sets of results suggests that a greater number of individuals may, in fact, fall on the extreme side of the MI continuum close to Brown's (2006, p.48) reported frequency – "I typically hear between 2 and 10 different fragments on a daily basis" which implies that some participants may experience MI episodes akin to Brown's (2006) Perpetual Music Track (or PMT). Figure 2 clearly demonstrates that the average daily experience of MI ranged from about 0.4 to 3.3 episodes every day over the seven day sampling period. In fact, the majority (43.75%) of self-rated MI episodes of the Stage Two participants was reported to occur 'A few (1 to 3) times every day', as noted from their Stage One questionnaires. Evidently, their self-reports' were realistic estimations, since most were comparable with their individual mean daily counts.

Correspondingly, the self-reported everyday incidence of involuntary musical imagery (INMI) in Liikkanen's (2008) sample was similar to these findings: 91.7% of the participants experienced MI at least once a week; 33.2% reported experiencing INMI 'Every day'; and 26.1% of the sample reported experiencing the phenomenon 'Several times a day' (n = 11,904). Likewise, findings from Beaman and Williams (2010) first study (non-experimental survey) indicated that all participants (n = 103; 64 male, 39 female; 55 individuals with some musical training) had previously experienced a 'catchy tune' or the earworm phenomenon. Most of the participants (88.2%) retrospectively reported that earworms typically lasted for

several hours, and 159 different songs were named by participants as previously experienced earworms (Beaman & Williams, 2010). Thus, what is apparent is that participants seem to naturally recognise the phenomenon of 'stuck song syndrome' and are able to recall key features when questioned about their retrospective experiences. Although the Stage One results are analogous to Liikkanen's (2008) and Beaman and Williams (2010) findings, they are not directly comparable given the differences in the samples (Finnish and British respectively) as well as the fact that the two studies operationalised different sub-categories of MI regarding its rate of occurrence – Liikkanen's (2008) results purportedly relate to involuntary MI (INMI) and both of Beaman and Williams (2010) studies related to a specific form of involuntary MI, namely earworms.

However, the Stage One data was purely based on self-reports and may either be an over-estimate or an under-estimate of the experience of MI. For example, *Participant 9* may have over-estimated their every day MI experience in Stage One. Their self-reported MI frequency was 'Many (4 or more) times every day', whilst their mean score after Stage Two participation, was an estimated 2.71 episodes. Although this is reasonably high, it was not in the vicinity of four or more episodes per day. The participants may have over-reported self-reported MI episodes owing to demand characteristics or may have under-estimated MI occurrences without the advantage of being able to pay attention to real-time instances of MI via experience-sampling. A similar critique could be levelled at Liikkanen's (2008) study. Beaman and Williams (2010) recognise this limitation with regard to their first study and employed a second longitudinal, diary-based study concerning earworms. Although the method employed does not equate to an experience-sampling study. Consequently, it is difficult to determine whether participants were intermittently reporting on MI retrospectively since no signal-prompts were employed. With regard to Stage One findings, the researcher was unable to discriminate between the incidence of voluntary and involuntary MI since the demographics questionnaire did not differentiate between the two. Nevertheless, it gives an approximation of the prevalence and constancy of the MI in a reasonably large sample of South African students that predominantly had no musical training (58.62%). Furthermore, these findings suggest that Brown's (2006) empirical claim is to some extent flawed. Brown (2006, p.43) states that:

> Everyone has had the experience of having a melody stuck in their head for an extended period of time, especially just after listening to a piece of music. However, most people

say that this is an infrequent event in their lives and that they rarely have music running through their heads.

Given Liikkanen's (2008) findings, in addition to the Stage One results of this study, the experience of habitual occurrences of MI is not likely to be as scarce as Brown (2006) alleges, especially since he based his premise purely on self analysis and anecdotal evidence[62]. In fact, it might even be a widespread phenomenon in individuals with no history of musical education. This is not to imply that the Stage One participants displayed no interest or passion for music but rather that musical training was not necessarily a prerequisite for the regular, even everyday occurrence of MI, whether voluntary or not. In fact, the musical activities engaged in by the Stage One sample suggest a strong interest or zeal for music and a range of activities specifically related to it. Most importantly, daily exposure to music seemed to be a more significant factor than any formal musical experience or training. Approximately 92% of the sample listened to music on a daily basis, the majority of which (59.77%) did so between one and three hours per day.

This supposition appears to be supported by other studies' findings. For example, 98.1% of Liikkanen's (2008) sample reported listening to music on a weekly basis. In addition, Bennett's (2002) findings indicate that Musical Imagery Repetition (MIR) was stated to occur more frequently if the participant listened to more than 30 hours of music per week ($F(1, 98) = 11.56$, $p < .0009$). Beaman and Williams (2010) did not include a specific question pertaining to daily musical exposure but note that the self-ascribed importance of music is important to the experience of involuntary MI. The authors report that a significant positive relationship was found between the reported duration of the earworm and the self-rated everyday significance of music[63] by participants (likelihood ratio (8) = 18.42; $p = .018$). They note that the participants' receptiveness to music is likely to be more important than musical training with regard to earworms. Beaman and Williams (2010) also suggest that since there were few overlaps in tunes which indicates that the tune itself it not inherently 'sticky' or 'catchy'. Thus, it seems that even earworms are more likely to result from recent priming. However, these inferences do not insinuate that musical training, education or experience has no bearing on the experience of MI. These findings merely suggest that musical training

[62] Brown (2006) reports that he asked colleagues whether they experience a phenomenon akin to the PMT, most were stated as having responded in the negative. It is also not stated how many individuals Brown incidentally 'surveyed'.

[63] In response to the following question: "Do you consider music to be an important part of your life? No/Yes" (see Catchy Tunes Questionnaire in Beaman and Williams, 2010, p.651).

and/or experience are not necessarily the main factors underpinning the regular experience of MI. This study's results also serve to highlight that non-musicians are perhaps equally prone to experience MI quite regularly. Therefore, both a keen interest for and regular exposure to music might be equally significant factors regarding the consistent experience of MI episodes.

This assertion appears to be partially supported by extant findings relating to associated forms of MI. Liikkanan (2008) utilised an Analysis of Variance (ANOVA[64]) to determine the effects of different background variables on the retrospective reports of involuntary MI. The interpreted findings suggest that Active Musical Training (AMT), Active Musical Listening (AML[65]) were statistically significant variables since the p-values were less than 0.0001.

Liikkanen (2008) also states that there was only one statistically significant interaction effect which was found between AML and AMT; however, the Eta-squared value (0.0013) was considered to be a small. Moreover, in the current study, the two statistically significant predictor variables highlighted by the binomial logistic regression included the absence of external music and musical training. Both were associated with MI given that there p-values were less than 0.05. Thus, the two odds ratio indicates that individuals (in this study) were 51% more likely to experience MI in the absence of external music and musicians had an 85% higher probability of experiencing MI than non-musicians. Similarly, in Bennett's (2002) study, MIR was also reported to be more frequently experienced if the participant was musically trained ($F(1, 277) = 4.86$, $p < .028$). Essentially the current study's results demonstrate that MI episodes occurred frequently over the sampling frame and MI was experienced fairly regularly by both musicians and non-musicians. However, the interpretation of the odds ratio does indicate that the Stage Two participants, classified as musicians, were more likely to experience MI than non-musicians. As previously alluded to, this may be owing to the broad definition which was utilised to differentiate the two groups.

Gender has also been hypothesised as an explanatory variable concerning the consistent experience of MI. In this study, the Fisher-Freeman-Halton test indicates that gender was

[64] Presumably, Liikkanen (2008) is referring to a Two-Way ANOVA since one significant interaction was reported. However, no post-hoc tests were discussed in the article. This may be as a result of small effect sizes.
[65] No clear definitions are provided for either AMT or AML. It is somewhat ambiguous what the author means by appending the term 'active'. It is also unclear whether the author is referring to cognitive musical processing of musical imagery or more generally to music perception.

associated with self-reported MI (Stage One data; p = .04). Contrastingly, when the binomial logistic regression analyses were run, the test for association (between gender and MI) was not statistically significant for the Stage Two experienced-sampled data. The interpreted odds ratios that were computed suggest that female participants only had an 11% greater chance than the male participants of experiencing MI. Similarly, Beaman and Williams (2010) report that there were no statistically significant gender differences in self-reported earworm experiences using a Mann-Whitney *U* test ($z = -0.437$; p = .662) which is also in direct contrast to Liikkanen's (2008) results. Bennett (2002) asserts that female participants reported experiencing MIR more regularly. However, the corresponding p-values indicate that there was insufficient evidence to indicate significant differences between sexes ($F(1, 279) = 3.23$, $p < .073$) concerning MIR reports. Evidently, there are varied findings regarding the statistical significance of gender across different groups of participants. It cannot be assumed that because Liikkanen's study (2008) had the largest sample, that those results are the most accurate reflection of gender's apparent significance. This is because a notable complication with Liikkanen's (2008) results is that the ANOVA did not appear to meet the requisite parametric assumptions[66]. Liikkanen (2008) acknowledges that data conversions were done when reporting the Spearman's Rho correlation coefficients but does not elucidate the procedure that was undertaken in relation to the ANOVA. Given the conflicting findings, further research is required to determine whether gender is a significant variable corresponding to the regular experience of MI. A pertinent observation that emerged from this study is that certain contextual variables could be important factors in the constancy of MI experiences.

5.2. CONTEXTUAL VARIABLES

The contextual data provides an added depth to the results as well as allowing for certain trends to emerge. However, since the experienced-sampled data did not specifically relate to the exact onset of MI, definite inferences cannot be made concerning the relationship of MI to these variables. However, there are some tentative hypotheses that emerge.

[66] The dependent variable was of an ordinal scale and it was converted to allow for the use of an ANOVA rather than using the non-parametric equivalent (Friedman Two-Way ANOVA). Alternately, it may have been more rigorous to have done multiple Kruskal-Wallis tests for each main effect even if interactions were not possible using this method.

To begin with, calculating odds ratios was a unique strategy for attempting to adjudicate between Bailes' (2007) and Lipson' (2006) contrasting hypotheses regarding the presence/absence of others and MI. Odds ratios were considered a suitable tool to employ since the computations utilise experienced-sampled data for all timeously completed questionnaires, regardless of whether MI was present or not. Thus, all the experienced-sampled data, completed within the 30 minute time frame, was analysed. This is not always possible in studies of this nature, often only data regarding the presence of mental phenomena are analysed. The odds ratios indicated that Stage two participants were approximately 28% more likely to experience MI in the absence of others. However, there were noticeable variations in this trend across participants. In general, there appeared to be a slight inclination toward the experience of MI whilst alone in both sample groups. Regardless, there was insufficient evidence, at a 5% level of significance, to suggest that MI was associated with the presence of others. Lipson (2006) hypothesised that MI serves as a transitional object since it is able to provide companionship to the imager during periods of solitude. Conversely, Bailes (2007) postulates the opposite owing to the findings of her study. She asserts that MI was more frequent when individuals were in the company of others. As previously alluded to, this study did not capture data pertaining to the presence of others at the precise onset of a MI episode. Consequently, no definite resolution can be made regarding the aforementioned hypotheses. Nevertheless, the reported odds ratio is inconsistent with Bailes' (2007) findings and might imply that Lipson' (2006) hypothesis is fairly compelling.

Similarly, no distinctive patterns could be identified in terms of activities engaged in during the precise moment MI moves into conscious awareness. In the current study, during periods where MI was present, the top three activities included studying, driving, and eating. In the contrasting non-MI periods, the top three activities participants were engaged in included watching television or a movie, studying and socialising/interacting with others. Similarly, Bailes (2007) reported that whilst participants were watching television, MI was less likely to be present. She states that interacting with others was an important factor associated with increased likelihood of experiencing MI which is divergent to the present study's findings. In terms of the present study's results, the common factor between the two contrasting periods was 'studying'. Bailes (2007, p.560) reports the following results: "Activities categorized as 'time filler' (for instance, waiting, lying in bed) and states of 'being' (for instance, getting up, sitting) were twice as likely to be accompanied by imagery". Thus, it could be inferred that MI might be more likely during periods where cognitive capacities are relatively perfunctory.

Contrastingly, in Bennett's (2002) study, there was insufficient evidence to suggest that there was a statistically significant difference in the frequency with which MIR was reported to have begun across high and low states of conscious arousal ($F(1, 226) = 0.01$; $p < .75$). Thus, the onset of MIR did not appear to be more frequent during periods of high activity levels associated with increased concentration in direct contrast to periods where the participant's described their mind as empty (Bennett, 2002).

Wammes and Barušs (2009, p. 50 – 51) propose the following supposition regarding the presence of MI in terms of the discussion of an exploratory factor analysis which they conducted:

> The Entertainment factor is intriguing because it seems that the individuals who score high on this dimension only experience musical imagery in the absence of any other stimuli requiring cognitive attention. Moreover, the musical imagery that they experience in these instances consists of songs they have heard before and songs that they like. Perhaps this musical imagery simply serves to keep the mind occupied and entertained in the absence of other tasks requiring concentration.

Accordingly, one might hypothesise that the activities engaged in are a proxy for the level of attention, arousal and focus required to actively engage with the task at hand. In light of the individual differences with respect to the kinds of activities engaged in, as well as the varied findings across extant research, it could be argued that if the primary activity requires lower attention levels, the MI might become more prominent in the imager's mind (for example, increased volume or vividness). This premise was alluded to by two participants (in the present study) who stated the volume of the MI varied depending on the task engaged in and tended to decrease in volume during activities requiring interaction with others. Equally, it could also be hypothesised that if the level of attention required for an activity is high, then MI might move out of conscious awareness and return during a task that does not require high levels of attentiveness. This supposition was partly inferred from participant's reported MI volume levels which were predominantly soft to moderate in nature. A few participants remarked that they needed to actively focus on the MI in order to hear it clearly especially during soft MI episodes. However, this premise requires adjudication given that Bailes (2007, p.565) concludes that despite the counter-intuitive nature of her conjecture, MI might be more prominent during activities requiring high levels of arousal (interacting with others as well as working). She speculates that "the generation of imagined music operates to either

self-regulate or to match levels of arousal" in addition to qualifying that future studies should investigate this claim. Given these incongruous deductions, it would be prudent to examine the aforesaid hypotheses further.

Another contextual variable hypothesised to be related to MI is whether external music is present or absent during or at the onset of MI. In the current study, in just over one third (35.05%) of the experience-sampled episodes, there was a slightly higher incidence of external music during non-MI periods. The odds ratio pertaining to external music provides an added depth to these inferences given that it indicates that Stage Two participants were nearly 50% more likely to experience MI when external music was absent. Furthermore, external music was statistically associated with MI. Overall, the presence of external music was not a regular occurrence – in approximately one fifth of the ESI cases external music was present at the time of the SMS-prompt. Of these cases, 72.73% the external music was different to the MI. Similarly, Brown (2006) reported that his MI tended to be less prevalent during periods where external auditory stimuli were present (conversing with others, listening to music and viewing television). Given that previous research has implicated the same specialised cortical areas (specifically the right temporal neo-cortex as well as other right-hemisphere regions) in the processing of both imagined and perceived auditory stimuli (Herholz et al., 2008; Halpern, 2003), these results are unsurprising. Presumably, it is exceedingly complex for these cortical regions to adequately process dual musical stimuli (imagined as well as perceived) concurrently. Thus, it is, to some extent, expected that the presence of MI would be more prevalent when external musical stimuli is absent, as has also been tacitly proposed by Brown (2006).

It has been posited that high levels of cognitive engagement are required whilst processing music especially during rehearsal and performance related activities (Liikkanen, 2008). Liikkanen (2008, p. 411) offers the following explanatory interpretation of the cognitive process which may reinforce MI formation:

> This means that the repeated processing of musical memories strengthens them [cross-domain semantic networks] and leads to prolonged high activation levels within this network. This makes it more likely that some memories exceed the mental threshold, and under certain circumstances internal music is perceived.

This hypothesis implies that involuntary semantic memory formation underpins the experience of MI and it suggests that this phenomenon would be more prevalent in individuals who actively immerse themselves in musical activities such as rehearsal and performance. In order to critically engage with this premise, future studies might wish to investigate the prevalence of MI in individuals who do not voluntarily engage in music-related activities. In the present study, one individual reported that they did not choose to listen to music as well as having no prior musical training. Even so, this participant also reported experiencing MI, albeit slightly less frequently than the majority of the Stage Two sample. This might suggest that MI could operate outside of active engagement with musical activities. Furthermore, it may also suggest that Sacks' (2008) claim about our intrinsic inclination; fascination or 'tuning' toward musical stimuli is rather astute.

5.3. CONTENT AND NATURE OF MUSICAL IMAGERY

In this study, there appears to be an underlying link between the content and nature of MI since there is some overlap between the two dimensions. For instance, the involuntary nature of the majority of reported MI cases seems to suggest an apparent connection with the reported content of it. Moreover, the documented recency of a participant having heard a particular musical composition may underpin its materialisation as the content of a MI episode. With regard to the MI's recency, the of the Stage Two results indicate that in 68.75% (11 out of 16) of the voluntary MI cases, the MI had been heard from an external source on the same day. Similarly, in approximately half (51.69% – 46 out of 89) of the involuntary MI cases, participants perceived the original composition, from an external source, on the same day. Moreover, 79.05% (83 out of 105) of the ESI reports were heard by participants from an external source within the same week relative to the occurrence of their experienced-sampled MI episode.

In general, both samples were generally familiar with their MI, whether it was classified as an ESI, DESI, MIOW or LRI case, and these percentages ranged from 74.25 to 96.55. Bailes (2007) found comparable patterns regarding the familiarity of MI episodes – 83.18% of the tunes were named by participants. Liikkanen's research (2008, p.410) also demonstrated analogous findings – "familiar lyrical music dominated over instrumental or new music (76% vs. 26%)". As previously mentioned, Beaman and Williams (2010) also noted that participants were able to name a large proportion of the documented earworms in both

studies. Although they did not specifically ask whether the earworm was familiar, presumably if the participant was able to name either the artist or song title, it was indeed known to them. Correspondingly, Bailes (2007) found that only 6.5% of the reported MI cases were original in content. Similarly, Beaman and Williams (2010, p. 649) hypothesise that "popular and predominantly recent, music tunes (likely to be overlearned) were by far the most frequent earworms reported in the current study". Beaman and Williams (2010) state that across both studies, participants could name 99% of the earworms that were experienced, suggesting that the tunes were well-known to the participants. Accordingly, how recently a musical composition had been heard in addition to the familiarity of the music are both likely to be a key factors underpinning the content and the nature of MI, regardless of its form.

A considerable proportion of the involuntary episodes were either described as spontaneous in the sense that they "popped into" the imager's awareness (39.04%) or alternately, got "stuck" in the participant's mind after recent exposure (35.24%). However, closer examination of the findings suggests that these two categories are, to some extent, merely artificially distinct. Only 31.71% of the latter category of cases can be considered to be truly spontaneous, since ten were not recently heard and three were original cases of MI. The remaining cases were recently heard and although they may not have instantaneously begun playing in the imager's conscious awareness, it appears that they may have 'stuck' in the participant's mind and moved to the fore at a later stage – usually on the same day or, at most, in the same week. In light of these results, the MI, captured by the experienced-sampling method, illustrates that truly spontaneous occurrences were relatively rare over the sampling period. In fact recent exposure to familiar music appears to be the underlying trend. Even according to Brown's (2006, p. 49) self-reported experiences, recency appears to be a priming factor as illustrated by the following excerpt:

> In general, the most recently heard piece of music on a particular day is the one that will be imaged first. In the absence of that, some other piece of music, usually something heard the day before, will take over. On other occasions, distant pieces spontaneously pop into my head.

This study suggests that in general, the everyday experience of MI was not within the imager's control. Only 14.29% of ESI cases were reported as being voluntarily conjured by participants. Accordingly, in the majority of the experienced-sampled cases, the participants' were presumably unable to manipulate significant aspects of the MI's content and nature (for

instance, its loudness or clarity) given that most MI cases were described as involuntary. However, since the SMIQs did not explicitly ask participants to discuss whether they were able to mentally manipulate their MI, this is an unverifiable postulation. The presumption rests on the fact that none of the participants noted or mentioned the ability to alter their MI in their SMIJs during the sampling period.

The content of the documented MI tended to involve vocal music or a combination of vocal and instrumental music (85.72%). Pure instrumental MI was less frequently occurring, which is comparable with existing research (Liikkanen, 2008; Bailes, 2007). Although Bailes' (2007) suggests that a 'tune in the head' is an apt descriptor for the phenomenon, this study indicates that lyrical content was fairly frequently experienced and as such, MI does not primarily involve only melodies/tunes. Similar to other studies involving MI, (Bailes, 2007; Brown, 2006; Bennett, 2002), the sample tended to hear repeated musical fragments often occurring in a cyclic manner (59.19%) as opposed to a full mental rehearsal of an complete song. For example, in Bennett's (2002) study, in the majority of reported episodes, MIR was reported to predominantly involve lyrical content (75.5%) and musical fragments (71.5%) rather than full songs. Beaman and Williams (2010) indicate a slightly different trend since in their second study, approximately one third (33%) of the earworm episodes consisted of the chorus of a song only; 27% involved a fragment of another (shorter) portion of a song; and an unexpected, 28% of the earworms consisted of an entire song. There are potentially a multitude of explanations which might elucidate why looped musical fragments are typically experienced during an episode of MI. Particular elements of a song might be prone to becoming the subject of MI owing to the inherent properties of the musical piece such as repetitiveness within the song, its simplicity, its familiar melodic structure, along with the regularity of it having been recently heard. It is reasonably feasible that it would depend on memory encoding processes of perceived music, variations in the properties of the music (for example choruses in contrast to other components of songs), as well as individual differences pertaining to imagery capabilities.

With regard to involuntary MI episodes where the participants had not been recently exposed to the tune from an external source, there was some evidence to suggest that a specific external stimuli may have triggered a cognitive association which may have subsequently catalysed an episode of MI. The present study's findings suggest that 11 ESI incidents (10.48%) were allegedly triggered by either a textual cue or a specific thought, suggesting

that cognitive (or emotional) associations could prompt an episode of MI. Moreover, all of the 11 cases were reported to be familiar, involuntary, and as not having been heard on the same day. Similarly, Bailes (2007; 2006) reported nine incidences (8.41%) of MI which were apparently activated by a personal association, a particular thought or a visual trigger. It is feasible that certain cases of MI were predisposed in the imager's mind owing to the personal nature of the tune. A large proportion of the participants reported a personal association with at least one episode of MI. Nevertheless, the group trend suggests that in the majority of reported cases, awareness of personal associations was intermittent. Sacks (2008) states that emotional attachments to particular tunes may cause the imager to become more susceptible to hearing specific tunes as repetitive MI. Although this study's findings suggest that a personal cognitive association plays a less significant role in the nature of MI experienced, it is still a possible mechanism of triggering MI that warrants further investigation (even if it is not a constant feature of MI). Understanding the relationship between the content and some triggers of MI could explain its aetiology. For example, it is possible that an individual's preference in music influences the content of their MI. This premise was not investigated in this study but the trends in genres of MI were documented.

The genres of MI were fairly varied across participants. Some imagers tended to have relatively specific genres frequently occurring (e.g. *Participant 1*), whilst others experienced a wider variety of MI genres ranging from pop music to metal (e.g. *Participant 12*). Clearly, the genre of MI is a variable factor given that individuals are to be expected to oscillate between the varying amounts of music they are exposed to as well as to the genres and artists they might prefer to listen to over time. The genres of particularly significance were the recurring artists across the sample groups as well as the trend of television theme songs and movie soundtracks appearing during sampling periods. These results might suggest that the role of music for advertising and jingles created specifically for television or movies is a moderately significant source of MI in the samples.

Beaman and Williams (2010) note that unexpectedly, television themes songs, jingles and other music typically considered to be "sticky" were not over-represented in their two studies. Moreover, they highlighted that the genres of earworms were quite varied and conclude that the content of earworms is diverse since it depends on musical exposure. Only three Stage Two participants (18.75%) documented persistently recurring MI over the sampling period either by the same artist(s) or regarding the same familiar song replaying itself in their mind

across the seven day period. Thus, there is some evidence, albeit intermittent, to suggest that there is some consistency in the MI content during for some participants during experience-sampling. Additionally, there were a few artists which were repeatedly listed by participants from both the Stage One in addition to the pilot sample over the data collection period. The documented content of MI implies, at least in part, that perhaps there are some properties of the tunes that are cognitively "sticky". Even though these forms of catchy tunes were present in the Stage Two data, they were not the dominant content (similar to Beaman and Williams, 2010). Accordingly, the content of MI appears to coincide with existing findings even though it also displays some variations. Sacks (2008, p.44) states the following with regard to sticky tunes:

> Sometimes normal musical imagery crosses a line and becomes, so to speak, pathological, as when a certain fragment of music repeats itself incessantly, sometimes maddeningly, for days on end... This endless repetition and the fact that the music in question may be irrelevant or trivial, not to one's taste, or even hateful, suggest a coercive process, that the music has entered and subverted a part of the brain, forcing it to fire repetitively and autonomously (as may happen with a tic or seizure).

Sacks (2008) then suggests a possible explanation underlying the "stickiness" of particular music. Firstly, certain tunes are essentially designed (by composers, marketers and the like) to become etched in the listener's mind in order to "hook" the public in some manner. In relation to the television theme songs, these may also feasibly fall within the scope of both familiar and "sticky" tunes, analogous with television jingles. Thus, it is unsurprising that these kinds of tunes were occasionally reported within the documented MI cases. Most notably, in this study, the song "All the single ladies" performed by the artist Beyoncè, and utilised in a South African advertisement, was quite commonly reported across all samples. This song was receiving regular (perhaps even daily) radio play as well as appearing on television fairly frequently during the data collection period. Its constant repetition may have contributed to its persistent occurrence in this study. Additional factors which may have contributed to its recurrent manifestation could be explained by multiple memory encoding processes. For example, this song was not simply a television jingle, it was a full song associated with a particular cellular-phone service provider. The advertisement was humorous and comparable to a music video. Thus, the song was likely to have been encoded into memory and linked to a wide array of recollection cues such as visual stimuli, comedic

associations, commercial branding and so forth. This indicates that MI could be triggered by a variety of cues but that it might be linked with other mental phenomena.

Previous studies have acknowledged that MI may not occur in isolation and is likely to be experienced in a multimodal manner (Liikkanen, 2008; Bailes, 2007). The present study examined the simultaneous occurrence of visual imagery and found that two primary characteristics emerged. Firstly, music videos pertaining to the MI were among one of the most persistent trends. Perhaps visual imagery involving music videos were prominent because participants were sufficiently familiar with the music in this format. Moreover, both auditory and visual events are likely to be dually encoded into memory if they are generally perceived in this manner. Secondly, imagery classified as 'other' became a recurrent theme. In general, these involved descriptions relating to a movie or television programme or alternately, a scene that was in some way cognitively associated with the MI. In accordance with Sacks' (2008) supposition, perhaps an emotional or cognitive association increases the likelihood of a musical composition being triggered into conscious MI. Even though the occurrence of multimodal imagery was not consistently experienced by all participants, it was documented in almost half (48.28 %) of the total MI incidences (both ESI and DESI cases). Noticeable individual variations indicate that the experience of dual imagery is specific to each individual rather than being the norm.

It was apparent that in general, the vividness of MI was typically reported to be quite clear in the minds' of the participants with respect to the Melody, Lyrics, and Rhythm of it. Stage Two results suggest that the Melody and Lyrics of a tune were generally experienced as vivid in the imager's mind (which is similar to Bailes' (2007) findings). The Rhythm of the MI was rated as less vivid in comparison to the melody and lyrics. However, this may be as a result of very few participants having any pre-existing percussion and rhythm knowledge. Bailes (2007) examined the clarity of certain elements of her participant's MI but failed to report means and standard deviations. Consequently, no statistical comparisons can be calculated. Nonetheless, based on *prima facie* analysis, it appears that these two studies demonstrate comparable results in terms of the lyrical and melodic dimensions of MI. Future studies might wish to delve further into the vividness of the varying features of MI in order to explore its overall clarity in addition to its resemblance to perceived music.

Another element of vividness relates to the reported loudness of MI. MI was typically experienced as soft to moderate in volume (73.28% of ESI and DESI cases). The loudness of MI seems to partly influence the distracting nature of the phenomenon. In a few cases from the Stage Two findings MI was usually only reported to be severely distracting in cases where the volume was reported to be loud (80%) or moderate (10%). Similar research focusing on other variants of MI has not investigated the internal volume of MI, consequently, it is not clear whether this is a distinctive characteristic of MI. Brown (2006, p. 47) does indicate that the volume of his MI displays the following characteristics:

> The volume of the music track in my head depends on the extent to which music is the focus of my consciousness. When the music track is the dominant focus, its volume is quite comparable to that of the verbal imagery track, being neither greatly louder nor greatly softer. When it is not the dominant focus, the music track will play quietly in the background, occasionally being amplified as it pops its head into conscious awareness.

Similarly, based on the participants' experiences and descriptions, presumably, the volume of MI is linked to the activity engaged with during the experiences of MI but future studies might wish to examine this proposed relationship. Accordingly, it might be reasonable to believe that if the volume of the MI is experienced as loud, this might distract the individual from everyday tasks, and this disruption could be an element which makes the experience of MI unpleasant. Conversely, Brown (2006) discussed the intrusive and distracting nature of perpetual MI but argues that it is the inability to exert sufficient control over his MI (in other words, switch off the PMT) that causes him to experience distress.

Beaman and Williams (2010) specifically investigated whether earworms were considered by participants as unpleasant in addition to whether they are perceived to be causing interference with daily activities given the assumption that earworms are usually involuntary and intrusive (resembling something akin to obsessive compulsive thoughts). Results from their first study indicate that participants who reported longer durations of earworms were more likely to experience the phenomenon as unpleasant (likelihood ratio (8) = 23.62; p = .003) (Beaman & Williams, 2010). It is feasible that if involuntary MI is not experienced as unpleasant, it might be inversely proportional the degree of distraction it causes. However, there are the inconsistencies in the findings concerning the perceived unpleasantness of involuntary MI experiences and whether they resemble some form of psychopathology (such as OCD). Sacks (2008) states that even if brainworms ('earworms') resemble certain pathologies (such as

Tourette's, Obsessive Compulsive Disorder (OCD) and certain frontal lobe injuries), the simple fact that they are universally experienced implies that human memory is simply more susceptible to music as compared to other auditory stimuli. Correspondingly, Beaman and Williams (2010) mention in the results from their first study that in general, participants did not rate earworms to be problematic in terms of interfering with other activities or wasting time (Beaman & Williams, 2010). Similarly, in the second study, almost two thirds (66%) of earworm episodes were reported to neither interfere with daily activities nor waste time.

The results from Beaman and Williams (2010) first study indicate a moderate to weak statistically significant positive correlation between the interference an earworm is perceived to cause and difficulty of dislodging the earworm from the inner ear (Kendall's $\tau = .28$; $p < .001$). Earworms were perceived by participants to cause more interference with daily activities if it was hard to dislodge and if it was in infrequent occurrence (Beaman & Williams, 2010). Evidently, it is apparent that there are definitely individual cases of MI that are experienced as unpleasant, or even distressing. However, in general, research suggests that the phenomenon is not typically experienced as wholly intrusive or even anxiety provoking even if steps taken to dislodge the earworm are unsuccessful (Beaman & Williams, 2010). Perhaps the duration of the experience, the vividness of certain elements of MI, the volume and the degree of attention the MI draws from other activities, as well as the frustration associated with attempts to dislodge involuntary MI may account for some MI being experienced as unpleasant, distracting, distressing and so forth.

5.4. CORPOREAL MANIFESTATIONS

Corporeal manifestations (CM) related to MI are understudied characteristic of the phenomenon given that existing research has failed to rigorously investigate this motor manifestation. There is dearth of research against which the present study's CM results can be contrasted. Nevertheless, the Stage Two results indicate that CMs were not necessarily a typical characteristic of MI since only 10 of the 16 participants experienced CMs during the sampling period. The overall incidence of CM in the Stage Two sample was low (18.1%). Akin to co-occurring visual imagery, CMs were not the norm within the sample, and there were noticeable variations across participants. For example, six Stage Two participants did not report experiencing CMs during the sampling period.

Brown (2006) originally speculated that there is a motor component inherently associated with MI. As noted in Chapter 2, some neurological research suggests that the experience of voluntary MI can activate pre-motor vocal areas during musical discrimination tasks (Brown & Martinez, 2006). Additionally, it has also been argued that the supplementary motor area (SMA) is activated during MI experiences. The SMA serves to activate (involuntary) motor and vocalised responses associated with MI (Halpern, 2003). Bennett (2002) stated that 89.7% of participants reported humming during an MIR episode (Bennett, 2002). Most notably, participants who reported co-occurring motor manifestations (related to their MIR) experienced the phenomenon more frequently ($F(1, 236) = 13.38$, $p < .0003$) in direct comparison to participants that did not report CMs. In the present study, humming and foot-tapping (similar to Bennett's (2002) results) were consistently the most frequently experienced CMs across both sample groups. There were differences in the underlying nature of CMs. There was no distinct pattern regarding the voluntariness of CMs since the Stage Two sample tended to experience their CMs as involuntary (78.95%) whilst in the pilot sample, the opposite trend was evident. In the current study, six of the ten Stage Two participants who reported experiencing CMs were musicians (60%). Thus, these findings could imply that CMs may well be predominately more common in individuals with musical training or alternately in individuals actively involved in various performing arts (dance, drama and so forth) since their musicality could serve to augment these responses.

The overarching theme, presented in Chapter 4, did suggest a dynamic interplay between MI and CM. It was also apparent that participants experienced CMs as serving an expressive function in relation to the simultaneously occurring MI. These findings also suggest that Brown's (2006) experience of CMs appear to be atypical given that no individual in the existing study expressed being entirely incapable of exerting control over their associated motor manifestations. Sacks (2006) indirectly alludes to the notion of corporeal manifestations during his commentary titled *"The power of music"*. He implies that such motor responses are seemingly innate reactions, even if involuntary in nature, and are typically expressive of the influence music has on our consciousness. Sacks' (2006, p.2528) describes motor arousal fairly aptly in the following excerpt:

> Another passionate musical philosopher, Nietzsche, said, 'We listen to music with our muscles.' This, at least, is something we can see. It is evident in all of us – we tap our feet, we 'keep time', hum, sing along or 'conduct' music, our facial expressions mirroring the rises and falls, the melodic contours and feelings of what we are hearing.

> Yet all this may occur without our knowledge or volition. All this is normal, and may be seen as a half-conscious resonance to music, a sort of involuntary personal expression as the music works on us. But these effects, the overflow of music into the motor system, can easily go too far, becoming irresistible and perhaps even coercive.

This extract essentially summarises several of the participants' everyday experiences of CMs in relation to their MI. It appears to capture the essence of CMs. Nonetheless, future research needs to examine this component of MI in order to understand its role in MI, its nature, its prevalence and perhaps attempt to do so in an experimental context.

CHAPTER 6

IMPLICATIONS, LIMITATIONS, RECOMMENDATIONS AND CONCLUSION

6.1. THEORETICAL AND PRACTICAL IMPLICATIONS

This Chapter serves to conclude the research report by integrating final annotations regarding this study. It initially summarises the main theoretical and practical implications of this investigation, including its underlying strengths. It then discusses the primary limitations of the research in light of the method, procedure, analysis and results. Finally, it concludes by indicating potential areas for future scientific enquiries relating to MI as well as providing a succinct review of the general findings.

The two central strengths of this study are the use of mixed methods and the conceptual contributions it offers. Since the overarching aim of this study was to explore the everyday experiences of MI, the experience-sampling methodology was demonstrated as an effective technique to achieve this objective. Experience-sampling is fairly robust in its implementation and it appears to be practicable to apply in a variety of settings even if it is time-consuming and resource intensive (Klinger, 2011). Additionally, it proved to be valuable in addressing several of the drawbacks linked with retrospective self-report data (Scollon, Kim-Prieto & Diener, 2003).

Accordingly, a wealth of descriptive data was obtained pertaining to MI through both data collection procedures. This research presents Brown's (2006) four dimensions as useful categorisation tools to classify MI and highlights their usefulness in respect of analytic methods in addition to instrument development. Since this research specifically examined the various experienced-sampled MI reports in terms of temporal properties, this is a positive analytic feature because retrospective reports should not be treated as equivalent to real-time reports. Moreover, the experienced-sampled reports were also investigated in accordance with the MI taxonomy (presented in Chapter Two). Accordingly, a notable benefit proposed by this study relates to the taxonomy of MI. This taxonomy could assist future studies focusing on the measurement and conceptualisation of MI since it provides a reasonably detailed foundation of the various MI sub-sets. The taxonomy helps integrate the different forms of MI holistically because it demonstrates how the multitude of synonyms used to describe MI phenomena (for example, earworms, PMT, sticky tunes, INMI and so forth) are

theoretically distinct even if all of them can be considered to fall within the broader umbrella label of MI. It also served to highlight that everyday experiences of MI are heterogeneous. Consequently, this research highlights the utility of the MI taxonomy for thematic analyses.

This study's results are not entirely generalisable, since the samples were relatively homogenous, and convenience sampling was employed. Nevertheless, the findings supplement existing theories of MI in two specific ways. Firstly, it presents some cross-cultural findings concerning MI (albeit limited) and provides evidence to suggest that the phenomenon is experienced outside of typical or mainstream samples (i.e. European, North American and British participants). In addition, the participants' high compliance rates in this study, especially without any intrinsic gains, is fortuitous but is certainly a positive feature. Presumably, participants' tremendous effort and levels of commitment to the experience-sampling tasks might imply that this topic is able to hold their interest, along with signifying that MI is relatively important in their daily conscious experiences.

Secondly, the results indicate, to some extent, that predictor variables potentially associated with MI include musical training/experience in addition to highlighting the importance of external/environmental music as an avenue for further investigation. Furthermore, it proposes that both the extent and the degree of daily exposure to music may be an important explanatory factor underpinning particular MI episodes. Nevertheless, these three factors certainly require further exploration and additional corroborating evidence. An overall implication of this study is that it presents several suppositions based on the amalgamation of recent research regarding novel directions for future studies which should augment theoretical understandings of this phenomenon. On the whole, this research has also provided some corroborating information on the phenomenon of MI as it naturally occurs, albeit in a specific and reasonably homogenous sample. Essentially, these propositions are not necessarily limited to experimental methods considering that this research has demonstrated the efficacy and utility of experience-sampling.

This study has systematically described what it is like to experience a 'tune inside the head' across four dimensions. It provides both ideographic data as well as aggregated and generalised trends relating to between-participant processes. It is one of the few studies on MI which utilised mixed methods and real-time sampling to assist in systematically exploring and disentangling the intricacies of the phenomenon including the co-occurrence of corporeal

manifestations and visual imagery. Clearly, there is still a great deal to be understood about MI in everyday settings as well as its aetiology and role in music perception. This study has proposed numerous hypotheses that require further investigation. Nevertheless, as with most research, it too has several limitations which are discussed below.

6.2. STUDY LIMITATIONS

Given that internal phenomena are particularly difficult to study empirically (Liikkanen, 2008; Marcel, 2003; Piccinini, 2003; Hurlburt & Heavey, 2001), the key limitations of the study also relate to the methodology[67] and each one shall be elucidated. The study was restricted, in a sense, because it was dependent on volunteers. Accordingly, the sampling strategies employed in this study were both convenient and economical which was necessary owing to limited resources (Rosnow & Rosenthal, 1996) and the relatively narrow scope of the research. Even though convenience sampling saves time and other valuable resources, it can be at the expense of generalisability (Babbie et al., 2004). Accordingly, although this study demonstrates interesting findings, a caveat remains: the reported results relate to a specific sample especially taking into account the age ranges of both Stage One and Stage Two participant groups as well as the fact that all the participants shared the commonality of being Psychology students.

Secondly, the reliability of the two instruments employed in this study could not be adequately evaluated[68]. Since the construct of MI is multi-faceted, the SMIQ attempted to document its various domains and resultantly, it may appear to be measuring unrelated constructs. However, justifications have been provided where content may be appear to be independent from MI. In addition, the tools were developed to address the research objectives and were intended to be bespoke instruments for the focus of the study and its methodology. Nevertheless, considering some of the results, it is possible that the experience-sampling instrument also measured a particular form of memory rather than solely capturing data concerning MI. Accordingly, the two instruments would need to be independently evaluated for their reliability and validity. Construct validation of the two instruments could not be ascertained since no related/unrelated measures were administered to either sample group. Given that there were content overlaps between the SMIQ and Bailes' (2007) ESF, as well as

[67] See Sutton (2011) for a critical review of DES methodology.
[68] Both instruments are not scales (they are not additive), and they are multi-dimensional; thus, Cronbach's alphas could not to be calculated as estimates of reliability (Cohen & Swerdlik, 2005).

Wammes and Barušs (2009) MIQ, it would not have been suitable to co-administer those instruments as measures of convergent validity. Thus, convergent validity could not be determined and no correlation coefficients were calculated or interpreted to assess these components of validity (Murphy & Davidshofer, 2005). Lastly, limited resources and ethical protocols excluded the employment of a third party to independently code the raw data. Consequently, Cohen's Kappa was not calculated and resultantly no inter-coder reliability estimates (Devlin, 2006) are available for the thematic content analysis.

The third set of limitations relates to complexities typically grappled with during research involving first-person reports. The implementation and administration of the SMIQ was partly problematic given the thorny issue of whether participants should receive training. This is a general dilemma in studies analogous to this one. Perhaps if the pilot had been for a longer duration, other practical issues that arose during the Stage Two study would have been identified in advance. For instance, examination of the pilot journals suggested that training was not necessary given that instructions appeared to be well understood. This was not necessarily the case in the Stage Two phase. Certain individuals may have misinterpreted particular questions. One participant remarked upon returning their journal that they were not sure how to respond to the question relating to the link between the corporeal manifestations and the MI. In this regard, it may have been beneficial to explain each question contained with the experience-sampling instrument purely for clarification purposes since expositional interviews were not feasible. It may also have been useful to the participants if specific examples had been provided in the instructions in order to spell out what kinds of mental imagery did not constitute an episode of MI. This would have been helpful since a few journal entries indicated that the MI was identical to an external source of music. Thus, it was unclear if the participant simply perceived music or if they were simultaneously imagining music that was also being heard. This created certain ambiguities regarding the analysis of such descriptions. Accordingly, traditional DES expositional interviews would have been advantageous in terms of clarifying the essential nature of such ambiguous responses.

Moreover, there is a possibility that certain participants experienced reactivity to the methodology (Scollon, Kim-Prieto & Diener, 2003). This is another characteristic predicament related to studies utilising repeated measures (such as experience-sampling) as well as activities which require persistent introspection activities (Scollon, Kim-Prieto & Diener, 2003). It is difficult to ascertain whether participants are paying extra or

uncharacteristic attention to internal phenomena (Scollon, Kim-Prieto & Diener, 2003) such as MI. However, in this study, the main control mechanism for this form of reactivity was the unpredictability of the SMS-prompt, from the participants' viewpoint. In other words, the researcher controlled the timing of the prompting signal. Thus, the experienced-sampled data is assumed to include reports of MI experiences immediately after the prompt was received as opposed to inadvertently or spontaneously generated reports which could transpire from repeated measures. Presumably using random prompting is a more reliable method of controlling for reactivity in comparison to retrospective reports, diary-based research methods and phenomenological self-analyses.

As mentioned, conventional DES methodology uses a "sampling-then-interviewing process" which is cyclical and spans over a number of days (Hurlburt & Heavey, 2004, p.118). Typically, DES requires a research team in order to complete this cyclical process (Hurlburt & Akhter, 2006). Expositional interviews were not feasible for the current study since both fiscal and ethical constraints prevented the training and remuneration of research assistants. Additionally, the scope of the research had to be restricted owing to time constraints. Thus, the current study is an adaptation of conventional DES methodology. Hurlburt (2011) suggests that the iterative nature of DES method aims to automatically train participants in the introspective task. Accordingly, it could be argued that expositional interviews could introduce some reactivity during the daily interview process as demand characteristics are more likely to arise. Interactions with the researcher through recurring interviews could influence the participant to inadvertently alter reports on facets of their experience based on the way the researcher's phrases their questions. Additionally, the interviewer could inadvertently introduce biases in their interpretation of participant's experiences which could carry over into analyses. Although this study may not demonstrate as rich or thick data as traditional DES studies, it aimed to systematically capture real-time MI experiences through the SMIJs. Moreover, as previously noted in Chapter 3, the questions within the SMIJ were carefully constructed and piloted to ensure that the SMIQs were able to function in a similar manner to the expositional interviews with the intention of being considered as iterative in nature.

The final limitation of this study concerns a statistical technique which was utilised for specific variables. In terms of the Fisher-Freeman-Halton tests which were performed, each observation was mutually exclusive (no observation could have fallen into more than one

cell). However, the marginals were unable to be fixed by the researcher *a priori* (Howell, 1997) since the characteristics of the sample were determined by the convenience sampling strategy. Accordingly, one of the tests assumptions was violated. However, it has been suggested that this assumption is widely ignored in practice (Fong, Lee & Lau, 2008) and that it can be difficult to generate the set of reference tables with the required fixed marginals (Agresti, 1992). Furthermore, if the marginals were to have been fixed *a priori*, the researcher would have ideally chosen a balanced sample for the two nominal variables (gender and musical training/experience). By pure chance, the musical training/experience marginal turned out as would have been intended if quota sampling had been employed. Nevertheless, the statistical and descriptive findings highlight a number of interesting and novel avenues for future MI studies to investigate.

6.3. FUTURE RECOMMENDATIONS

Various recommendations pertaining to future research have already been alluded to in the discussion. However, the most pertinent ones shall be succinctly explicated below for clarity purposes. The following set of potential relationships or observations, could serve to facilitate future research endeavours relating to MI:

i. the nature and degree of personal (emotional and/or cognitive) associations in relation to the aetiology of involuntary MI across different contexts;
ii. exploring the vividness, loudness and clarity of various dimensions of MI across different activities and in different situations;
iii. the relationship of dual imagery (MI and another imagery modality) specifically focusing on which imagery modality is the precursor and their relationship to memory processes;
iv. the characteristics and aetiology of truly spontaneous episodes of MI;
v. exploring statistical or theoretical models of predictive variables which might explain the role and variations in different MI experiences;
vi. theoretical frameworks concerning the cyclic and repetitive nature of involuntary MI and memory processes;
vii. the role, nature and prevalence of corporeal manifestations in relation to MI across various sample groups (such as performing artists, professional dancers, and different levels of musical training);

Additionally, future research might attempt to investigate the types of activities engaged in and the presence of others during the initial onset of involuntary MI despite the obvious difficulties associated with this endeavour. If reliable investigations are undertaken, they are likely to provide important evidence regarding the aetiology of the various MI sub-types.

6.4. CONCLUSION

This study has presented a variety of data specifically related to the everyday occurrence of MI using experience-sampling methodology. It has also demonstrated that relative to other modalities of mental imagery, MI is an understudied phenomenon. Additionally, it has provided some evidence pertaining to the dimensions of MI as it is experienced during everyday waking states. This research has proposed a few speculative theories concerning MI that appear to have some merit. For example, even though everyday MI is experienced by the imager as involuntarily and seemingly spontaneous in nature, the experienced-sampled data indicates that it might arise from recent priming. In other words, the content of the MI was recently heard from external auditory stimuli and the episode is not strictly spontaneous. Although recency and repeated exposure are factors which have been alluded to in previous studies, it is reasonably patent from the findings in this study that these dimensions appear to underpin everyday MI incidents observed in this research. Furthermore, MI is consistently experienced by various individuals regardless of their musical background even though musicians may have a higher inclination toward MI occurrences. Essentially, daily exposure to music appears to be an equally significant factor in especially since most episodes of MI are usually familiar to the respective imagers. In conclusion, there certainly is an extensive scope for future MI research to examine. Prospective research ought to consider utilising an assortment of complementary methods given that the phenomenon is remarkably multifaceted and it certainly necessitates additional scientific examination given the paucity of research investigating MI, particularly in everyday contexts.

APPENDICES

APPENDIX A: Demographics Questionnaire

Section A: General Information

(1) Age:_____

(2) Gender (*place an 'X' in the appropriate column)*

Female	Male

(3) Do you have any of the following conditions to the best of your knowledge?

(a) Epilepsy

(experiencing seizures or convulsions where you lose awareness of your environment)

(*place an 'X' in the appropriate column)*

Yes	No

(b) Significant Hearing Loss

(unable to listen to external sounds very well)

(*place an 'X' in the appropriate column)*

Yes	No

(c) Sustained a severe **head injury** that caused a bad concussion or unconsciousness?

(*place an 'X' in the appropriate column)*

Yes	No

(4) How would you rate your English proficiency?

Excellent	
Good	
Adequate	

Section B: Musical History

(1) Do you play any musical instrument(s) either professionally or for fun?

Note: *In this questionnaire, singing/choir is also considered a musical instrument.* For example, the instrument would be 'Voice' and you began 'playing' when you started voice training or choir.

Yes	No

(a) If Yes, please list the instrument(s) you play?

_____

_____

_____

(b) At what age(s) did you begin playing your instrument(s)?

* Instrument 1:_____
* Instrument 2:_____
* Instrument 3:_____
* Instrument 4:_____

(c) How many years of formal training have you had?

* Instrument 1:_____
* Instrument 2:_____
* Instrument 3:_____
* Instrument 4:_____

(d) Approximately how many hours per week to do you play or practice?

* Instrument 1:_____
* Instrument 2:_____
* Instrument 3:_____
* Instrument 4:_____

(2) Have you ever performed your instrument in public (in front of more than ten people)?

Yes	**No**

(a) If Yes, approximately how many times have you done so?

(*place an 'X' where appropriate)*

Never	
1 to 5	
6 to 10	
11 to 15	
More than 15	

(3) Do you listen to music everyday?

Yes	**No**

(a) If Yes, approximately how many hours per day do you listen to music?

(*place an 'X' in where appropriate)*

None	
1 to 3 hours	
4 to 6 hours	
7 to 9 hours	
More than 9 hours	

If you have any additional comments about your musical history, please add them below:

_____

_____

_____

_____

Section C: Spontaneous Musical Imagery

(1) How often do you hear music or pieces of music 'in your head' (that is, in the absence of any external source)?

(*place an 'X' where appropriate)*

Once a month	
Once a week	
2 to 3 times a week	
4 to 5 times a week	
6 to 7 times a week	
A few (1 to 3) times every day	
Many (4 or more) times every day	

(2) Generally speaking, at what time(s) does this mostly happen (choose as many of the following as necessary)?

Early morning	
Mid-morning	
Afternoons	
Evenings	
Late night	

Section D: Personal Code

Please create a personal code by using the last letter of your first name, with the first letter of your mother's maiden name and then combining it with the last two numbers of your student number.

For instance, my name ends with the letter 'N' and my mother's maiden name begins with 'G' and the last two digits of my student number are 60. Thus, my code would be: **NG60**.

Please enter your code in the box below.

If you would be willing to participate in the second part of this study (involving the Spontaneous Music Imagery Journal), please provide the following contact details:

Cellular phone number: _____

Email address: _____

Please return your completed questionnaire to me or drop it off at Room U211 located on the second Floor of the Umthombo Building at WITS.

THANK YOU!

APPENDIX B: Spontaneous Musical Imagery Questionnaire

SMIQ Day One (No.1)

Section A:

(1) Time SMS was received: _____

Time SMS was read: _____

Time of filling in SMIQ (questionnaire): _____

(2a) Did you wake up with any music in your head?

Yes	No

(2b) If **Yes**, please describe in as much detail as possible what you are hearing. You may include the song name if you know it.

_____

_____

_____

_____

(3) Are you currently hearing any music in your head?

Yes	No

(4) If **No**, please move directly onto ***Sections C and D.***

(5) If **Yes**, please describe in as much detail as possible what you are hearing. You may include the song name if you know it.

_____

_____

_____

_____

(6) Is the music you are hearing mostly an instrumental piece or a vocal piece?

_____

_____

_____

(7) Please also discuss if what you are hearing is a full song, part of a song or a repeated loop *(a piece of music that plays over and over*).

_____

_____

_____

(8) Is the music familiar to you?

Yes	No

(9) If **Yes**, when do you think you might have heard it last?

_____

_____

_____

_____

_____

(10) If **No**, how would you describe it – style and genre that it sounds similar to?

_____

_____

_____

(11) Are you aware of any association between the music and some important personal event or occasion?

Yes	No

(12) Did the music just 'pop into your head', or would you say you thought about or chose the music? Please explain.

_____

_____

_____

_____

(13) Is your experience of the music as if the volume is soft (like background music) or quite loud? Please elaborate.

_____

_____

_____

(14) Please circle the number that best describes the **clarity** of the following features of the tune in your head (if applicable):

	Absent						**Very sharp/clear**
Melody (tune)	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Lyrics (words / singing)	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Rhythm (beat)	**1**	**2**	**3**	**4**	**5**	**6**	**7**

(15a) What other mental imagery was present when you heard music in your head (choose as many options as necessary)?

None	
Music video	
Musical score or notation	
Imagining how you would dance to the music	
Imagining how you might play the music on an instrument	
Other imagery	

(15b) If **other** mental imagery is present, please describe it.

_____

_____

_____

_____

_____

_____

(16) Please judge how distracting you are finding the music.

Not distracting at all	
Mildly distracting	
Moderately distracting	
Severely distracting	

Section B:

(1a) Are you experiencing or doing anything with your body that you would link directly with the music?

Yes	No

(1b) If **Yes**, please describe what that is. For example, finger or foot-tapping, humming, moving your head etc.

_____

_____

_____

(1c) If **Yes**, would you say these bodily movements feel voluntary or involuntary?

Involuntary	Voluntary

(2) How would you describe the link or connection between the music and the bodily movements?

_____

_____

_____

_____

_____

Section C:

(1) Are you presently hearing any music from an external source?

Yes	No

(2) If **Yes**, and you are also hearing music 'in your head', is the external music the same or different from the music in your head?

Same	Different

(3) If you are hearing external music, can you briefly describe it and where it is coming from?

_____

_____

_____

Section D:

(1) What activity were you engaged in immediately prior to receiving the SMS?

_____

_____

_____

(2a) Where you alone or with other people?

Alone	With Others

(2b) If you were not alone, how many people were you with?

_____

_____

SMIQ Day One (No.2)

Section A:

(1) Time SMS was received: _____

Time SMS was read: _____

Time of filling in SMIQ (questionnaire): _____

(2) Are you currently hearing any music in your head?

Yes	No

(3) If **No**, please move directly onto ***Sections C and D*.**

(4) If **Yes**, please describe in as much detail as possible what you are hearing. You may include the song name if you know it.

_____

_____

_____

_____

(5) Is the music you are hearing mostly an instrumental piece or a vocal piece?

_____

_____

_____

(6) Please also discuss if what you are hearing is a full song, part of a song or a repeated loop *(a piece of music that plays over and over*).

_____

_____

_____

_____

_____

(7) Is the music familiar to you?

Yes	No

(8) If **Yes**, when do you think you might have heard it last?

(9) If **No**, how would you describe it – style and genre that it sounds similar to?

(10) Are you aware of any association between the music and some important personal event or occasion?

Yes	No

(11) Did the music just 'pop into your head', or would you say you thought about or chose the music? Please explain.

(12) Is your experience of the music as if the volume is soft (like background music) or quite loud? Please elaborate.

(13) Please circle the number that best describes the **clarity** of the following features of the tune in your head (if applicable):

	Absent						**Very sharp/clear**
Melody (tune)	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Lyrics (words / singing)	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Rhythm (beat)	**1**	**2**	**3**	**4**	**5**	**6**	**7**

(14a) What other mental imagery was present when you heard music in your head (choose as many options as necessary)?

None	
Music video	
Musical score or notation	
Imagining how you would dance to the music	
Imagining how you might play the music on an instrument	
Other imagery	

(14b) If **other** mental imagery is present, please describe it.

_____

_____

_____

_____

(15) Please judge how distracting you are finding the music.

Not distracting at all	
Mildly distracting	
Moderately distracting	
Severely distracting	

Section B:

(1a) Are you experiencing or doing anything with your body that you would link directly with the music?

Yes	**No**

(1b) If **Yes**, please describe what that is. For example, finger or foot-tapping, humming, moving your head etc.

_____

_____

_____

(1c) If **Yes**, would you say these bodily movements feel voluntary or involuntary?

Involuntary	Voluntary

(2) How would you describe the link or connection between the music and the bodily movements?

_____

_____

_____

_____

Section C:

(1) Are you presently hearing any music from an external source?

Yes	No

(2) If **Yes**, and you are also hearing music 'in your head', is the external music the same or different from the music in your head?

Same	Different

(3) If you are hearing external music, can you briefly describe it and where it is coming from?

_____

_____

_____

_____

Section D:

(1) What activity were you engaged in immediately prior to receiving the SMS?

(2a) Where you alone or with other people?

Alone	With Others

(2b) If you were not alone, how many people were you with?

(3a) If you are not hearing music in your head, when was the last time you were aware of music in your head since your last journal entry?

(3b) Please describe in as much detail as possible what you were hearing the last time this happened.

SMIQ Day One (No.3)

Section A:

(1) Time SMS was received: _____

Time SMS was read: _____

Time of filling in SMIQ (questionnaire): _____

(2) Are you currently hearing any music in your head?

Yes	No

(3) If **No**, please move directly onto ***Sections C and D*.**

(4) If **Yes**, please describe in as much detail as possible what you are hearing. You may include the song name if you know it.

_____

_____

_____

_____

(5) Is the music you are hearing mostly an instrumental piece or a vocal piece?

_____

_____

_____

_____

(6) Please also discuss if what you are hearing is a full song, part of a song or a repeated loop *(a piece of music that plays over and over*).

_____

_____

_____

_____

(7) Is the music familiar to you?

Yes	No

(8) If **Yes**, when do you think you might have heard it last?

(9) If **No**, how would you describe it – style and genre that it sounds similar to?

(10) Are you aware of any association between the music and some important personal event or occasion?

Yes	No

(11) Did the music just 'pop into your head', or would you say you thought about or chose the music? Please explain.

(12) Is your experience of the music as if the volume is soft (like background music) or quite loud? Please elaborate.

(13) Please circle the number that best describes the **clarity** of the following features of the tune in your head (if applicable):

	Absent						**Very sharp/clear**
Melody (tune)	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Lyrics (words / singing)	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Rhythm (beat)	**1**	**2**	**3**	**4**	**5**	**6**	**7**

(14a) What other mental imagery was present when you heard music in your head (choose as many options as necessary)?

None	
Music video	
Musical score or notation	
Imagining how you would dance to the music	
Imagining how you might play the music on an instrument	
Other imagery	

(14b) If **other** mental imagery is present, please describe it.

_____

_____

_____

(15) Please judge how distracting you are finding the music.

Not distracting at all	
Mildly distracting	
Moderately distracting	
Severely distracting	

Section B:

(1a) Are you experiencing or doing anything with your body that you would link directly with the music?

Yes	**No**

(1b) If **Yes**, please describe what that is. For example, finger or foot-tapping, humming, moving your head etc.

_____

_____

_____

_____

(1c) If **Yes**, would you say these bodily movements feel voluntary or involuntary?

Involuntary	Voluntary

(2) How would you describe the link or connection between the music and the bodily movements?

_____

_____

_____

_____

Section C:

(1) Are you presently hearing any music from an external source?

Yes	No

(2) If **Yes**, and you are also hearing music 'in your head', is the external music the same or different from the music in your head?

Same	Different

(3) If you are hearing external music, can you briefly describe it and where it is coming from?

_____

_____

_____

_____

Section D:

(1) What activity were you engaged in immediately prior to receiving the SMS?

(2a) Where you alone or with other people?

Alone	With Others

(2b) If you were not alone, how many people were you with?

(3a) If you are not hearing music in your head, when was the last time you were aware of music in your head since your last journal entry?

(3b) Please describe in as much detail as possible what you were hearing the last time this happened.

APPENDIX C: Self-Reflexivity Report

The aim of this short report is to document personal information relevant to the researcher that may have influenced both the perceptions of Musical Imagery (MI) and the interpretation of the study's findings in accordance with good qualitative practices. Given that the study utilised methods triangulation, and in view of the fact that there was limited direct contact with the participant's, the information that shall be reported is mainly in relation to the researcher's own musical history and MI experiences.

Demographic Details

The researcher is a white, female middle-class South African citizen. The researcher is 27 years old[69] and her home language is English. She currently plays drums for a rock band for enjoyment rather than as a professional endeavour.

Musical History and Activities

The instruments the researcher can play include acoustic and electronic drums. She began playing the former at the age of 13 and the latter from the age of 22. She attended a six-week beginner drumming course at the age of 13. These lessons were group lessons which consisted of a two-hour tutorial per week with three other beginner drummers. She then attended one-on-one tutorials with the same instructor for a period of a year. These lessons were an hour long and she attended on a weekly basis.

After joining her first band around the age of 14, she attended lessons aimed at grasping the essentials for rock drumming with a different instructor for another two years. Her last lesson was at the age of 16. Thus, her formal training spanned a three-year period and it included learning to read drum notation, being taught basic rudiments and understanding commonly used time-signatures. She would rate her proficiency as a drummer as beginner to intermediate. She currently practices drums between two to four hours per week.
She has performed with various rock bands in public[70] approximately 30 times. The researcher listens to music in the region of four to six hours every day, usually whilst working and driving. The genres of music the researcher enjoys includes, metal, progressive

[69] At the time the research report was compiled (Date of birth: 12-08-1983).
[70] As defined by the demographics questionnaire, public performances involve live concerts in front of ten or more people.

metal, alternative, grunge, punk, hard rock, instrumental music, acid jazz, some classical music and hip hop.

Musical Imagery (MI)

Prior to the commencement of the study, the researcher estimated that she heard MI once or twice a week, usually during day-time periods. The content of her MI tended to involve drum beats and rhythms which were coupled with corporeal manifestations of hand-tapping, foot tapping, and miming the act of playing drums.

Throughout the study, the researcher became aware of reactivity to the construct. She experienced a sharpened awareness to the occurrence of her MI particularly during the experience-sampling phase and data analysis stages. The researcher's self-reported MI may have been at least once a day during those periods, often upon waking and during activities related to the study. The content of these MI episodes frequently included looped fragments of recently heard music and musical fragments that appeared to be triggered by textual references discussed in the participant's journals.

As the study progressed, her MI episodes declined. This may either be as a result of a reduction in attentiveness to the phenomenon or owing to fewer additional stimuli having been simultaneously present. Thus, her existing MI is approximately two to three times per week. It also has a slighter more spontaneous character given that it frequently involved familiar but not recently heard compositions. Most of the researcher's MI predominantly involved repeated loops of musical fragments that were characteristically a blend of vocal and instrumental compositions. However, MI consisting purely of drumming rhythms remains a consistent feature of her MI.

Corporeal manifestations are experienced relatively regularly both in response to music perception (music emanating from an external source) and with respect to MI episodes. Typical corporeal manifestations include tapping (feet, hands and fingers) which tend to be expressions of the underlying rhythm as well as metering; sub-vocalizations (humming and soft singing) are usually associated with the melody; and there is also routine mimicry of drumming movements. Initially these motor responses are experienced as automatic or

involuntary but they are both controllable and voluntary once the researcher becomes sufficiently aware of them.

Multimodal imagery was not a common feature of the researcher's MI. Visual imagery tended to rarely occur simultaneously with MI episodes. This may be owing to the fact that the researcher has difficulty visualising imagery voluntarily and can usually only perform such tasks with her eyes open.

In general, the researcher's MI episodes are relative soft to moderate in volume and are usually only distracting during activities that require full attentiveness to the task at hand or if the MI is not within her musical preferences. If the MI spans longer then a period of an hour or two, then the level of distraction increases as the MI persists. However, if the researcher does not allow herself to consciously focus on the MI, it frequently dissipates after a short period.

Conclusion

Thus, the researcher's own experiences and theoretical knowledge of MI may have influenced the interpretation of the data. However, the researcher did endeavour to remain objective in her understanding of the participant's individual episodes rather than trying to deduce patterns in the data arising from her own MI experiences. She acknowledges that there are individual variations concerning this phenomenon and her MI experiences should not be an overriding point of reference.

APPENDIX D: Ethical Clearance Certificate

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

HUMAN RESEARCH ETHICS COMMITTEE (SCHOOL OF HUMAN & COMMUNITY DEVELOPMENT

CLEARANCE CERTIFICATE	**PROTOCOL NUMBER: MPSYC/09/001 IH**
PROJECT TITLE:	Exploring Persistent and Spontaneous Musical Imagery
INVESTIGATORS	Bronwyn Sherriff
DEPARTMENT	Psychology
DATE CONSIDERED	15/04/09
DECISION OF COMMITTEE*	Approved

This ethical clearance is valid for 2 years and may be renewed upon application

DATE: 01 June 2009

CHAIRPERSON _____
(Professor K. Cockcroft)

cc Supervisor: Michael Pitman
Psychology

DECLARATION OF INVESTIGATOR (S)

To be completed in duplicate and **one copy** returned to the Secretary, Room 100015, 10th floor, Senate House, University.

I/we fully understand the conditions under which I am/we are authorized to carry out the abovementioned research and I/we guarantee to ensure compliance with these conditions. Should any departure be contemplated from the research procedure, as approved, I/we undertake to submit a revised protocol to the Committee.

This ethical clearance will expire on 31 December 2010

PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES

APPENDIX E: Permission Forms (Psychology Department Representatives)

SCHOOL OF HUMAN & COMMUNITY DEVELOPMENT
UNIVERSITY OF THE WITWATERSRAND
Private Bag 3, WITS, 2050
Tel: (011) 717 4500 Fax: (011) 717 4559

Dear Sir/ Madam

My name is Bronwyn Sherriff, and I am conducting research for the purposes of obtaining a Masters degree in Psychology at the University of the Witwatersrand. My area of focus is exploring Spontaneous Musical Imagery.

A significant part of the research procedure involves handing out a demographics questionnaire and a Journal containing questionnaires relating to Spontaneous Musical Imagery. These will be given to students in the Department of Psychology at the University of the Witwatersrand, who willingly consent to participate in the study.

Participants are entitled to withdraw from the study at any point. There are no financial costs directly associated with participation and there are no advantages or disadvantages of participation. Every attempt will be made to keep all information collected in the study strictly confidential and anonymous. Participants will not be identified by name if the results are published.

In order to collect the relevant research information using Psychology students, I require your written approval. If you are willing to allow data collection to be carried out, please fill in the permission slip attached to the bottom of this letter.

Should you wish to contact me in respect of any queries or in relation to the proposed dates and times of the data collection, I can be reached by telephone or e-mail.

Bronwyn Sherriff (Cell) 082 401 1049 (E-mail) cannibal.pixie@gmail.com

Your cooperation would be greatly appreciated.

Yours faithfully

B. Sherriff

PERMISSION SLIP:

I, MAMBWE KASESE-HARA hereby give permission for research questionnaires and journals to be handed out to students in the Department of Psychology at WITS University acting in my capacity as: COURSE COORDINATOR – HONOURS IN PSYCHOLOGY

Signature: _____

Date: 15/07/2007

SCHOOL OF HUMAN & COMMUNITY DEVELOPMENT
UNIVERSITY OF THE WITWATERSRAND
Private Bag 3, WITS, 2050
Tel: (011) 717 4500 Fax: (011) 717 4559

Dear Sir/ Madam

My name is Bronwyn Sherriff, and I am conducting research for the purposes of obtaining a Masters degree in Psychology at the University of the Witwatersrand. My area of focus is exploring Spontaneous Musical Imagery.

A significant part of the research procedure involves handing out a demographics questionnaire and a Journal containing questionnaires relating to Spontaneous Musical Imagery. These will be given to students in the Department of Psychology at the University of the Witwatersrand, who willingly consent to participate in the study.

Participants are entitled to withdraw from the study at any point. There are no financial costs directly associated with participation and there are no advantages or disadvantages of participation. Every attempt will be made to keep all information collected in the study strictly confidential and anonymous. Participants will not be identified by name if the results are published.

In order to collect the relevant research information using Psychology students, I require your written approval. If you are willing to allow data collection to be carried out, please fill in the permission slip attached to the bottom of this letter.

Should you wish to contact me in respect of any queries or in relation to the proposed dates and times of the data collection, I can be reached by telephone or e-mail.

Bronwyn Sherriff **(Cell) 082 401 1049** **(E-mail) cannibal.pixie@gmail.com**

Your cooperation would be greatly appreciated.

Yours faithfully

B. Sherriff

PERMISSION SLIP:

I, Karen Miller hereby give permission for research questionnaires and journals to be handed out to students in the Department of Psychology at WITS University acting in my capacity as: Coordinator.

Signature:

Date: 15/07/09

SCHOOL OF HUMAN & COMMUNITY DEVELOPMENT
UNIVERSITY OF THE WITWATERSRAND
Private Bag 3, WITS, 2050
Tel: (011) 717 4500 Fax: (011) 717 4559

Dear Sir/ Madam

My name is Bronwyn Sherriff, and I am conducting research for the purposes of obtaining a Masters degree in Psychology at the University of the Witwatersrand. My area of focus is exploring Spontaneous Musical Imagery.

A significant part of the research procedure involves handing out a demographics questionnaire and a Journal containing questionnaires relating to Spontaneous Musical Imagery. These will be given to students in the Department of Psychology at the University of the Witwatersrand, who willingly consent to participate in the study.

Participants are entitled to withdraw from the study at any point. There are no financial costs directly associated with participation and there are no advantages or disadvantages of participation. Every attempt will be made to keep all information collected in the study strictly confidential and anonymous. Participants will not be identified by name if the results are published.

In order to collect the relevant research information using Psychology students, I require your written approval. If you are willing to allow data collection to be carried out, please fill in the permission slip attached to the bottom of this letter.

Should you wish to contact me in respect of any queries or in relation to the proposed dates and times of the data collection, I can be reached by telephone or e-mail.

Bronwyn Sherriff **(Cell) 082 401 1049** **(E-mail) cannibal.pixie@gmail.com**

Your cooperation would be greatly appreciated.

Yours faithfully

BB

B. Sherriff

PERMISSION SLIP:

I, Adilic Silva hereby give permission for research questionnaires and journals to be handed out to students in the Department of Psychology at WITS University acting in my capacity as: Course Coordinator.

Signature: Silva

Date: 11/03/2009

APPENDIX F: Participant Information Sheet (1)

SCHOOL OF HUMAN & COMMUNITY DEVELOPMENT
UNIVERSITY OF THE WITWATERSRAND
Private Bag 3, WITS, 2050
Tel: (011) 717 4500 Fax: (011) 717 4559

Hello, my name is Bronwyn Sherriff, and I am conducting research for the purposes of obtaining a Masters degree in Psychology at the University of the Witwatersrand. My area of focus is examining the everyday experience of persistent and spontaneous musical imagery – in other words, hearing music that is 'in your head' rather than coming from an external source. I would like to invite you to participate in this study.

Participation in the first part of this research will initially involve filling in a questionnaire which you can give directly to me or you can drop it into a marked sealed box at Room U211 which is located on the second Floor of the Umthombo Building at WITS. It should take approximately 5 – 10 minutes to complete.

Doing so will indicate you have voluntarily consented to participate in the first stage of the study. The second part of the study requires participants who regularly experience spontaneous musical imagery, and who have not suffered from certain medical conditions. A number of participants who meet these criteria will be contacted via email with a request and instructions for keeping a journal over a period of seven days. You will also be required to create a personal code which will help me link your questionnaire anonymously to your journal. Consent to participate in the second part of the study will be requested separately.

Participation is voluntary, and you will not be advantaged or disadvantaged in any way for choosing to participate. You may leave out any questions you do not feel comfortable answering if you chose to get involved in this study and you may withdraw from the study at any point. Your questionnaire will not be seen by any person at the University of the Witwatersrand at any time, other than myself and my research supervisor. No information that could identify you would be included in the research report. Should you wish to contact me regarding any queries you have or in relation to the study, I can be reached by telephone or e-mail. Although you may not be completely anonymous to me, every effort will be made to ensure confidentiality and anonymity to others.

Once the study is complete, your demographic questionnaires will be destroyed.

Once the research report has been finalised by WITS University, I will send out a final email of a summary of my research findings in relation to persistent and spontaneous musical imagery.

I do not anticipate that filling in the questionnaire will cause you any distress but if it does upset you in any way you can withdraw immediately. The contact number for Lifeline has also been provided on this form below.

Your participation in this study would be greatly appreciated. This research will help contribute to a larger body of knowledge on spontaneous musical imagery.

Kind Regards,

Bronwyn Sherriff (Researcher) **AND** **Michael Pitman (Supervisor)**

(Cell) **082 401 1049** **(011) 717 4505**
(E-mail) **cannibal.pixie@gmail.com** **Michael.Pitman@wits.ac.za**

LifeLine National Counselling Helpline: **0861 322 322**

- This Helpline operates twenty four hours a day, seven days a week and 365 days a year
- It provides an anonymous and confidential telephonic counselling service
- Alternatively, visit **www.lifeline.org.za** as face to face counselling and e-mail options are also available.

LifeLine Johannesburg Contact Numbers

Crisis: (011) 728-1347

Office: (011) 728-1331

Website: www.lifelinejhb.org

APPENDIX G: Participant Information Sheet (2)

SCHOOL OF HUMAN & COMMUNITY DEVELOPMENT
UNIVERSITY OF THE WITWATERSRAND
Private Bag 3, WITS, 2050
Tel: (011) 717 4500 Fax: (011) 717 4559

Hello, my name is Bronwyn Sherriff, and I am conducting research for the purposes of obtaining a Masters degree in Psychology at the University of the Witwatersrand. My area of focus is examining the everyday experience of persistent and spontaneous musical imagery – in other words, hearing music that is 'in your head' rather than coming from an external source. I would like to invite you to participate in this study.

Participation in this stage of the study will involve filling in three Spontaneous Musical Imagery Questionnaires (SMIQs) per day over a period of a week. You will receive three messages on your cellular phone per day any time between 08H00 and 21H00. As soon as you receive the message and are able to do so, you would need to fill in the corresponding questionnaire in the Spontaneous Musical Imagery Journal that I will provide. Each SMIQ will take you approximately 10 – 15 minutes to complete. I will send a message and an email to you a few days prior to the start of the study asking you to collect your journals from Room U211 located on the second Floor of the Umthombo Building at WITS.

You would need to keep both the Journal and your cellular phone with you during the abovementioned times over the period of the week. I will inform you of the commencement date at a later stage via text message and email. You will also be required to create a personal code which will help me link your journal to your previous questionnaire anonymously. Once the week is finished, you would need to return your journal to a sealed, marked box labelled "Spontaneous Musical Imagery Journals", in Room U211.

Returning a Spontaneous Musical Imagery Journal to the specified location will be considered consent to participate in this part of the study.

Participation is voluntary, and you will not be advantaged or disadvantaged in any way for choosing to participate. You may leave out any questions you do not feel comfortable answering if you chose to get involved in this study, and you may withdraw from the study at any point. Your Spontaneous Musical Imagery Journal will not be seen by any person at the University of the Witwatersrand at any time, other than myself and my research supervisor.

Pseudonyms (made up names) will be used to identify your responses in all transcripts and in the research report and, in doing this, the researcher will keep responses as anonymous as possible. Thus, no information that could identify you would be included in the research report. Any feedback that will be given to the University of the Witwatersrand will be in the form of group responses and not individual experiences. Should you wish to contact me regarding any queries you have or in relation to the study, I can be reached by telephone or e-mail. Although you will not be completely anonymous to myself, every effort will be made to ensure confidentiality and anonymity to others.

Once the research report has been finalised by WITS University, I will send out a final email of a summary of the results. At this point, the Spontaneous Musical Imagery Journals will also be destroyed. However, data captured from your journal will be kept by myself for a period specified by WITS.

If participation leads to any distressing feelings or discomfort, you should withdraw immediately. The contact number for Lifeline has also been provided on this form below.

Your participation in this study would be greatly appreciated. This research will help contribute to a larger body of knowledge on spontaneous musical imagery.

Kind Regards,

Bronwyn Sherriff (Researcher) AND Michael Pitman (Supervisor)

(Cell) 082 401 1049 **(011) 717 4505**
(E-mail) cannibal.pixie@gmail.com **Michael.Pitman@wits.ac.za**

LifeLine National Counselling Helpline: 0861 322 322

- This Helpline Operates twenty four hours a day, seven days a week and 365 days a year
- It provides an anonymous and confidential telephonic counselling service
- Alternatively, visit **www.lifeline.org.za** as face to face counselling and e-mail options are also available.

LifeLine Johannesburg Contact Numbers

Crisis: (011) 728-1347

Office: (011) 728-1331

Website: www.lifelinejhb.org

APPENDIX H: Journal Instructions

(1) Please create a personal code by using the last letter of your first name, with the first letter of your mother's maiden name and then combining it with the last two numbers of your student number.

For instance, my name ends with the letter 'N' and my mother's maiden name begins with 'G' and the last two digits of my student number are 60. Thus, my personal code would be: **NG60**.

Please enter your code in the box below.

(2)Over the next week, you will receive **three text messages per day** on your cellular phone asking you to complete the corresponding Spontaneous Musical Imagery Questionnaire (SMIQ) for the day. For example, on Day One, when you receive your first SMS, fill in the SMIQ labelled Day One (No.1).

(3)If you only read the message a while after you have received it or if you are busy at the time of receiving it, please fill in the relevant SMIQ as soon as practically possible. If for instance, you are driving when you receive the message, try to become aware of the music in your head at that moment and later when it is safe to do so, fill in the appropriate SMIQ.

(4) Each SMIQ should take about 10 – 15 minutes to complete.

(5) If you receive a message and you are not aware of any music in your head then please only answer questions (1) and (2) of Section A and then answer Sections C and D.

(6) The three messages will be sent at any time between 8am and 9pm over the period of one week.

(7) Once the week is over, please return your journals to Room **U211** on the second floor of the Umthombo Building at WITS.

Thank you for your help ☺

APPENDIX I: Tables pertaining to Musical Activities

Table I. List of instrument frequencies

Instrument	Frequency	Rank
Piano	15	1
Voice / Singing	13	2
Guitar	10	3
Bass guitar	4	4
Keyboard	3	5
Drums (acoustic)	2	6
Saxophone	1	9
Trumpet	1	9
Violin	1	9
Harmonica	1	9
Djembe Drums (African hand drums)	1	9
Column Total	**52**	

Table II. Frequencies of Public Performances

Public Performance[71]	**Frequency (Percentage)**	**Rank**
1 to 5 times	16 (59.26%)	1
6 to 15 times	3 (11.11%)	3
More than 15 times	8 (29.63%)	2
Column Total	**27 (100%)**	

[71] "Public performance" was defined in the demographic questionnaire as playing an instrument in front of 'more than ten people'.

APPENDIX J: Multivariate Binomial Logistic Regression Results

Table I: Multivariate Binomial Logistic Regression Results for the ESI data utilising four predictor variables

Predictor Variable	Unadjusted Odds Ratio	Adjusted Odds Ratio	95% Confidence Intervals	
Musical training	1.849	2.852	1.571	5.178
Gender	1.113	1.982	1.066	3.686
External Music	0.491	0.434	0.242	0.777
Presence of others	0.721	0.555	0.327	0.943

Pseudo $R^2 = 0.0571$ (5.71% of the total variance is explained by the four predictors)

Table II: Multivariate Binomial Logistic Regression Results for the ESI data utilising two predictor variables

Predictor Variable	Unadjusted Odds Ratio[72]	Adjusted Odds Ratio	95% Confidence Intervals	
Musical training	1.849	2.369	1.357	4.136
Gender	1.113	1.679	0.962	2.934

Pseudo $R^2 = 0.0252$ (2.52% of the total variance is explained by the two predictors)

Table III: Multivariate Binomial Logistic Regression Results for the ESI data utilising two predictor variables

Predictor Variable	Unadjusted Odds Ratio	Adjusted Odds Ratio	95% Confidence Intervals	
Musical training	1.849	2.040	0.250	0.779
External music	0.491	0.441	1.245	3.345

Pseudo $R^2 = 0.0383$ (3.83% of the total variance is explained by the two predictors)

[72] The unadjusted musical training odds ratio increased from once gender was added to the multivariate binomial logistic regression. Similarly, the odds ratio pertaining to gender also increased during the analysis of MI in relation to gender and musical training. The large increase in these odds ratios suggests an interaction between the two predictor variables on the outcome variable. Thus, there is an increased likelihood of an episode of MI occurring if the individual is a female with musical training. In this model (where only gender and musical training were added as predictors), the Pseudo R^2 (0.0252) suggests that 2.52% of the variance in MI can be explained by these two factors.

APPENDIX K: Justifications for SMIQ Exclusions

The analysis excluded five SMIQs in total, owing to the following inconsistencies and ambiguities which are discussed below.

Participant	SMIQ	Rationale for exclusion
Four	Day 4-1	The participant stated in response to Section A (Question 9) that they last heard the song "Years back. I cannot remember when". Then in response to Question 12 (in the same SMIQ) they wrote "I just heart [sic] it play on the CD I just put in". Additionally, the answer given to Question 3 (Section C) was that the external music is the "same as the song that won't stop playing in my head. From a DVD player." Based on these annotations, the entry is problematic. It is unclear whether the individual is merely describing hearing music from an external source or whether this entry is an accurately documented case of MI.
Four	Day 5-1	The Musical Imagery On Waking (MIOW) entry was excluded from the analysis owing to the fact that it was completed more than four hours after the DES signal. This entry was reporting on MIOW at 16H00. Moreover, the description of the apparent MI was vague and it was not clear whether the description was of music originating from an external source or if it was an accurate case of MIOW. Given the excessive time lag as well as the aforementioned ambiguity in the SMIQ, it was decided that memory bias may have confounded this entry and as a result, it was excluded.
Four	Day 5-2	This journal entry had some inconsistencies which suggested misinterpretation of the concept of MI. In response to Question 4 (in Section A), they stated the following: "Some Zulu music being played by the taxi driver. I am not familiar with it". Later in the same SMIQ, they wrote: "I heard it from an external source as soon as it stopped playing, I stopped hearing it" which may suggest some confusion concerning the phrase "music in your head". Additionally, the participant did not enter a valid times regarding completion of this SMIQ entry. They state they read and received the SMS at 15H02 but completed the SMIQ at 14H00 which is obviously nonsensical. Given the aforementioned justifications, this entry was excluded from the Experienced-Sampled Imagery (ESI) analysis since the individual appeared to be describing music emanating from an external source rather than MI.

Participant	SMIQ	**Rationale for exclusion**
Four	Day 7-2	Details of the apparent MI were vague: "Different music pieces played on the TV". The participant reported hearing the same MI as music from an external source. Thus, it was unclear whether this was a clear incident of MI or a description of external music especially considering the previous case where this occurred (Day 5-2). This journal entry was excluded from the Last Recalled Imagery (LRI) analysis.
Six	Day 2-2	This entry was fairly vague since the participant merely described hearing music from an external unknown source but did not describe whether MI resultantly occurred. Since this journal entry related to the Last Recalled Imagery (LRI) section, it was excluded from the analysis since no supplementary data was available to adjudicate whether it was a valid MI episode or not.

APPENDIX L: Tables pertaining to Contextual Data

Table I. Presence of others for the Stage Two sample

Participant	Frequency of MI	Frequency of MI in the presence of others	Frequency of no MI	Frequency of no MI in the presence of others
1	11	10 (90.91%)	9	9 (100%)
2	3	2 (66.67%)	18	5 (27.78%)
3	8	2 (25.00%)	13	11 (84.62%)
4	4	4 (100%)	8	7 (87.50%)
5	3	1 (33.33%)	15	9 (60.00%)
6	2	2 (100%)	17	9 (52.94%)
7	6	3 (50.00%)	13	4 (30.77%)
8	3	2 (66.67%)	18	10 (55.56%)
9	4	0 (0.00%)	11	5 (45.45%)
10	7	3 (42.86%)	5	3 (60.00%)
11	13	8 (61.54%)	8	8 (100%)
12	7	2 (28.57%)	14	8 (57.14%)
13	6	4 (66.67%)	12	9 (75.00%)
14	10	0 (0.00%)	11	0 (0.00%)
15	14	6 (42.86%)	7	5 (71.43%)
16	4	2 (50.00%)	15	8 (53.33%)
Column Totals	**105**	**51 (48.57%)**	**194**	**110 (56.70%)**

Table II. Presence of others for the pilot sample

Participant	Frequency of MI	Frequency of MI in the presence of others	Frequency of no MI	Frequency of no MI in the presence of others
A	4	3 (75.00%)	2	1 (50.00%)
B	1	1 (100%)	4	4 (100.00%)
C	3	2 (66.67%)	1	0 (0.00%)
D	2	0 (0.00%)	1	0 (0.00%)

Table II continued:				
Participant	**Frequency of MI**	**Frequency of MI in the presence of others**	**Frequency of no MI**	**Frequency of no MI in the presence of others**
E	4	4 (100%)	1	0 (0.00%)
F	3	1 (33.33%)	3	3 (100%)
G	3	0 (0.00%)	3	1 (33.33%)
H	N/A	Unknown[73]	N/A	Unknown
Column Totals	**20**	**11 (55%)**	**15**	**9 (60%)**

Table III. Types of activities engaged for both samples

Activity	Frequency with MI	Rank	Frequency with no MI	Rank
Driving	**14**	**2**	17	5
Eating	**10**	**3**	10	8.5
Other non-university work	6	9.5	5	13.5
Relaxing	2	19	3	15.5
Self-maintenance (bathing, showering, dressing etc)	8	5.5	5	13.5
Leisure activities	3	16.5	10	8.5
Watching television/movies	8	5.5	**29**	**1**
Interacting with others	9	4	**25**	**3**
Cooking	6	9.5	7	12
Walking	3	16.5	2	18
Reading	5	12.5	10	8.5
Exercising	6	9.5	2	18
Cleaning room or house	3	16.5	3	15.5
Sleeping	5	12.5	16	6
Shopping	3	16.5	8	11
Computer work	7	7	10	8.5
Relaxing	6	9.5	2	18
Studying	**17**	**1**	**27**	**2**
Other	4	14	18	4
Column Total	125		209	

[73] Participant H did not complete any of the Section D portions for her SMIQs. Thus, there was no information relating to the presence of others or the kind of activity engaged in during the experiences of MI.

Table IV. Presence of external music for the Stage Two sample

Participant	Frequency of MI	Frequency of MI in the presence of external music (Percent %)	Frequency of no MI	Frequency of no MI in the presence of external music (Percent %)
1	11	6 54.54%	9	4 44.44%
2	3	1 33.33%	18	9 50.00%
3	8	1 12.5%	13	5 38.46%
4	4	2 50.00%	8	2 25.00%
5	3	0 0.00%	15	1 6.67%
6	2	1 50.00%	17	1 5.88%
7	6	1 16.67%	13	8 61.54%
8	3	1 33.33%	18	10 55.56%
9	4	1 25.00%	11	8 72.73%
10	7	1 14.29%	5	2 40.00%
11	13	1 7.69%	8	5 62.5%
12	7	1 14.29%	14	8 57.14%
13	6	1 16.67%	12	0 0.00%
14	10	2 20.00%	11	1 9.09%
15	14	2 14.29%	7	1 14.29%
16	4	0 0.00%	15	3 20.00%
Column Total	**105**	**22 (20.95%)**	**194**	**68 (35.05%)**

Table V. Presence of external music for the pilot sample

Participant	Frequency of MI	Frequency of MI in the presence of external music (Percent %)	Frequency of no MI	Frequency of no MI in the presence of external music (Percent %)
A	4	3 75.00%	2	2 100%
B	1	0 0.00%	4	2 50.00%
C	3	0 0.00%	1	1 100%
D	2	0 0.00%	1	1 100%
E	4	4 100%	1	0 0.00%
F	3	1 33.33%	3	1 33.33%
G	3	1 33.33%	3	2 66.67%
H	N/A	Unknown	N/A	Unknown
Column Total	**20**	**9** **45%**	**15**	**9** **60%**

APPENDIX M: Tables pertaining to the Content of Musical Imagery

Table I. Overview of Recurring MI

Participant (Gender; Musician)	**Artist**	**Song Title**	**Type of MI**	**SMIQ Number**	**Last Recalled Exposure**	**Volume**
Participant 7 (male; musician)	Tool	"Schism"	Involuntary MI – A specific thought triggered it	Day 1, Number 3	Within the last week	Soft
	Tool	"Schism"	LRI	Day 2, Number 2	Not specified	Not specified
	Tool	"Schism"	LRI	Day 3, Number 3	Not specified	Not specified
	Tool	"Schism"	LRI	Day 5, Number 2	Not specified	Not specified
	Tool	"Schism"	LRI	Day 6, Number 2	Not specified	Not specified
Participant 9 (male; non-musician)	Eminem	"Hello"	Involuntary MI – A specific thought triggered it	Day 1, Number 3	Previous day	Loud
	Eminem	"Stay Wide Awake"	Involuntary MI – 'Popped' into awareness	Day 7, Number 1	Within the last week	Soft
	Eminem	"Medicine Ball"	LRI	Day 7, Number 2	Not specified	Not specified
	Eminem	"Medicine Ball" and "Must be the Ganja"	LRI	Day 7, Number 3	Not specified	Not specified
	Corinne Bailey Rae	"Day-dreaming"	MIOW	Day 2, Number 1	Not specified	Not specified
	Corinne Bailey Rae	"Munich"	MIOW	Day 3, Number 1	Not specified	Not specified

Table I continued						
Participant (Gender; Musician)	**Artist**	**Song Title**	**Type of MI**	**SMIQ Number**	**Last Recalled Exposure**	**Volume**
Participant 15 (male; musician)	Tool	"10 000 Days"	Involuntary MI – 'stuck' in memory after recent exposure	Day 1, Number 3	Same day	Loud
	Tool	"The Pot"	Involuntary MI – 'stuck' in memory after recent exposure	Day 4, Number 3	Same day	Moderate
	Tool	"The Pot"	Involuntary MI – 'stuck' in memory after recent exposure	Day 5, Number 3	Same day	Moderate
	Tool	"Reflection"	Involuntary MI – 'stuck' in memory after recent exposure	Day 7, Number 2	Same day	Moderate
	Tool	"10 000 Days"	Involuntary MI – 'stuck' in memory after recent exposure	Day 7, Number 3	Same day	Moderate
	Porcupine Tree	"Wedding Nails"	MIOW	Day 2, Number 1	Previous day	Moderate
	Porcupine Tree	"Anaesthetize"	Involuntary MI – 'stuck' in memory after recent exposure	Day 3, Number 2	Same day	Soft

Table I continued						
Participant (Gender; Musician)	**Artist**	**Song Title**	**Type of MI**	**SMIQ Number**	**Last Recalled Exposure**	**Volume**
Participant 15 (male; musician)	Porcupine Tree	"Trains"	Involuntary MI – 'stuck' in memory after recent exposure	Day 3, Number 3	Same day	Moderate
	Porcupine Tree	"Collapse the Light into Earth"	LRI	Day 4, Number 2	Not specified	Not specified
	Porcupine Tree	"Glass tree shattering"	LRI	Day 6, Number 3	Not specified	Not specified
	Porcupine Tree	"Anaesthetize"	MIOW	Day 7, Number 1	Not specified	Not specified

APPENDIX N: Tables pertaining to the Nature of Musical Imagery

Table I. Frequencies for personal associations with the MI for the Stage Two sample

Participant	Frequency for the presence of personal associations	Frequencies for the absence of personal associations	Percentage of personal associations	Total
1	2	10	20%	**12**
2	0	3	0%	**3**
3	0	8	0%	**8**
4	1	3	33.33%	**4**
5	0	4	0%	**4**
6	1	1	50%	**2**
7	4	2	66.67%	**6**
8	1	2	33.33%	**3**
9	1	6	14.29%	**7**
10	4	4	50%	**8**
11	3	10	23.08%	**13**
12	0	7	0%	**7**
13	0	9	0%	**9**
14	6	4	60%	**10**
15	3	11	21.43%	**14**
16	0	6	0%	**6**
Column Totals:	**26**	**90**	**22.41%**	**116** [*74]

Table II. Frequencies for personal associations with the MI for the pilot sample

Participant	Frequencies for the presence of personal associations	Frequencies for the absence of personal associations	Percentage of personal associations	Total
A	2	2	50%	**4**
B	0	1	0%	**1**
C	2	2	50%	**4**
D	0	2	0%	**2**
E	2	3	40%	**5**
F	0	3	0%	**3**
G	0	3	0%	**3**
H	1	6	14.29%	**7**
Column Totals:	**7**	**22**	**24.14%**	**29**

[*74] This total includes DESI incidences and voluntary MI cases.

Table III. Simultaneous occurrence of dual imagery for the Stage Two sample

Participant	Frequency of MI	Frequency of visual imagery	Percentage of times both imagery co-occurred
1	12	9	75%
2	3	2	66.67%
3	8	2	25%
4	4	1	25%
5	4	0	0%
6	2	2	100%
7	6	6	100%
8	3	1	33.33%
9	7	0	0%
10	8	3	37.5%
11	13	10	76.92%
12	7	1	14.29%
13	9	1	11.11%
14	10	6	60%
15	14	12	85.71%
16	6	0	0%
Column Totals:	**116**	**56**	**48.28%**

Table IV. Simultaneous occurrence of dual imagery for the pilot sample

Participant	Frequency of MI	Frequency of visual imagery	Percentage of times both imagery co-occurred
A	4	1	25%
B	1	1	100%
C	4	4	100%
D	2	1	50%
E	5	4	80%
F	3	0	0%
G	3	0	0%
H	7	4	57.14%
Column Totals:	**29**	**15**	**51.72%**

Table V. Frequencies with respect to level of distraction of the MI for the Stage Two sample

	Level of distraction	Frequency of rating	Total number of observations	Percent
(f)	Not distracting at all	61	105	**58.10%**
	Mildly distracting	24	105	22.86%
	Moderately distracting	15	105	14.29%
	Severely distracting	5	105	4.76%

Table VI. Frequencies with respect to level of distraction of the MI for the pilot sample

	Level of distraction	Frequency of rating	Total number of observations	Percent
(f)	Not distracting at all	12	25	**48%**
	Mildly distracting	6	25	24%
	Moderately distracting	7	25	28%
	Severely distracting	0	25	0%

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