Improving Analogical Reasoning Skills in Adolescence Through Figurative Music Lyric Exposure: Towards better decision-making skills

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Declaration.

This thesis project contains no material that has been accepted for the award of any other degree or diploma in any university or other institution, and to the best of my knowledge and belief, it contains no material previously published or written by another person(s), except where due reference is made.

The ethical principles and procedures specified by the Australian Catholic University’s policy document on Human Research and Experimentation have been adhered to in the preparation of this report.

Signed

Date
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Again, and always... Kaboom, Kaboom!!!
Abstract

Adolescents are known through both anecdotal and empirical research to be poor decision-makers; especially when risk is involved. Numerous factors are highlighted as influential to decision-making in adolescence; however, no complete understanding has been offered despite the endeavour. Understanding is suggested to be key to decision-making, and analogical reasoning is key to understanding. In addition, figurative-language comprehension skills are reported to be practically identical in their neurological mapping as analogical reasoning skills. Furthermore, lyrical music can be heavily represented by figurative language; and adolescents are exposed to lyrical musical for up to a quarter of their waking days. The existing research on specific effects of music lyrics is limited to its declarative content. Linguistic-structural parameters, such as metaphoricity and other forms of figurativeness, have yet to be investigated. The extant literature suggests such stimuli are important for the acquisition of behavioural idiosyncrasies, knowledge structures, and schemas/scripts acquired during adolescence. This study aimed to examine the effects of exposure to lyrically figurative music, compared to lyrically literal music, on cognitive performance (i.e., analogical reasoning) in an adolescent and young adult sample (14-24 years). 31 participants (M_{age} = 17.4 years, SD = 2.54) were recruited from secondary and tertiary institutions in the Melbourne metropolitan area, and randomly assigned to either a ‘figurative-lyric exposure’ group or a ‘literal-lyric exposure’ group. Participants were scored on their analogical reasoning skills before and after an experimental induction of music lyric type. Demographic variables served as covariate measures on the effect of exposure to lyrical-music stimuli on a measure of analogical reasoning. The results showed that participants in the figurative-lyric exposure group exhibited significantly greater transient increases in analogical reasoning skills compared to participants in the literal-lyric exposure group. The figurative-lyric exposure effects were consistent across age, gender, and extracurricular activity involvement. Furthermore, the effect remained significant after controlling for existing analogical reasoning skills and analogical reasoning task practice effects. Limitations and future research are discussed.
Chapter 1

Introduction and Context

Adolescence is a period characterised by rapid physical and psychological transition (Blakemore, & Choudhury, 2006; Lerner, & Steinberg, 2004). This transition period is made more complex by the ever-increasing social, economic, educational, and technological pressures that influence adolescents’ experience (Miranda, & Claes, 2009). In this stage of life, adolescents may be vulnerable to the influences of peer pressure and popular culture, and may be inclined to experiment, push boundaries and take risks that could affect their immediate and longer-term health and wellbeing (Bjork et. al., 2004). And, with recent statistics showing that 14% of the total population in Australia is adolescents (ABS, 2008), the decisions being made that affect their immediate and longer-term health and wellbeing are of paramount concern.

Without the intent to appear pessimistic, and only to provide a critical eye, the importance of decisions made in adolescence can be seen in figures taken from some of the more recent Australian Bureau of Statistics (ABS) and other government-run surveys. For example, there were close to 2-million adolescents (aged 15-24 years) not attending school in 2009 with 67% of them reporting having ‘dropped-out’, and most leaving school before 17 years (Wilson, Tanner-Smith, Lipsey, Steinka-Fry, & Morrison, 2011). Additionally, a series of national surveys of secondary students in Australia showed that adolescents are becoming sexually active earlier, with higher rates of risky sexual behavior (Agius, Dyson, Pitts, Mitchell, & Smith, 2006). Another study highlighted that more than half of adolescents (14-18 years) surveyed had had sex, of which less than 55% reported that they had never used a condom (Smith, Agius, Dyson, Mitchell, & Pitts, 2003). Recent statistics also show that 30%
of adolescents surveyed reported that they had repeatedly (more than once a week) engaged in risky drinking behaviour during the last 12 months (Australian Social Trends Survey 2008; ABS, 2014). This was more than double the comparable rate (13%) of risky drinking among adults (The National Drug Strategy Household Survey, 2007). The study also found that 23% of adolescents surveyed reported using illicit drugs, which was even higher (36.7%) in adolescents with a mental health issues. Based on information from the National Hospital Morbidity Database (2006), the hospital visit rate among adolescents aged 15-24 years due to acute substance overdose (e.g., drugs and alcohol) doubled from 1998 to 2006 to almost 3,000 visits, and 15,100 adolescents (aged 15-24 years) had visited hospital for transport accidents.

In addition, the Criminal Courts collection showed that adolescents (17-24 years) were more likely to appear in court charged with driving under the influence of alcohol and/or drugs than people in any other age group (ABS, 2007). Figures from the Australian Institute of Criminology show that adolescents (aged 15 to 19 years) are Australia's most dangerous people, as violent crime is highest among this group. Adolescents are reportedly responsible for a disturbing number of bashings, robberies, abductions and sexual attacks (Richards, 2013). Furthermore, adolescents are suggested to carry the greatest burden of mental illness, as more than 75% of all severe mental illnesses in Australia occur prior to the age of 25 (National Advisory Council on Mental Health, 2009). Numerous studies spanning decades consistently show that more than a quarter (26%) of adolescents (aged 14–26) surveyed had a mental health disorder compared to only 6% of adults (aged 25–85) (Sawyer et al., 2000; ABS, 2007; National Advisory Council on Mental Health, 2009). During the same period, there was an average of 266 deaths per year attributed to suicide among adolescents (15-24 years), accounting for 20% of deaths in this age group. In comparison, suicide accounted for only 1% of deaths among people aged 25 years and over (The National Drug Strategy
Household Survey, 2007). As such, and it is stressed, not to ignore the many positives aspects of this developmental period, these statistics and surveys highlight adolescence to be a crucial ‘decision-making’ period for not only adolescents’ own wellbeing, but the wellbeing of others and the wellbeing of the society in general; which has been suggested to be due to their heightened involvement in risky and reckless behaviours (Smith, Chein, & Steinberg, 2014).

With that being said, this is an exploratory study largely informed by previous literature and a grounded theory approach, drawing additionally on several separate fields of psychological knowledge in order to shed further light on, and to add to the existing theoretical underpinnings concerning ‘adolescent decision-making’. Moreover, this chapter intends to highlight a previously unsighted (and possibly pivotal) link between some of these factors, relevant to improving the decision-making process in adolescence.

The extant literature highlights a myriad of factors that affect the cognitive, affective, and behavioural development of adolescents, and this paper will discuss those presenting as relevant, in an effort to develop a theoretical premise. First, the issue of Cognitive Immaturity (or poor decision-making itself in adolescence) will be highlighted. Second, the concept of a Cognitive Core (or the value of analogical reasoning to adolescent decision-making) will be discussed, along with Cognitive Core Comparisons (or the link between analogical reasoning and figurative language). Third, Cognitive Coverage (or the pervasiveness of figurative language, and the value in its competence) will be highlighted, including a discussion of Cognitive Crossover (or the relevance of lyrical music exposure to figurative language, analogical reasoning, and adolescent development). Finally, the potential for a Cognitive Convergence (or developing adolescents’ figurative language competence and analogical reasoning skills through lyrical music exposure) will be postulated.
Cognitive Immaturity: Poor Decision-Making Skills in Adolescence

Reasoning skills have been consistently recognised as being important cognitive skills in the decision-making process (see Santrock, 2008), and adolescents are expected to have developed at least ‘effective’ reasoning skill; as highlighted by numerous cognitive developmental stage theories (Santrock, 2008). However, it has often been highlighted (see Glass, 2004) that some adolescents have not attained effective reasoning skills leading to poor decisions (Blakemore, & Choudhury, 2006; Smith, Chein, & Steinberg, 2014; van Duijvenvoorde, & Crone, 2013). An explanation for the poor decision-making and subsequent involvement in risky behaviour(s) commonly associated with adolescence has been provided by Bjork et al. (2004). Bjork and colleagues (2004) postulated that some adolescents are driven to seek extreme incentives (i.e., those deriving from risky behaviours) in order to compensate for the low recruitment of motivational brain activity (meaning the required schema is not functioning adequately yet) in the right ventral striatum and right amygdala (i.e., a brain area responsible for anticipating gains and losses). Bjork et al’s postulation is one that has been supported by research into adolescent decision-making, which suggests that some adolescents place greater value on the ‘un-thought-out’ (and often incorrect) solutions that are arrived at quickly, rather than to exhibit the reflexive thinking (Glass, 2004) that leads to more innovative (and more often than not… correct) solutions (Nippold, 1986). This can result in the adolescent developing the negative cognitive habits of relying on initial ‘quick to mind’ solutions – or to stop trying to find a solution if a problem cannot be solved quickly (Glass, 2004).

Empirically, poor decision-making in adolescence has also been shown in numerous studies. For example, experimental studies using methods such as ‘reaction-timed, computer-based one-line scenario judgements’ (such as, “is swimming with sharks a good or bad idea?”), have highlighted this phenomenon. In an fMRI study investigating the neural
mechanism differences between adolescents’ and adults’ decision-making processes, Baird, Fugelsang, and Bennett (2005) showed through a comparison analysis that adolescents incorrectly judged risky behaviours, showed less relevant brain structure (prefrontal) activation during the judgment, and took significantly longer to respond to the ‘not good idea’ scenarios than did adults. Baird and colleagues suggested that the adolescence period itself may compromise good decision-making due to the lack of recruitment of specific brain functions; which is a product of their incomplete or still-developing prefrontal brain structures. Other examples highlighting poor decision making in adolescence include studies in which adolescents’ consideration of future consequences of risky behaviour were assessed (see Mckay et. al., 2012). Sixty eight adolescents were involved in a qualitative and quantitative study, which fostered a group discussion of participants’ experience with risky behaviours, and the subsequent completion of the Consideration of Future Consequences Scale. Mckay and colleagues showed that participants reported consideration only of the short-term consequences of their risky behaviours, which led the researchers to suggest that in the consideration of future consequence—i.e., understanding how immediate risk-taking actions can have delayed and sometimes serious repercussions—adolescents’ decision-making processes are quite poor. Similarly, studies investigating risk-taking behaviour in adolescence (see Wolff, & Crockett, 2011) have identified additional factors contributing to poor decision-making. Using self reported data of the thought processes that adolescents experienced preceeding their risky behaviour involvement, Wolff and Crockett (2011) showed that performing a ‘cost-benefit-analysis’ or exercising ‘deliberative’ decision-making (i.e., weighing-up one’s choices and outcomes as relevant factors in whether or not to carry out a behaviour) was significantly negatively correlated with risky behaviours; some of which included, illicit drug use, criminal and juvinille delinquency, and risky sexual behaviour. In other words, when some adolescents are involved in making a decision to either; ‘take drugs
or not’, ‘commit that crime or not’, or ‘to have unprotected sex or not’, executive functions that include filtering information, inference making, future planning, and inhibiting impulses are evidently not being recruited.

These studies, taken together, can suggest that when risk is involved some adolescents may not, or simply cannot, make use of their executive functions (see Zelazo, Carter, Reznick, & Frye, 1997 for a definition) to either carefully analyse the positives and negatives of their choices, or to see the long-term consequences and repercussions of their choices (such as sexually transmitted diseases, pregnancy, prison, or physical and psychological harm for example). It may be that fostering the use of, or providing tuition in, the areas of cognitive functioning relevant to reasoning and decision making at this developmental stage, could decrease the likelihood of negative choices being made by adolescents relevant to decisions involving risky behaviours.

Cognitive Core: The value of analogical reasoning to adolescent decision making

There are many different factors that can have an influence on adolescent decision making in addition to the decision parameters themselves (e.g., education, peer pressure, risk taking, romance, media and parents etc.), and making ‘effective decisions’ requires the cognitive ability or cognitive capacity to ‘understand’ the intertwining complexities of all these factors before coming to a decision (Defoe, 2014). Understanding in itself, has been described/defined as requiring one to ‘make connections’ (i.e., a mapping between data that is created, checked, and modified until the data is linked) between existing internal connections and new information/knowledge, or to ‘make new connections’ between existing internal pieces of knowledge (Glass, 2004). It is therefore suggested that it is only when new knowledge or ideas resulting from these connections can be fitted into the larger framework of existing knowledge or ideas that actual understanding has occurred (Davis, 1992, p228).
Furthermore, it is believed that innovative and often more effective solutions are also derived from this process of ‘understanding’ (Green et al., 2010). As such, this knowledge connecting process described above as understanding would not only be evident of, and possibly highly dependent on, higher-order cognitive skills, it would also involve the more specific and specialised cognitive skills of Reasoning by Analogy (Green et al., 2012); which is defined in the same way as ‘understanding’- i.e., making new connections between existing internal pieces of knowledge, or making connections between existing internal connections and new information/knowledge (Glass, 2004). Effective decision making and effective problem solving in general (i.e., not making ‘poor’ decisions) during adolescence then, would not only require the recruitment of analogical reasoning processes in the recognition of these connections (i.e., those between existing and new knowledge concepts that seemed at first unrelated), both prior to the decision being made and during the decision-making process, but would also be evident in the resulting outcomes/solutions (Green et al., 2010).

As such, if understanding is key to ‘effective decision-making’, and analogical reasoning is key to ‘understanding’, it makes sense then, why the ability to reason by analogy is claimed to be at the ‘core of cognition’ (Hofstadter, 2000). Whereby the definition of both understanding and analogically reasoning—that is, ‘abstraction of commonalities between distinct ideas’—are also recognised as central learning principles; and are therefore generally accepted as the key components of superior intelligent behaviour (Alexander, 1984; Prat, Mason, & Adam-Just, 2012). In support of this assumption, Watson and Chatterjee (2012) argued that the overt use of analogies are a means to communicate complex ideas in a wide range of domains (including education, politics, math and science, and social interactions); and they further postulated that the intentional use of analogies can promote greater learning and understanding in these settings. The ability to reason by analogy, in addition to allowing adolescents to create and communicate their ideas more efficiently (Hoffman, 1981), could
thus also facilitate effective problem solving and decision making by normalising (through repeated exposure) the process of understanding (Watson, & Chatterjee, 2012).

Similar to numerous other cognitive skills, analogical reasoning skills have been shown to improve throughout adolescence as the prefrontal regions of the brain associated with this executive function also develop (see Moran, Nippold, & Gillon, 2006, Nippold, 1986). One explanation for the improvement in analogical reasoning in adolescence is provided by findings from brain-imaging studies. Although analogical reasoning studies have been conducted for decades; there is a recent growing interest in neural-imaging studies focussing on the neural processes that are involved in analogical reasoning (see Bassok, Dunbar, & Holyoak, 2012). Early work on the neural basis of analogical reasoning indicated that the prefrontal cortex plays a pivotal role in its occurrence and success (see Robin, & Holyoak, 1995; Waltz, et. al., 1999), which has since been consistently supported by numerous other neural-imaging studies (see Bassok, Dunbar, & Holyoak, 2012; Green et, al,. 2012; Prat, Mason, & Adam-Just, 2012; Watson, & Chatterjee, 2012).

As highlighted by the previously mentioned fMRI studies, the cognitive structures responsible for analogical reasoning, as it relates to adolescent decision-making, are the same structures still ‘under development’ during adolescence (Blakemore, & Choudhury, 2006). This highlights a cognitive developmental paradox whereby the cognitive capacity to optimise decision making, as it relates to adult functioning, is not fully developed. The abovementioned paradox also highlights an opportunity to shape/facilitate the ‘knowledge-structure formation’ that is occurring during this developmental period; by training adolescents in tasks that prime or recruit specific cognitive functions (e.g., analogical reasoning tasks). Beginning in the early 1980s, a breadth of programs were designed aimed at enhancing analogical reasoning abilities in children and adolescents; and has been a continuing and consistent trend within cognitive neuroscience (Sternberg, 1983). Sternberg explained that at
the time this was due to the pervasiveness of assertions linking analogical reasoning capabilities with superior intelligence, and the subsequent institutional use (i.e., education and employment) of analogy problems on measures of such intelligence and aptitude. Here is a very good opportunity to connect this study to the literature; where analogical reasoning is the cognitive ability linked to the researchers’ hypotheses

Some examples of analogical reasoning improvement endeavours include a 1984 direct-instruction study (i.e., teaching the specific skills and complexities) designed to test a pedagogy for this skill. Alexander (1984) used 9-16 year old students to show that, after a 7-day period that included only three sessions of direct instruction to analogical reasoning processes, participants’ number of correct responses on an analogical reasoning task significantly improved from 5.16 (pre-test) to 13.76 (post-test). Alexander et al., (1987) further validated the previous findings by examining the ‘direct instruction’ effects on a different cohort (same age range) using a different analogical reasoning task, and obtained similar improvement effects. Similarly, Robins and Mayer (1993) also found that analogical reasoning skills could be improved; this study however, had a greater focus on fostering the schema formation required for analogical reasoning. After conducting three experiments with college age students designed to prime the cognitive schema relative to analogical reasoning (a diversion from the ‘direct-instruction’ method), it was shown that inducing a relational schema through exposure to similar tasks (i.e., priming) significantly enhanced participants’ analogical reasoning capabilities. More recently, White and Caropreso (2001), who used the same ‘direct-instruction’ method mentioned earlier, but differed in sample and analogical reasoning task again, have reported similar findings to the earlier work of Alexander and colleagues’ (1984; 1987) by showing improved performance after direct exposure to the processes and complexities of the task.
Furthermore, investigations into training analogical reasoning have began to shift focus from the question of efficacy to the effective components of training methods, such as immediacy and potential transfer of effects (see Green et al., 2012; Tzuriel, & George, 2009). From this change of focus, the success of analogical reasoning training has been shown to not only improve analogical reasoning with a single cue (i.e., session/exposure) (e.g., Green et al., 2012; Robins, & Mayer, 1993), but has also been shown to improve cognitive functions that rely on the same prefrontal neural mapping (or cognitive pathways) including creativity, math and language comprehension (e.g., Green et al., 2012 and Tzuriel, & George, 2009). Tzuriel and George (2009) showed that, in a non-clinical sample of 53 7-year olds, after undergoing a 1 week, 15 x 50 minute Analogical Reasoning Training Program (ARP), the experimental group not only showed improvement in analogical reasoning skills (from pre and post task scores), but also showed improvements in math and reading comprehension skills. Similarly, this was exhibited in a sample of 40 adolescents and young adults (mean age 20 years) who participated in a study conducted by Green et al., (2012). Green and colleagues were the first to show that a single explicit cue (i.e., priming a specific cognitive process) was enough to significantly improve post-test performance of analogical reasoning tasks. In addition, it was shown that the improved analogical reasoning mapping (i.e., cognitive-structure formation) that resulted from the ‘priming’ effect, led to improved performance on other measures of creativity.

In sum, successful cognitive-structure formation of analogical reasoning skills can be considered more than relevant to both cognitive development and decision making in adolescence; such that it is viewed as one of the more important components of intelligence (Hofstader, 2000). The skills themselves (analogical reasoning) are used as a measure of numerous competencies and deficiencies, and decades of research has been dedicated to its teaching. However, the cognitive skills required in adolescence to make the most effective
decisions rely on cognitive structures that are yet to fully mature. Moreover, given this cognitive developmental paradox efforts are being made to teach (and therefore cognitively-map/stamp in) this executive function much earlier in life than the expected cognitive maturity norm; which have consistently been shown to produce positive results. As such, there appears to be potential for analogical reasoning skills to be improved through exposure to analogical reasoning tasks, or tasks that require the same cognitive structure/neural pathways.

**Cognitive Comparisons: The link between analogical reasoning and figurative language comprehension**

The cognitive processes, and structures required for *Figurative Language Comprehension*—specifically the comprehension of metaphor as a prototypical example—are synonomous with analogical reasoning (Prat, Mason, & Adam-Just, 2012). The brain structures and the specific cognitive processes required for facilitating the semantic comparisons between two superficially dissimilar ideas/items as a means to solve an issue are virtually identical in both figurative language comprehension and analogical reasoning (Mitchell, 2011; Prat, Mason, & Adam-Just, 2012). The similarity in neural mapping between analogical reasoning and figurative language comprehension has been extensively highlighted in fMRI studies (see Bassok, Dunbar, & Holyoak, 2012; Green, et. al., 2012; Green, et. al., 2010; Prat, Mason, & Adam-Just, 2012; Watson, & Chatterjee, 2012), with both processes consistently shown to be relying heavily on the prefrontal region of the brain (Chiappe, & Chiappe, 2007; Watson, & Chetterjee, 2012). Moreover, the consistently shown neural synonomy between analogical reasoning and figurative language comprehension draws a consensus within the collective interest (i.e., researchers in the field), and has thus been
widely accepted for several decades now as an “unquestionable significant link” (Genter, et. al., 2001; Prat, Mason, & Adam-Just, 2012).

Clearly then, by repeatedly exposing an individual who is experiencing a period of increased cognitive-structure formation (such as an adolescent) to tasks that require the recruitment of specific neural pathways, such as those required for analogical reasoning and figurative language comprehension, it is possible that the repeated exposure, or rehearsal, of those specific structures would lead to a ‘synaptic parsimony’ (i.e., an extreme economy – becoming extremely proficient) of it that would strengthen it. In turn this would allow that cognitive-structure to avoid/survive the ‘synaptic pruning’ (i.e., a culling of infrequently used/weak structures) process experienced during the latter period of this instrumental developmental stage. Furthermore, the repeated recruitment (or activation) of specific neural pathways/knowledge-structures (e.g., analogical reasoning) would provide an ancillary benefit of priming, and consequently strengthening, of other cognitive functions that rely on the same neural mapping; such as figurative language comprehension. Moreover, the ancilliary benefits of neural path strengthening may be reciprocal. That is, and of specific interest to this study, figurative language use (production and comprehension) may prime and consequently strengthen analogical reasoning skills; which – as highlighted earlier – is essentially facilitating a greater understanding.

**Cognitive Coverage: The pervasiveness of figurative language, and the value in its competence**

Whereas understanding literal utterances requires just few cognitive processing steps, figurative language comprehension and interpretation involves several more such steps (Gibbs, 2002; Giora, 2007; Glucksberg, McGlone, & Manfredi, 1997; Kintsch, 2000; Searle, 1995), and it has been suggested that competence with figurative language employs several
overlapping processes of cognition (Levorato, & Cacciari, 1992). Researchers have argued that in order to comprehend figurative language people first must analyse the literal meaning of figurative stimuli before other information is processed in order to infer non-literal meaning; until the process is mastered or has become automated (see Glucksberg, McGlone & Manfredi, 1997; Kintsch, 2000; Searle, 1995). On this view, figurative language comprehension clearly breaches the cognition-limited conventional norm of literal language comprehension; a breach which serves to highlight the necessity for adolescents to recruit the additional cognitive requirements in order to achieve the same goal of deriving meaning as their more cognitively developed adult counterparts. The additional cognitive processes required to comprehend figurative language, as highlighted above, indicates the higher order qualities of analogical thinking (Moran, Nippold, & Gillon, 2006), and are suggested to elevate the comprehension process from conventional to a cognitively deeper, higher-level of processing; and subsequently has been attributed to higher/superior intelligence and superior cognitive processing in general (Chiappe, & Chiappe 2007). Moreover, the ability to comprehend figurative language has been shown by previous research to correlate with many facets of executive functioning, including superior reading ability (Salceda, et. al., 2007; Seidenberg, & Bernstein, 1988), general IQ, analogical and abstract thinking (Prat, Mason, & Adam-Adam-Just, 2012; & Sawyers, et. al., 1992), and working memory (Chiappe, & Chiappe, 2007; & Qualls, & Harris, 2003).

With the abovementioned in mind, studies that had been conducted reporting any significant associations between competence in figurative language comprehension and superior cognition were compiled and reviewed for this study. The complied research demonstrated that during the late 1980’s, and early 1990’s, figurative language comprehension, production, and performance had been explored in numerous studies and reviews. In these studies, figurative thinking in children and adolescents, as measured by
figurative responses and interpretation of figurative meaning, had been related empirically to a variety of other cognitive abilities, including divergent thinking and general intelligence (see Sawyers, Moran, FU, & Horm-Wingerd, 1992). More recently, figurative language competence has been related to cognitive abilities associated with higher order thinking (Dorn, & Soffos, 2005), reading and math ability/academic results (Scaleda, et. al., 2007; Leck, 2006; Weinrauch, 2005), working memory (Chiappe, & Chiappe, 2007; Qualls, & Harris, 2003), and creative and analogical problem solving (Indurkhya, 2007; Prat, Mason, & Adam-Adam-Just, 2012). Further examples of positive associations between competence in figurative language comprehension and superior cognition are evident in Salceda et. al., (2007). Their study showed that when primary school aged students are asked to provide responses to a list of figurative sentences, those who produced far superior responses to the figurative sentences (defined as aligning most accurately with the researchers expected ‘superior’ responses) obtained better results in cognitive measures (including reading comprehension and mathematics tests) than did those who produced average and inferior responses to the figurative sentences (defined as aligning most accurately with the researchers expected ‘average’ and ‘inferior’ responses). Another example includes a study that was designed to examine the efficacy of cognitive behavioural therapy interventions incorporating metaphor. The metaphors used for the interventions were adopted from contemporary popular music, and were intended to encourage participants’ acceptance of the intervention. The interventions were reported as being well received by participants, and were shown to be very effective in fostering processes including cognitive rehearsal and cognitive restructuring; in a number of case examples (Friedberg, & Wilt, 2010). Furthermore, an American study which was designed to evaluate the effects of metaphor use (delivered through popular music) on learning was conducted with first year psychology students. Participants were randomly assigned to learn personality theories over a semester through
either *music metaphor exposure* or exposure to *traditional teaching methods*. Students’ class assessments and end of semester exam results were used as a measure of facilitation effects. The results showed that those exposed to personality theories through music metaphor significantly scored higher on both their class assessments and their exams, than did those in the non-music classes (Leck, 2006). The findings presented by Leck are supportive of earlier studies showing similar results across other learning disciplines, including commerce and marketing (for review see Weinrauch, 2005).

Conversely, to consider the negative associations with figurative language comprehension several studies have also been conducted linking *poor* performance on figurative language comprehension tasks with negative aspects of cognitive functioning such as *learning disabilities* (Lee, & Kamhi, 1990), *inferior reading ability* (Seidenberg, & Bernstien, 1988), and *working memory deficiencies* (Elvevag, et. al., 2011; Qualls, & Harris, 2003). For example, Lee and Kamhi (1990), compared hearing impaired participants with a ‘normal-hearing’control on measures of cognitive performance and figurative language competence. Their results showed that the hearing impaired group were significantly less intelligent, had lower reading abilities, and were significantly less competent with the comprehension of non-literal language. Lee and Kamhi’s (1990) research further validated the earlier work of Seidenberg and Bernstien (1988), who were some of the first to link reading ability to figurative language comprehension. In a sample of primary school aged students, those with superior reading abilities scored significantly better on figurative language comprehension tasks than did those with poor readers. Elvevag, et. al., (2011) and Qualls and Harris (2003) have demonstrated consistent results when looking at the interactions between reading ability, working memory, and figurative language comprehension. Both studies showed that, in samples of adolescents and young adults, participants with poor reading ability, scored lower on measures of working memory.
capacity, which predicted their significantly lower scores on a figurative language competence task.

To highlight another example of the cognitive advantages related to figurative language competence, it has been theorised (e.g., Avery-Natale, 2009; Indurkhya, 2007) that the use of figurative language (specifically metaphor) as a means of understanding or deriving meaning can alter an existing schema (i.e., change the neural mapping) towards a target, thereby creating a new perspective on it. This often includes recognising new information not originally contained in the existing representation. Moreover, this new information that is absent from the existing representation can often facilitate effective decision-making and the resolution to a problematic situation that may have seemed impossible from the familiar perspective—that is, a different angle or lens by which to view it, so to speak. Thus, if figurative language types are suggested to be used as tools of abstract, analogical and creative reasoning facilitation (Indurkhya, 2007; Prat, Mason, & Adam-Adam-Just, 2012)—to be more specific, traits of executive functioning—then figurative language exposure, may be considered a form of cognitive-process heuristic toward abstract and conceptual knowledge-structure recruitment (Elvevag, Helsen, Hert, Sweers, & Storm, 2011); and non-literal meaning attainment in general (Eisner, 1978).

The ability to (a) identify changes in word meanings and translate the word meaning into abstract and generalised concepts; (b) interpret degrees and properties of meaning; (c) identify the remoteness or connectedness of semantic relationships; (d) identify the open-endedness or duplicity of interpretation; (e) identify the obviousness of stimulus-meaning; and (f) interpret the speaker’s intended message; are all factors that relate to the necessary cognitive process requirements of successful figurative language comprehension (Giora, 2007). Figurative language is suggested to occur frequently in spoken and written communication in both popular culture and in the classroom (Moran, Nippold, & Gillom,
2006), two variables easily considered relevant experiential/environmental influences during the adolescent life-stage, and has been stated to pervade many other forms of discourse and communication (Steiner, 2012; Hoffman, 1981). Furthermore, adolescents are consistently presented with these subtle forms of multiple meaning (such as, an ironic statement, a cartoon, an epigram, a poem, or even a peer’s indirect means of communication) that give them an ideal opportunity to exercise and practice the abovementioned cognitive abilities during their ‘normal’ (day-to-day) experiences.

To clarify the value of exposure to figurative language during adolescence, the process itself is considered to be cognitively synonymous with deeper thought processes such as higher-order, lateral, abstract, analogical, and executive thinking; and competence in figurative language use and comprehension would reflect these abilities (Prat, Mason, & Adam-Just, 2012; Sawyers et al., 1992; Watson, & Chatterjee, 2012). In addition, researchers have theorised that the cognitive structures and processes of figurative language comprehension emerge from an interactive cognitive process that is mirrored in the cognitive processes underlying mathematics performance (Indurkhya, 2007); further highlighting the complexity (as math is complex), and thus the value of, figurative language comprehension.

Obviously, the abovementioned studies can be considered somewhat of a ‘lightening-tour’ across different fields of language research. However, the collective findings do converge to highlight an importance of figurative language competence; as a beneficial relevance to cognitive development and subsequently cognitive performance. This may be of extra importance to adolescents who are experiencing a proliferation in synaptic density (i.e., increased knowledge-structure formation) during this developmental period.
Cognitive Crossover: The additional relevance of music exposure on adolescent development

Another important aspect of adolescent development is a proliferation in popular-music exposure and specifically intentional consumption. For adolescents, popular music and its lyrics can have a myriad of uses. Meaningful lyrics can express issues that span a wide range of significance for an adolescent (Pettijohn II, & Sacco, 2009; Leung, & Kier, 2011). Within the differences in lyrical meaning, music can provide entertainment, it can provide distraction from problems, and it can serve as a way to relieve tension and boredom (McDermott, & Hauser, 2005; Miranda, & Claes, 2009; North, & Hargreaves, 2006). Some studies (e.g., North, Hargreaves, & O’Neill, 2000) have reported that adolescents use popular music to deal with loneliness and to take control of their emotional status or mood. Others have suggested that popular music provides adolescents with the means to resolve both conscious and unconscious conflicts related to their particular developmental stage (e.g., North, & Hargreaves, 2006). Intentional music listening has been reported as being the most important coping strategy of adolescents (Arnott, 1995; Miranda, & Claes, 2009; Zillman, & Gan, 1997). At the same time, it has been reported (see Saarikallio, Gold, & McFerran, 2015 for review) that adolescents’ music uses, from an unhealthy dimension, can highlight possible links to mental and/or social health issues. Nonetheless, it appears that some adolescents are listening to music that resonates with both themselves and their issues; and its occurrence (music listening) is quite frequent.

The extant literature on music research demonstrates that adolescents have reported that listening to music is a major component of their daily activities (Council on Communications and Media: American Academy of Pediatrics, 2009). For example, a qualitative survey of 14-16 year old Americans revealed that adolescents listened to music on average 40 hours per
week (Council on Communications and Media: American Academy of Pediatrics, 2009). The
AAP’s (2009) findings have been supported by numerous other American studies, which
show that adolescents self-report listening to music between 3 and 6 hours per day (Roberts,
et. al., 2008; Ward, Hansbrough, & Walker, 2005). Similar findings concerning the
pervasiveness of popular music exposure during adolescence have also been reported in
English studies (see North, Hargreaves, & O’Neill, 2000). Taken together, it can be said that
the majority of Western adolescents are spending much of a crucial developmental period
listening to popular music; and within it, the multitude of declarative (or lyrical message
component), and instrumental (or musical component) parameters.

Given that adolescents are exposed on average to lyrical music for more than a quarter of
their waking day (McDermott, & Hauser, 2005; Sloboda, & O’Neill, 2001), it is therefore not
surprising that listening to music is identified as the most popular past time of Western
adolescents (Sloboda, & O’Neill, 2001) notwithstanding interpersonal, sociocultural and
economic influences. This level of exposure to popular music during adolescence may
constitute one of the most influential experiential and environmental variables on cognitive,
affective, and behavioural development (American Academy of Pediatrics, 2009; McDermott,
& Hauser, 2005; Ward, Hansbrough, & Walker, 2005). This is concerning given that many
studies have empirically demonstrated the importance of the influence of music exposure on
cognitive, emotional, and behavioural development, with relevance to both instrumental and
declarative content.

There is a well-established association between both musical ability and music perception
skills in its instrumental or structural sense (i.e., non-lyrical music and its auditory changes),
and enhanced performance of cognitive abilities, including reading ability, auditory memory,
verbal memory, spatial ability, selective attention, and mathematic achievement (see Anvari,
et. al., 2002; Chan, et. al., 1998; & Schellenberg, 2004). For instance, researchers presume
that music lessons alone (both instrumental and vocal) would increase musical aptitude as well as non-musical abilities associated with aptitude (via Transfer effects; see Bennett, & Ceci, 2002; Prat, Mason, & Adam-Just, 2012). Studies reflecting this postulation have demonstrated both correlationally and experimentally that (a) children who are typically and strikingly insensitive to rhyme and alliteration, are also poor readers (Anvari, et. al., 2002); (b) music perception skills (i.e., the ability to discern changes in pitch, tone, and melody etc.) contribute significant unique variance in predicting reading ability (Avari, et. al., 2002); (c) children’s (6-7 years old) increases on intelligence measures (WISC III) over a 1-year period were larger for music exposure groups than for control groups (Schellenberg, 2004); and (d) adults with musical training are significantly better at recalling verbally presented words than non-musically trained adults (Chan, Ho, & Cheung, 1998). In addition, let’s not forget the ground breaking study that demonstrated the Mozart Effect, by which cognitive performance (i.e., spatial IQ) was increased (by up to 9 points) after being exposed to only 10 minutes of Mozart’s K. 448; that was originally shown in only 36 undergraduates (Rauscher, Shaw, & Ky, 1993). However, a critical evaluation of Rauscher, Shaw, and Ky’s (1993) methodologies and interpretation of their findings is suggested (see Fudine, & Lembessis, 2004) to raise questions that need to be answered before their evidence can be regarded as valid, despite its repetition (see Rauscher, Shaw, Levine, Ky, & Wright, 1994; Newman, Rosenbach, Burns, Latimer, Matocha, Vogt, 1995; & Rauscher, & Shaw, 1998). In short, these results do provide relatively modest but widespread suggested positive benefits from being involved in, or exposed to, music at an instrumental level (i.e., without lyrics).

In addition to the established influential effects of instrumental music exposure, there is also a well-established association between repeated exposure to music lyrics and cognition, affect, and behaviour that includes aggressive thought and actions (Anderson, Carnagey, & Eubanks, 2003), sexual attitudes and behaviour (Fischer, & Greitemeyer, 2006; Primack, et.
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al., 2009), drug taking behaviour (Primack, et. al., 2010), and helping behaviour and facets of emotional intelligence (Greitemeyer, 2009a). For example, Anderson et al., (2003) showed that, in first year college students, exposure to violent lyrics produced higher state hostility (as measured by the State Hostility Scale), greater interpretations of ambiguous words as aggressive, and higher aggressive scores on a word completion task (i.e., when presented with ‘h_t’ aggressive lyric exposure participants produces ‘hit’ rather than ‘hot’, ‘hat’, or ‘hut’ for example); which was noticeably greater in female participants ($F(1, 54) = 6.71, MSE = 0.426, p < .02$). Fischer and Greitemeyer, (2006) showed that adolescents’ (i.e., 1st year college students) sexual attitudes and sexual behaviour can be attributed to sexual music lyrics. After being exposed to either misogynistic or neutral music lyrics, male participants in the misogynistic lyric group administered more hot chili sauce (intended to be a measure of sexual-aggressive behaviour) to a female confederate than did (a) females in the misogynistic lyric group and (b) males in the neutral lyric group. Moreover, males in the misogynistic lyric group administered more hot chili sauce to a female than to a male confederate. Primack et al., (2009) conducted a correlational study using self-report data from 711 American adolescents and showed that, those with a preference for music with sexually degrading lyrics were twice as likely to have had sexual intercourse, and were further progressed along a noncoital sexual continuum than those with a preference for music without sexually degrading lyrics. It was also shown that the lyric-behaviour relationship was independently associated with other factors including older age, male gender, and individual difference variables (e.g., education level, extracurricular activity). Primack et. al., (2010) also investigated correlational links between 959 American adolescents’ exposure to music with drug references and their drug use. The results of this study suggested that participants were exposed to an estimated 40 drug references per day through their intentional music listening, and that participants in the high drug reference exposure group were again twice as likely
(using odds ratios) than those in the low drug reference exposure group to have consumed drugs in the past month. It was also shown that drug reference/drug use association was more prevalent with older adolescents (16+ years of age). Obviously, the Primack et al., studies do not imply that music exposure causes negative behaviour, however they do highlight a consistent link which highlights the need to investigate causality.

Furthermore, several studies, both correlational (e.g., Martin, Clarke, & Pearce, 1993) and experimental (e.g., Peterson, Safer, & Jobes, 2008), have linked repeated exposure to specific music lyrics with a number of other outcomes that include, adolescent suicide and self-harm. For example, Martin et al., (1993) conducted a preliminary study investigating relationships between adolescents' music preference and aspects of their psychological health. High school students (mean age 14.76 years) completed self-report questionnaires on preferred music type, family closeness, suicidal thoughts and behaviour, depression, delinquency, risk taking, and drugs and alcohol. Their results showed that preferences for metal music genres were associated with suicidal thoughts, self-harm acts, depression, delinquency, drug taking, and family dysfunction. Moreover, feeling sadder after listening to the music differentiated the most disturbed group. Similarly, Peterson et al., (2008) linked metal music exposure with suicidal thoughts in an adolescent college sample (mean age 19.53 years). Participants were exposed to three songs with suicidal lyrics, and then asked to complete/respond to a Thematic Apperception Test (TAT) and a Vignette Reaction Generation Form (VRGN). Their results, despite the studies limitations, showed that participants recorded high levels of suicide-related content in their projective story-writing task after listening to suicide-themed music.

Although the majority of existing research is predominantly correlational and despite the wide range of methodologies, participants, materials, procedures, and resulting outcomes, the above mentioned studies consistently show relationships between the exposure to the
declarative content of music lyrics (i.e., the messages) and changes in cognition, affect, and/or behaviour in adolescents. In saying that, due to the lack of true causal experiments, it has also been suggested that a genuine and causal music-lyric effect remains to be demonstrated clearly (George, et. al., 2007; Greitemeyer, 2009).

This calls for further investigation into this relationship; approached from differing viewpoints. For example, literary utterances (i.e., spoken words, or in this case sung lyrics) have several parameters other than just declarative content, including delivery technique, pitch and tone, valance, and linguistic-structure. Regarding linguistic-structure specifically, several authors (e.g., Djikic, 2011; Greenfield, et. al., 1987) have postulated that song lyrics may in fact be a form of figurative language insofar as they often contain metaphor and other features of poetry. For intentional listeners, music containing lyrics that are highly figurative could effectively be considered figurative language exposure, and would require the listener to exercise the higher-order cognitive ability of figurative language comprehension in order to derive an attributive meaning from the stimuli (Prat, Mason, & Adam-Just, 2012); and this would potentially occur at each exposure. Moreover, each exposure to figurative language through such music may lead to the rehearsal and implicit formation of cognitive-structures and processes related to (i.e., similar in neural-mapping) the processing and comprehending of figurative language (Prat, et. al., 2012). As such, knowing the highlighted lyrical linguistic-structural parameters of popular music may prove valuable in further understanding the link between individual differences and music preferences in adolescents and developmental outcomes. Additionally, assessments of the differences in lyrical linguistic-structure may prove valuable in further understanding the highlighted influential effects of lyrical music exposure.
Cognitive Convergence: Developing figurative language and analogical reasoning competence through music exposure

To conclude, the reviewed literature demonstrates that adolescents are exposed to lyrical music for a significant portion of their waking day, and that the linguistic-structure of those lyrics can be high in figurative language. In addition, the literature demonstrates that the neural mapping of figurative language comprehension is one in the same with the neural mapping of analogical reasoning, i.e., they reside and rely on the same cognitive-structures in the prefrontal region of the brain. Furthermore, the processes of analogical reasoning and ‘understanding’ are defined in the same way… the abstraction of commonalities between distinct ideas. Moreover, ‘understanding’ is suggested to be key to effective decision-making, which is an attribute that appears to allude adolescents; especially when risk is involved. As such, there appears to be an opportunity here to further understand the effects of music exposure on facets of adolescent development; specifically, the yet unlinked area of cognitive (or neural) development.

Aims and Hypotheses:

In a grounded theory approach, drawing together and drawing from the research, this study thus aims to examine the effects of exposure to music with lyrics high in figurative language, compared to music with lyrics high in literal language, on the cognitive performance of analogical reasoning in adolescents. It is hypothesised that exposure of adolescents to highly figurative music lyrics will result in greater positive transient effects (i.e., temporary increases here on referred to as Transient Cognitive-Performance Effects [TCPE]) on the cognitive performance of abilities related to figurative language comprehension such as analogical reasoning, compared with exposure of adolescents to highly literal music lyrics.
NB: In addition, despite the age, gender, and individual similarities and differences highlighted in music-exposure effects, it is hypothesised that these variables will not interfere with the positive effects of figurative language exposure (through music lyrics), i.e., the TCPE will remain constant across these variables. Furthermore, it is hypothesised that the TCPE will remain significant after accounting for existing cognitive ability and practice effects of repeated cognitive task exposure. This is suggested to be a result of the implicit influence of figurative lyric exposure on knowledge-structures relative to the cognitive ability (i.e., analogical reasoning) being engaged. However, these latter hypotheses are secondary to the major inquiry and will thus only be discussed in the appendicies (see Appendix 10 and 10.1).
Chapter 2

Methods

Design and Methodology

A within groups pilot study was first conducted to assess the validity of potential stimuli (i.e., the songs to be used for the main study), viz., the identification of the ‘literalness and figurativeness’ of the song lyrics. Second, the main study was a between groups experiment entailing exposure to different music lyric conditions, with pre- and post-measurements of cognitive performance (analogical reasoning). The independent variable consisted of music lyric condition (2-levels, figurative and literal). Transient cognitive performance change (i.e., pre- and post-test analogical reasoning difference scores) served as the dependent variable.

The pilot and main study data collection techniques

The Pilot Study

In order to identify a relevant pool of songs, the researchers had two criteria; to use only stimuli used in the extant, and to cut across music genre. As such, the lyrical music (or stimuli) used in the current study was intended to have been used previously in published research, more specifically in research where music with specific types of lyrics was required (e.g, aggressive versus non-aggressive lyrics). As such, a database search of the extant literature was conducted using ‘key terms’ including: songs, music, lyrics, music lyrics, song lyrics, music exposure, and music preferences. Papers that contained the key terms in either their title or abstract were complied, with more than 274 music exposure studies initially reviewed for their stimuli (i.e., songs used). However, for the current research only the neutral
stimuli (songs) from those studies was compiled and assessed (via the Pilot Study) for their experimental specific requirements (i.e., their figurative- and literal-ness). From those 274 studies, 201 songs were banked, of which 84 had been used in experimental studies. Originally, 53 songs were classified as ‘neutral’ stimuli within the studies reviewed; however, 21 songs were excluded from the 53 due to the use of censorable content. The use of ‘neutral’ only stimuli from previous research was intended to control for the emotional valance of the declarative content of the stimuli. By selecting songs that were less likely to induce an affective response, the pool of songs can be considered valence neutral and thus serve as a measure of mood/valance control. In addition, as instrumental music itself can induce emotion, and as a means to further control for (or at least keep constant) mood/valence, songs were matched auditorily (e.g., beat, tempo etc) across the figurative and literal groups.

The Pilot Study Participants

Participants for the pilot study were considered a convenience sample (immediately available to the researcher through the university) and recruited via snowball methods (i.e., intra-institutional word of mouth), starting with identified experts in English and music education, writers and musicians. Nine raters were recruited based on their academic qualifications/credibility alone; as such, demographic and descriptive details were not deemed relevant, and therefore not obtained nor recorded. After being invited to participate via an expression of interest email, participants read an information letter containing a web link (Appendix 3); consent was indicated by clicking on the link. Participants were then directed to an online survey (appendix 4-4.2) that took approximately 45 minutes to complete. Inter-item correlations and Inter-rater reliability coefficients provided empirical evidence for the use of the chosen stimuli, presented in Table 1 (see Results section).
The Pilot Study Materials

The materials for the pilot study consisted of the same questionnaire for each lyrical set. The questionnaire was designed specifically for this study (see Appendix 4.3). The questionnaire included the title and artist of the song with the song’s lyrics centred on a computer screen in 12-point font. Participants were asked if: (1) they recognise the title and artist, (2) they could get a meaning from the lyrics presented, (3) they could foresee others arriving at an alternative meaning (speaks to plurality of meaning), and finally (4) they could rate the lyric’s literalness/figurativeness on a 7-point Likert scale (where 1 = Extremely Literal and 7 = Extremely Figurative); an example of both literalness and figurativeness was provided.

For example: (a) if the lyrics mean exactly what they say (i.e., “Out in the West-Texas town of Elpaso, I fell in love with a Mexican girl” – in reference to falling in love with a Mexican girl from Elpaso) – then they are 1, extremely LITERAL, or (b) if the lyrics are cryptic and need to be deciphered in order to get the meaning (i.e., “Darkness imprisoning me, all that I see is absolute horror, I cannot live, I cannot die, trapped in myself, body my holding cell” – in reference to a war victim blinded, deafened, and having all his limbs amputated by a landmine; and being kept alive by medical machinery) – then they are 7, extremely FIGURATIVE.

The Pilot Study Procedure

The participants were first asked to read the lyrics (there was no instrumental component to the lyrics). After reading the lyrics the participants were asked to respond to the 4-items by clicking on a ‘yes/no’ or ‘rating’ option presented on a computer screen.

The Main Study.

Data Collection: The data were collected over three phases. Initially, the ‘Registration Phase’ (completed at the participant’s home) was conducted through online self-report
measures of demographic data. The following two phases, completed in a computer lab in-
school/on-campus, included pre-testing on the cognitive performance of analogical reasoning
(Phase-1), and then the experimental induction (i.e., music exposure) and post-test cognitive
performance of analogical reasoning (Phase-2).

**The Main Study Participants**

**Method of Sampling.** The target population was at least 30 (see Tabachnick, &
Fidell, 2007 for n rationale) adolescents aged 14 to 24 years. Specifically, a non-clinical
sample of early and late adolescents was recruited with an age range between 14-24 years,
inclusive. This age span required the researchers to target two groups. First, the
‘younger/minor’ group (14 to 17 year olds) was recruited from secondary education
institutions across the Melbourne metropolitan area (from a list provided by Catholic
Education of Melbourne). Invitations/consent-forms supplied by the researcher were taken
home by students to their parents, carer or guardians who provided the consent. The
Australian Catholic University (ACU) Melbourne campus was the site used to recruit
participants between the ages of 18 and 24 years (the ‘older/adult’ group) via internal email
and campus noticeboard announcements.

**Ethical Considerations:** The data collected from these participants was non-
identifiable and procedures were non-intrusive. Participants did not undergo any procedure
that caused physical or psychological harm, and thus, ethical risks were minimal to nil and
The Australian Catholic University Human Research Ethics Committee granted approval for
the study [2013-206V] – see Appendix 5). All participants were given entry into a
competition to win $1000.00 worth of Apple Store vouchers (where it was advertised as
redeemable for an electronic educational device, e.g., an iPad); which was HREC approved.
Description of Sample. The sample consisted of 31 participants, Males = 14 (45.16%) and Females = 17 (54.84%) with a mean age of $M = 17.42$, $SD = 2.74$. The percentage of participants classified as ‘younger’ was 64.52% ($n = 20$, $M_{age}=15.75$, $SD=7.16$) and for the ‘older’ group 35.48% ($n = 11$, $M_{age}=20.45$, $SD=2.42$). The ethnic background of participants was not considered relevant to the outcomes of the current study because it has not been found to be a relevant factor in the studies reviewed; thus, where not obtained. Equally, individual music preference was deemed not relevant, as the stimuli itself (i.e., songs used) cut across music factors (see Clark, & Giacomantonio, 2013), and excluded extreme genres, all participants’ music preference will not match the researcher’s play-list – holding this at a constant across the sample; therefore, was also not recorded.

The Main Study Materials

Due to the exploratory nature of this study, care has been taken in being informed by the extants research methods. So, in terms of stimulus to be presented, it had been shown that previous research concerning music lyrics has not exposed participants to more than four (4) songs during any experimental phases. On the majority of occasions, the stimulus presented is either one (1) or two (2) songs for each condition (i.e., experimental and control). As such, for the current study a minimum of five (5) songs per lyric condition was utilised, in order to maximise the likelihood of a genuine Music Lyric Effect (MLE).

Music stimuli. Resulting from the Pilot Study, ten songs were used as stimuli, five each for the experimental and control conditions. The music itself was given to the schools on CD to be played aloud at the testing sessions, by the researcher (see Table 1 for song list).

Participants were also presented with a ‘Lyric Sheet’ to accompany each stimuli presentation, and a ‘Lyric Questionnaire’ following each stimulus presentation. This process
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was a measure of attention control (i.e., to ensure participants were paying attention to the lyrics or ‘intentionally’ listening).

**Lyric Questionnaire:** adopted in part from Greenfield et. al., (1987), participants were asked to respond to items including: Did you understand the lyrics of this song?, and What do you think the meaning of this song was? Finally, participants rated the lyrics on their literalness using a Likert scale where 1 = Extremely Literal, and 5 = Extremely Figurative (see Appendix 9).

**Lyric Sheet:** An A4 sheet of paper included the artist’s name, the song title, and the song lyrics centered on the page in 12 point font (see Appendix 4.2).

**The Dependent Variable**

Analogical Reasoning (AR) has been operationalised as making new connections between existing internal pieces of knowledge, or making connections between existing internal connections and new information/knowledge (Glass, 2004); or the cognitive processes that involves a deeper understanding of the elements of a problem and their relationships (Galotti, 2008). AR can be measured with verbal and pictorial analogies, such as Series Completion and Matrix Completion tasks. Analogical reasoning is representative of the ‘schema’ (or neural mapping) required for figurative language competence, and thus was the cognitive ability construct employed for this study.

The Analogical Reasoning Task developed by Green and colleagues (Green, et. al., 2009; 2012) was used as the measure of cognitive performance for this study. The Analogical Reasoning Task is a verbal analogies task (i.e., “A is to B as C is to ____.”) derived quantitatively from latent semantic analysis (see Green, et. al., 2009). On each analogy trial participants view an analogy on a computer screen comprising three main words and a question mark (i.e., Blindness is to Sight as Deafness is to ?). Participants then generate a
word, by typing it out, that completes the analogy. The stimuli consisted of 80 trials, which were split to form pre-post conditions, and took no longer than 15 minutes to complete per condition. This task has been administered to adolescents up to the age of 24 years – making it the ideal test for the current study (see Appendix 8, 8.1, and 8.2).

Having established a baseline analogical reasoning ability (with a pre-test score), and consistent with the literature on music and lyrical content, participants were exposed to the stimuli and then assessed again on analogical reasoning ability. A change score was calculated and used for statistical analyses.

The Main Study Procedure

Two methods of stimulus exposure procedures have previously been used in, what I am referring to as, ‘psychomusicological’ research: (a) overt exposure, such as having participants intentionally listen to music, and (b) covert exposure, such as having music being played in the background. Given that this study focused on the effects of intentional music listening on cognition, the overt exposure method was used.

The testing for both groups took place over three separate time-points; one at the point of consent (the Registration Phase), and two points conducted in a computer lab (Phases I & II) at each participant’s school or university. Duration of the study was 7 days from registration to post-test, with a 3-day period between pre-testing and experimental induction/post-testing. Students were (pseudo) randomly assigned to either the control or experimental groups by their birth date (odd numbers for the control group [n = 15] and even numbers for the experimental group [n = 16]).

Registration Phase: Younger participants were given a permission slip to take home by their teachers, on which their parent/carer either afforded or denied consent. A description of the study was given to the parent/carer, with the consent section to be brought separately to
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the school to be given to the researcher (Appendix 6.7). For entry into the incentive-competition, the parents were directed to provide an email address on the consent form ‘return slip’. There was no identifiable information on this return slip. The schools were asked to keep a record of which participants had not consented to the study and to exclude them from the participant pool (thus preserving their anonymity from the researcher).

The parent/carer followed the URL provided by the researcher and entered an ID code, comprising the child’s initials plus the first two digits of his/her birthday. This non-identifiable code was used to link the data of the different phases, and it did not required the child to memorise anything new. The participant then completed the questionnaires. Older participants were either extended an invitation email or asked to contact the researcher via email (the latter option was a directive on the on-campus notice board announcements). The invitation email (see Appendix 6) contained an Information Letter and Consent form (see Appendicies 6.1-6.7). The consent form contained a link to the study, and participants were informed that consent was given by clicking the link. Older participants followed the same procedure as the younger, i.e., they first entered their ID and then completed the questionnaire. Conducting the registration phase at home was intended to reduce in-class testing time.

**Phase I:** This session took place within 4 days after the cut-off period for permission slip return. The participants presented to a computer lab (by prior arrangement with the schools in question) and were checked off an attendance list. Participants were then directed to a computer and told to await instructions. The first instruction participants received was to enter their “participant code”. Participants were given the following instructions to complete the pre-test analogical reasoning task:

*This part of the study requires you to complete as many analogical reasoning questions as possible in the time provided 20 minutes. Each question follows the same*
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'A is to B as C is to?' format, and requires a SINGLE word answer. An example question: You will be required to fill in the blank space that replaces the question mark. i.e., FATHER is to SON as MOTHER is to ? The correct response to this question would be DAUGHTER. "Father is to son as mother is to daughter". You would type daughter into the blank space provided.

1. barometer is to pressure as thermometer is to ?

After the analogical reasoning pre-test, participants were thanked and reminded of the date and time for their next session (Phase II). This completed Phase I.

**Phase II:** This took place 3 days after completing Phase I, and consisted of the experimental procedure, and the post-test analogical reasoning task. The participant again presented to a computer lab and was checked off an attendance list. Participants were then directed to a computer and told to await instructions. As with Phase I, the first instruction participants received was to enter their ‘participant code’. Participant were then given instruction of, and underwent, the experimental procedure. In this procedure, participants were exposed to the experimental stimuli, either five songs high in figurative or literal lyrical content. Songs were played to participants on a portable stereo with the volume set at ¾ of the units capacity. Participants were told they would hear a song played aloud, and were told that they would be quizzed on the song after presentation so as to ensure that they paid attention to the lyrics. Lyrics were provided on an A4 sheet of paper (obtained from www.lyricsdepot.com as recommended by Pettijohn, & Sacco Jr., 2009). After each song exposure, participants were asked to respond to a questionnaire assessing the stimuli’s “meaning” and linguistic-structure (i.e., literal-/figurative-ness). This process was repeated for
all 5 songs. Following the stimuli exposure phase of the experiment, participants were instructed of, and completed the post-test analogical reasoning task (see Phase-1 ‘Per-test’ Instructions). Participants were thanked and debriefed.

Duration of testing: The duration of the phases was limited to 20 minutes for the registration phase and no more than 35 minutes for phases I and II. The study was conducted over a 7-day period. Attrition is always a risk when multiple time-points are employed; however, a number of factors protected against prohibitive attrition. First, the testing times in each ‘in-school’ phase were no longer than a normal class that the participant would typically attend. Second, that Phases I and II were conducted at the school/university (for participants aged 14-17 years, with the administrative support of the school); a location easily accessible and known to participants.
Chapter 3

Results

Data Screening and Recoding

Prior to analysis, all data was screened, and assessed on all assumptions relevant to the chosen statistical analyses. The Sapiro-Wilk statistics were either non-significant or within an acceptable level of deviation (e.g., within -1 and +1 Skewness and Kurtosis; Allen, & Bennet, 2008), indicating that the assumptions of normality were not violated. A visual inspection of histograms and both normal and detrended Q-Q plots further confirmed that each group of scores was approximately normally distributed.

Data Analysis: Pilot Study

Initially, Likert scale ratings of the ‘linguistic-structure’ of the songs were recorded in a pilot study to support the use of the chosen stimuli. Cronbach’s alpha with all songs in the reliability analysis was .352 indicating a clear lack of internal consistency. As such, songs were separated according to the underlying construct they were tapping (i.e., figurative or literal); where songs with a mean of 3.5 or below were considered ‘Literal’ (n=14), and songs with a mean of 5.0 or greater were considered ‘Figurative’ (n=13). Cronbach’s alpha for the 14 literal songs was .916. Songs were then removed according to the item-total statistics until the desired number of song (5) was achieved. Cronbach’s alpha for the 5-Literal songs was .930. Cronbach’s alpha for the 13 figurative songs was .935. Again, songs were removed according to the item-total statistics until the desired number of song was achieved (5). Cronbach’s alpha for the 5-Figurative songs was .956. Inter-rater reliability coefficients (Cohen’s kappa) were used as a means to further assess the validity (i.e., the figurativeness
and literalness) of the experimental and control stimuli (i.e., the songs). Nine raters were in agreement regarding the lyric classifications. Cohen’s kappa was used to represent this data, and was found to reflect moderate to high levels of inter-rater agreement between the raters (with $K$ = between .34 – .65). The chosen stimuli songs are presented in Table 1.
Table 1.  
*Songs Selected for Literal and Figurative Conditions*

<table>
<thead>
<tr>
<th>Literal Lyric Condition</th>
<th>Figurative Lyric Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Title/Artist</strong></td>
<td><strong>Title/Artist</strong></td>
</tr>
<tr>
<td>Song 1</td>
<td>&quot;When I Grow Up (To Be A Man)&quot; The Beach Boys</td>
</tr>
<tr>
<td>Song 2</td>
<td>&quot;Self Esteem&quot; The Offspring</td>
</tr>
<tr>
<td>Song 3</td>
<td>&quot;Englishman In New York&quot; Sting</td>
</tr>
<tr>
<td>Song 4</td>
<td>&quot;Kingston Town&quot; UB40</td>
</tr>
<tr>
<td>Song 5</td>
<td>“The Way” Stryper</td>
</tr>
<tr>
<td></td>
<td>&quot;How Soon Is Now?&quot; The Smiths</td>
</tr>
<tr>
<td></td>
<td>&quot;The Unforgiven&quot; Metallica</td>
</tr>
<tr>
<td></td>
<td>&quot;4 Degrees&quot; Tool</td>
</tr>
</tbody>
</table>

*NB: Song lists were alternated by order to avoid 'order effects'*
Data Analysis: Main Study

Age group, gender, and extracurricular activity participation (which included; sport, drama, & music involvement) were recorded for the main study (NB: this last variable to be used in secondary analyses); distinctions were made between ‘male and female’, ‘younger (14-17) and older (18-24)’, and ‘extracurricular activity participation no and yes’. These distinctions were made in order to assess, at an exploratory level, potential differences between these groups (i.e., to enable comparative analyses). Pre-existing cognitive ability was recorded as ‘analogical reasoning pre-test score’, and transient performance change was recorded as ‘analogical reasoning post-test score’. Subsequently, an analogical reasoning difference score was recorded as ‘Transient Cognitive Performance Change Effect’ (TCPCE).

The data relevant to the hypotheses were analysed using independent sample $t$-tests to assess the significance of mean differences. An analysis of variance (ANOVA) was used to assess main effects and interactions between variables, and an analysis of covariance (ANCOVA) to assess the main effects and interactions of variables holding constant individual differences (i.e., age group, gender, and extracurricular activity participation). The descriptive details obtained can be seen in Table 2.
Table 2.

Main Study Descriptive Statistics – Means, and Standard Deviations for Transient Cognitive Performance Change Score

<table>
<thead>
<tr>
<th></th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-Test</td>
<td>23.73</td>
<td>4.55</td>
</tr>
<tr>
<td>Post-Test</td>
<td>27.90</td>
<td>4.21</td>
</tr>
<tr>
<td>Change</td>
<td>4.77</td>
<td>2.64</td>
</tr>
<tr>
<td>N</td>
<td>31</td>
<td></td>
</tr>
</tbody>
</table>

Figures represent scale measurements – see Appendix 1 for interpretation

The descriptive statistics in Table 2 highlight a cognitive change score across the sample as a whole. Cognitive performance, and cognitive performance change scores were further investigated across the lyric conditions, and the groups of age, gender, and extracurricular activity participation; these figures are shown in Table 3.
Table 3.
Main Study Means: Cognitive Performance and Cognitive Performance Change Scores

<table>
<thead>
<tr>
<th></th>
<th>Pre-Test</th>
<th>Post-Test</th>
<th>Change Score</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Literal</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(n = 16)</td>
<td>23.29 (4.43)</td>
<td>26.73 (4.35)</td>
<td>2.80 (1.63)</td>
</tr>
<tr>
<td><strong>Figurative</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(n = 15)</td>
<td>22.38 (4.70)</td>
<td>29.00 (3.86)</td>
<td>6.63 (2.01)</td>
</tr>
<tr>
<td><strong>Males (Literal)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(n = 8)</td>
<td>24.83 (5.12)</td>
<td>27.17 (5.67)</td>
<td>2.33 (1.83)</td>
</tr>
<tr>
<td><strong>Males (Figurative)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(n = 6)</td>
<td>23.13 (7.17)</td>
<td>29.88 (5.64)</td>
<td>6.75 (2.16)</td>
</tr>
<tr>
<td><strong>Females (Literal)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(n = 8)</td>
<td>23.33 (3.20)</td>
<td>26.44 (2.59)</td>
<td>3.11 (1.51)</td>
</tr>
<tr>
<td><strong>Females (Figurative)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(n = 9)</td>
<td>21.63 (2.35)</td>
<td>28.13 (2.46)</td>
<td>6.50 (1.97)</td>
</tr>
<tr>
<td><strong>Younger (Literal)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(n = 11)</td>
<td>23.33 (4.12)</td>
<td>26.11 (4.01)</td>
<td>2.78 (1.29)</td>
</tr>
<tr>
<td><strong>Younger (Figurative)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(n = 9)</td>
<td>21.00 (5.12)</td>
<td>27.36 (4.49)</td>
<td>6.36 (2.11)</td>
</tr>
<tr>
<td><strong>Older (Literal)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(n = 5)</td>
<td>24.83 (3.78)</td>
<td>27.67 (2.70)</td>
<td>2.83 (2.28)</td>
</tr>
<tr>
<td><strong>Older (Figurative)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(n = 6)</td>
<td>25.40 (4.26)</td>
<td>32.60 (2.81)</td>
<td>7.20 (2.04)</td>
</tr>
<tr>
<td><strong>ECA-Y (Literal)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(n = 4)</td>
<td>24.45 (4.93)</td>
<td>26.73 (4.99)</td>
<td>2.27 (1.81)</td>
</tr>
<tr>
<td><strong>ECA-Y (Figurative)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(n = 11)</td>
<td>22.55 (5.18)</td>
<td>29.09 (4.25)</td>
<td>6.55 (2.10)</td>
</tr>
<tr>
<td><strong>ECA-N (Literal)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(n = 5)</td>
<td>22.50 (3.54)</td>
<td>26.75 (4.25)</td>
<td>4.25 (2.10)</td>
</tr>
<tr>
<td><strong>ECA-N (Figurative)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(n = 11)</td>
<td>22.00 (3.11)</td>
<td>28.80 (3.10)</td>
<td>6.80 (0.50)</td>
</tr>
</tbody>
</table>

Standard Deviation in parentheses (SD). ECA = extracurricular activities  Y = yes  N = no
As can be seen in Table 3, (and taking into consideration the small group sizes at times) the figurative lyric condition had greater increases in post-test analogue reasoning scores than was evident in the literal condition. Independent samples t tests were conducted on participants’ transient cognitive performance change scores to assess the significance of the observed differences with comparisons on participants’ transient cognitive performance change score between age group, gender, and extracurricular activity participation. Levene’s tests were non-significant except that the ‘younger’ group and the ‘ECA-N’ group exhibited variance disparities between lyric conditions and were interpreted accordingly, thus equal variances can be assumed for the remaining comparisons.

The t test comparing the lyric conditions on transient cognitive performance change score was statistically significant, with the “literal lyric” condition (M = 2.80, SD = 2.01) showing change scores some 3.83 points lower (95% CI = ± 1.34) than the “figurative lyric” condition (M = 6.63, SD = 1.63), t(29) = -5.84, p < .001, two tailed, d = 2.10. The significant transient cognitive performance change scores between lyric conditions (i.e., figurative and literal) was evident across age groups, with the “younger/literal lyric” condition (M = 2.78, SD = 2.10) showing change scores some 3.59 points lower (95% CI = ± 1.61) than the “younger/figurative lyric” condition (M = 6.36, SD = 1.29), t(12.68) = -4.47, p < .001, two tailed, d = 2.61 (equal variance not assumed); and the “older/literal lyric” condition (M = 2.83, SD = 2.11) showing change scores some 4.37 points lower (95% CI = ± 2.95) than the “older/figurative lyric” condition (M = 7.20, SD = 2.28), t(9) = -3.35, p = .008, two tailed, d = 2.03. The transient cognitive performance change effect was evident across gender also, with the “male/literal lyric” condition (M = 2.33, SD = 2.16) showing change scores some 4.42 points lower (95% CI = ± 2.33) than the “male/figurative lyric” condition (M = 6.75, SD = 1.83), t(12) = -4.14, p = .001, two tailed, d =1.83; and the “female/literal lyric” condition (M = 3.11, SD = 1.97) showing change scores some 3.39 points lower (95% CI = ± 1.83) than the “female/figurative lyric” condition (M = 6.50, SD = 1.51), t(15) = -3.95, p < .001, two tailed, d = 1.92. Similarly,
extracurricular activity participation exhibited significant differences in transient cognitive performance change scores, with the “ECA-N/literal lyric” condition \((M = 4.25, SD = .50)\) showing change scores some 2.55 points lower (95% CI = ± 1.65) than the “ECA-N/figurative lyric” condition \((M = 6.80, SD = 1.30), t(5.36) = -4.02, p = .009, \text{ two tailed}, d = 2.46 \) (equal variance not assumed); and the “ECA-Y/literal lyric” condition \((M = 2.27, SD = 2.10)\) showing change scores some 4.27 points lower (95% CI = ± 1.74) than the “ECA-Y/figurative lyric” condition \((M = 6.55, SD = 1.81)\), \(t(20) = -5.11, p < .001, \text{ two tailed}, d = 2.18\).

The \(t\) tests were statistically non-significant when comparing groups outright, with the “younger” group \((M = 4.75, SD = 2.67)\) showing transient cognitive performance change scores only .068 points lower (95% CI = ± 2.68) than the “older” group \((M = 6.63, SD = 1.63), t(29) = -0.068, p = .947, \text{ two tailed}, d = 0.03;\) and the “male” group \((M = 4.86, SD = 2.96)\) showing transient cognitive performance change scores only .151 points greater (95% CI = ± 1.98) than the “female” group \((M = 4.71, SD = 2.44), t(29) = .156, p = .877, \text{ two tailed}, d = 0.05. \) The \(t\) tests were marginally significant (see Vogt, 2000 for a definition of ‘marginally significant’) when comparing the extracurricular activity participation groups, with “ECA-N” group \((M = 5.67, SD = 1.67)\) showing change scores some 1.26 points greater (95% CI = ± 2.12) than the “ECA-Y” group \((M = 4.41, SD = 2.91), t(29) = 1.21, p = .142, \text{ two tailed}, d = 0.48\).

**Summary of Findings**

In summary, it was hypothesised that exposure to highly figurative stimuli (as music lyrics) would show greater positive transient effects on the cognitive performance of analogical reasoning, than exposure to highly literal stimuli (i.e., music lyrics). The hypothesised lyric-condition differences were demonstrated in the data \((M_{FIG-Pre} = 22.37, M_{FIG-Post} = 29.00, M_{FIG-Change} = 6.63, \text{ cf. } M_{LIT-Pre} = 23.29, M_{LIT-Post} = 26.73, M_{LIT-Change} = 2.80, t[29] = -5.84, p < .001, \text{ two tailed}, d = 2.10)\).
And secondary to the main hypothesis, it was hypothesised that age, gender, and participation in extracurricular activity would not interfere with the hypothesised positive effects of figurative language exposure (through music lyrics). This hypothesis was also supported by the results from a factorial between groups ANOVA (see Appendix 10) showing no significant interaction between the variables and a main effect for the lyric-condition only ($F[1,18] = 20.54, p < .001$, partial $\eta^2 = .093$). Finally, it was hypothesised that the TCPE would remain significant after controlling statistically for pre-existing cognitive ability (i.e., analogical reasoning) and also for the practice effects of repeated analogical reasoning task exposure. Again, this hypothesis was supported by the results from the ANCOVA showing no significant IV-by-covariate interactions (see Appendix 10.1) whilst still demonstrating a significant main effect of ‘lyric condition’ on TCPE ($F[1,28] = 33.89, p < .001$, partial $\eta^2 = .548$).
Chapter 4

Discussion

This study was the first of its kind to investigate ‘lyrical-music exposure effects’, in relation to adolescents’ cognition, beyond declarative content; by focusing on parameters of music lyrics such as linguistic-structural differences. Specifically, this study aimed to examine the effects of exposure to music with lyrics high in figurative language, compared to the effects of exposure to music with lyrics high in literal language, on the cognitive performance (i.e., analogical reasoning) of adolescents. It was hypothesised that participants exposed to highly figurative music lyrics would have greater positive effects (i.e., temporary improvements in analogical reasoning skills), than those exposed to low figurative language (i.e., literal) music lyrics. Subsequently, it was hypothesised that the positive effects of figurative language exposure (through music lyrics) on analogical reasoning would not be moderated by demographic variables (e.g., age and gender), individual-difference variables (e.g., extracurricular activity participation and pre-existing cognitive ability), or cognitive task practice-effects (i.e., repeated analogical reasoning task exposure).

The results showed, with statistical significance, that exposure to highly figurative stimuli as music lyrics produced a greater positive (transient) effect on adolescents’ cognitive performance of analogical reasoning, than exposure to highly literal stimuli as music lyrics did. The statistical significance between lyric-conditions was replicated across all groups, with participants exposed to highly figurative-lyrics experiencing greater TCPE than their literal-condition counterparts. The hypothesised ‘lyric-condition’ differences were thus clearly demonstrated in the data. In addition, it was hypothesised that age, gender, and participation in extracurricular activity would not account for the hypothesised positive effects of figurative language exposure (through music lyrics). Support for this hypothesis was also demonstrated with the results of a factorial ANOVA.
showing no significant interactions between participants’ TCPE and demographic or individual difference variables; and showing only a significant main effect for the lyric-condition on participants’ cognitive change scores. Finally, it was hypothesised that the TCPE would remain significant after accounting for participants’ pre-existing cognitive ability (i.e., analogical reasoning pre-test scores) and also for the practice effects of repeated analogical reasoning task exposure. Again, this hypothesis was demonstrated in the results of an ANCOVA showing no significant ‘IV-by-covariate’ interactions whilst still demonstrating a significant main effect of ‘lyric condition’ on TCPE.

**Positioning the findings in the Extant Literature**

The results of the current study lend themselves to being the lyrically-structural equivalence of the Mozart Effect (understanding the questionable validity), in that they have shown that through exposure to *Highly Figurative Music Lyrics*, adolescents can *improve* a significant cognitive skill that is required for what can be considered a ‘parsimonious (or pure) understanding’; moreover, the improvement of a significant cognitive skill required for *effective decision-making*. The results of the current study showed that over a 30-40 minute period (3 times that of the Mozart study’s exposure) of figurative of literal language exposure, those in the highly figurative-lyric condition experienced significant increases in their analogical reasoning skills compared to those in the highly literal-lyric condition. It is postulated that the additional cognitive processes enacted in the comprehending of figurative language, which are over and above the cognitive processes enacted for literal language comprehension (Gibbs, 2002; Giora, 2007; Glucksberg, McGlone, & Manfredi, 1997; Kintsch, 2000; Searle, 1995), are acting as a primer for the cognitive processes required for analogical reasoning skills, as a result of their identical neurological mapping (Bassok, Dunbar, & Holyoak, 2012).

Moreover, the results of the current study support the findings of Green et. al., (2012) and Tzuriel and George (2009) who have demonstrated that priming specific knowledge-structures
positively effects cognitive skills that are mapped neurologically similar to those being primed. That is, by using highly figurative language exposure, which recruit cognitive processes in the prefrontal regions of the brain, participants in the current study experienced improved performance in their (neurologically identical) analogical reasoning skills.

Similarly, the results of the current study—in which one cognitive skill (i.e., figurative language comprehension) was used to prime and by proxy improve another (i.e., analogical reasoning)—also support the findings of an extensive body of neuroimaging studies (see Mitchell, 2011; Prat, Mason, & Adam-Just, 2012). This further highlights the similarity in neural mapping between analogical reasoning skills and figurative language comprehension as demonstrated by Bassok, Dunbar, and Holyoak (2012), Chiappe and Chiappe (2007), Green et al. (2010 & 2012), Prat, Mason, and Adam-Just (2012), and Watson and Chatterjee (2012). This similarity was not highlighted by way of fMRI results of course, moreover this was highlighted by way of providing empirical evidence of cognitive performance; that both supports and extends those neuroimaging laboratory findings.

As such, the results of the current study are consistent with previous researchers’ findings that have shown analogical reasoning skills to be improved over short periods (see Alexander, 1984; Alexander, et. al., 1987; Robins, & Meyer, 1993; White, & Caropreso, 2001). Furthermore, consistent with the hypotheses, and in contrast to the extant literature, demographic and individual difference variables had no mitigating effect on the significantly positive TCPE of figurative language exposure.

**Implications and Applications**

Developmental studies concerning the adaptive role of music in adolescence are quite rare (Miranda, & Claes, 2008), and typically this line of research has focused on the relationship between music and social identity, or the listeners’ uses of music (North, Hargreaves, & O’Neill, 2000; Saarikallo, Gold, & McFerran, 2015; Tekman, & Hortacsu, 2002). Although music
investment has received relatively little attention in mainstream social, and developmental psychology, recent investigations have begun to examine individual differences in music preferences (for a review, see Rentfrow, McDonald, & Oldmeadow 2009). However, additional research that validates music preferences and consumption habits as a measure of developmental accomplishments and issues is greatly needed (Rentfrow, Goldberg, & Levitin, 2011). It may be possible that exposing adolescents to a specific variety/genre of music could promote greater understanding, self-exploration, validation, and normalisation of their issues, thus enhancing their personal, educational, and social development (Schwartz, & Fouts, 2003).

To highlight the importance of just one of those factors for example, the number of years that a person is engaged in formal education is one of the best predictors of positive intrapersonal, social and economic outcomes. Dropping out of high school is associated with numerous detrimental consequences, including low wages, unemployment, incarceration, and poverty. It is therefore in the national interest to have a highly educated and skilled workforce, but getting to that stage presupposes children will remain in school long enough to gain the skills that enable them to participate in higher education. This is why there are a large number of school and community-based prevention and intervention programs for the general population and at-risk students (Wilson, Tanner-Smith, Lipsey, Steinka-Fry, & Morrison, 2011). The Australian Federal Government has also recognised the need to support young people who are at risk, which is why they have invested tens of millions of dollars into programs which allows local communities to work together to recognise local problems and develop local solutions (Richards, 2011).

**Limitations**

Despite the positive results of the current study, there were several limitations, including the sample size, music investment (and individual difference) coverage, stimuli (i.e., song/music) parameters, and the need for post-hoc investigation. Next, each of these is considered in turn.
Due to the time constraints of such a project, and the difficulties of obtaining state and institutional permission to recruit an adolescent sample, the participant numbers were low. Ideally, to improve the robustness of any findings, a much greater sample size would be necessary; however, the exploratory nature of this study lends itself to accepting the small sample obtained. Similarly, the same constraints led the researchers to limitations with the amount of testing that was considered acceptable for this target sample. A battery of knowledge concerning participants’ existing cognitive abilities at baseline (such as reading ability, figurative-language comprehension, working memory, and general intelligence for example), and also their music consumption/investment habits/patterns (such as genre preference, time spent listening and uses for example) would have proved valuable with regards to greater understanding of potential moderating, mediating, or confounding factors. Similarly, with respect to the Mozart Effect, and despite the current researchers’ efforts to control for, it may be that the arousal mood hypotheses (or the Blur Effect) (Schellenberg, & Hallam, 2005) plays a role in the demonstrated TCPE. As such, greater efforts to control for mood and arousal, or experimental designs including this variable, should be considered in future research.

In addition, as a measure of validity the songs chosen for this study were taken only from published music exposure research. As such, it could be considered that there was a distinct lack of temporal relevance regarding artist, genre and popularity of the songs used. Including modern artists and genres in the stimulus battery may have proved valuable with regards to sample interest and relevance. Moreover, this study used an inter-genre method of lyric-condition inclusion. It may be that a genre-specific, and subsequent cross-genre analysis, would provide further information as to the potential importance of popular and alternative music influence – the two main genres of teens.

Furthermore, the results clearly highlighted an improvement in cognitive performance; however, whether or not this leads to more effective decision-making skills remains unclear. A
between-groups assessment of decision-making skills post experimental induction would have provided an opportunity to clarify this.

**Future Research and Conclusions**

The use and comprehension of figurative language has been identified as being “a quality of good scientific theory” (Thaggard, 1978), in essence, a characteristic of being able to think rationally or the ability to use executive functioning cognitions. This is a cognitive advantage that is usually not attributed to teenagers (adolescents). However, it may be that through the linguistic-structural parameters (i.e., figurative language) in music lyrics specifically, that adolescents could obtain a higher level of cognition.

Thus, in addition to addressing the current study’s limitations, future research in this area may be useful in order to further understand the scope of influence that specific media exposure has on adolescents’ development, especially where lyrical-music is concerned, as the exposure and consumption of lyrical-music during adolescence is at its peak (Council on Communications and Media: American Academy of Pediatrics, 2009; McDermott, & Hauser, 2005; North, Hargreaves, & O’Neill, 2000; Roberts, et. al., 2008; Sloboda, & O’Neill, 2001; Ward, Hansbrough, & Walker, 2005). Specifically, further research may be useful in understanding the impact of this popular adolescent activity (i.e., music listening) on their knowledge-structure formation. Similarly, the influence of figurative language exposure on cognitive ability development and knowledge-structure formation may also require further research. This is especially so with adolescent samples, as both their cognitive capability and figurative language competence continues to develop during this period.

As such, an intentional facilitation of competence with figurative language use and comprehension during adolescence, may prove valuable in terms of fostering the use and competence of other important influential developmental cognitive variables (e.g., various types of thinking and decision making). This may prove especially valuable if the cognitive variables
facilitated are related to the successful resolution of adolescent life-cycle transitions that have the potential to negatively influence adult functioning and well-being.

Additional to the abovementioned value of the intentional use of figurative language, the importance of further understanding any association becomes paramount if one were to also consider that each figurative language exposure is synonymous with a figurative language comprehension learning trial. Repeated exposure (i.e., rehearsal) could possibly foster the strengthening of the cognitive structure(s) relevant to figurative language use and comprehension (Moran, Nippold & Gillon, 2006; Prat, Mason, & Adam-Just, 2012), and the ancillary strengthening of similarly mapped cognitive functions; especially during a period of such maturational cognitive flexibility and growth. With respect to cognitive flexibility, the prefrontal and parietal cortex have been consistently shown to undergo continued development during adolescence, and it might be expected that during this period cognitive abilities relying on the functioning of these regions (i.e., executive functioning and social cognition) should also undergo change (Blakemore, & Choudhury, 2006). Cognitive Process Formation, and Knowledge-Structure Formation are continually occurring and developing during adolescence (Blakemore, & Choudhury, 2006). As the knowledge structures associated with adolescent cognitive developmental processes are exercised (through repeated use/exposure), they will become more complex, differentiated, and difficult to change, and the cognitive processes and structures formed during this adolescent period will be evident in adult brain behaviours (see Anvari, et. al., 2002; Barnea-Goraly, et. al., 2005; Blakemore, & Choudhury, 2006; Chan, et. al., 1998; Schellenberg, 2004); which highlight the potential long-term effects (Anderson & Bushman, 2001) of the transient effects exhibited in the current study.

When one couples with this, the observation that during late adolescence and into adulthood there is also a period of synaptic elimination (or neural pruning)—in which frequently used cognitive connections are strengthened and infrequently used connections are eliminated.
Analogical Reasoning & Figurative Language Exposure

— knowledge-structure formation in this period has a heightened importance.

Adolescence thus entails a significant period of knowledge-structure and concept formation during brain maturation or a ‘synaptic reorganisation’ (Anvari, et. al., 2002; Blakemore, & Choudhury, 2006), which is the biological maturational process that underpins adolescent cognitive development, and consequently the brain may be more sensitive to environmental input and experiential influences (Schellenberg, et. al., 2004). Schellenberg et al., (2004) state that environmental input and experiential influences (i.e., things the adolescent experiences) have specificity in the realm of maturing cognitive processes that have been attributed to higher-order thinking processes (i.e., products of executive functioning), such as reasoning, and decision making (Blakemore, & Choudhury, 2006). Some of those processes include, filtering information, inference making, future planning, and inhibiting impulse (Blakemore, & Choudhury, 2006); all of which highlight the importance of further understanding environmental and experiential influences on adolescent cognitive development. It can be safely stated then, that much like ‘sound categorisation’ during language acquisition for example (i.e., a similar cognitive process), post-adolescence experience with executive functions may be much more difficult to incorporate or ‘stamp’ into neural networks once those networks are already established (Blakemore, & Choudhury, 2006).

Each of the highlighted executive functions mentioned above has a significant role in ‘cognitive control’ and ‘mastery’ of thinking, and these cognitive skills are postulated to be at their ‘developing peak’ or most influential during adolescence (Blakemore, & Choudhury, 2006). The study of the development of cognitive processes concerning executive functioning in adolescence is a new but rapidly evolving field, with applications in education, diagnosis, intervention, and social policy (Blakemore, & Choudhury, 2006). Existing research into the cognitive implications of continued brain maturation beyond childhood have been suggested to
be extremely relevant (i.e., influential) to the educational attainment and social development of adolescents (Blakemore, & Choudhury, 2006).

Thus, positively shaping or mapping these cognitive structures and functions may be paramount in terms of the adolescence ‘life-stage’ being a successful learning/knowledge-shaping period; that will eventually contribute to adult brain functioning (see Anvari, et. al., 2002; Blakemore, & Choudhury, 2006; Chan, et. al., 1998; & Schellenberg, 2004). Furthermore, if such critical periods in cognitive development are occurring during adolescence (as emphasised by the above researchers), and if the knowledge and concepts one learns can facilitate the development of ‘superior’ or ‘enhanced’ cognitive abilities, or to the contrary hinders them, then the interaction between these influences and such developmental periods, as a product of adult functioning, warrants importance and further investigation.
Reference


Australian Institute of Health and Welfare 2007, Young Australians: their health and wellbeing 2007, cat. no. PHE 87, AIHW, Canberra.


~ 66 ~


http://dx.doi.org/10.1521/suli.2006.36.5.582

http://dx.doi.org/10.1348/000709900158083


http://dx.doi.org/10.1126/science.283.5409.1908


http://dx.doi.org/10.1177/0261927X09335259


Sawyer et al., (2000). Care the Mental Health of Young People in Australia; The child and adolescent component of the national survey of mental health and well-being: Mental Health and Special Programs Branch, Commonwealth Department of Health and Aged.


Appendices

Appendix 1: Pilot Study Ethics Approval:

Dear Applicant,

**Principal Investigator:** Dr Stephen John Giacomantonio

**Student Researcher:** Mr Shannon Clark

**Ethics Register Number:** 2012 283Q

**Project Title:** Literalness in music lyrics: A pilot study to assess the stimuli for the research project "The Effects of Repeated Exposure to the Linguistic-Structural Parameters of Popular Music Lyrics on Adolescents' Transient Cognitive Abilities".

**Risk Level:** Low Risk 2

**Date Approved:** 03/06/2013

**Ethics Clearance End Date:** 30/11/2013

This letter is to advise that your application has been reviewed by the Australian Catholic University's Human Research Ethics Committee and confirmed as meeting the requirements of the National Statement on Ethical Conduct in Human Research.

This project has been awarded ethical clearance until 30/11/2013. In order to comply with the National Statment on Ethical Conduct in Human Research, progress reports are to be submitted on an annual basis. If an extension of time is required researchers must submit a progress report.

Whilst the data collection of your project has received ethical clearance, the decision and authority to commence may be dependent on factors beyond the remit of the ethics review process. For example, your research may need ethics clearance or permissions from other organisations to access staff. Therefore the proposed data collection should not commence until you have satisfied these requirements.

Decisions related to low risk ethical review are subject to ratification at the next available Committee meeting. You will only be contacted again in relation to this matter if the Committee raises any additional questions or concerns.

Researchers who fail to submit an appropriate progress report may have their ethical clearance revoked and/or the ethical clearances of other projects suspended. When your project has been completed please complete and submit a progress/final report form and advise us by email at your earliest convenience. The information researchers provide on the security of records, compliance with approval consent procedures and documentation and responses to special conditions is reported to the NHMRC on an annual basis. In accordance with NHMRC the ACU HREC may undertake annual audits of any projects considered to be of more than low risk.
It is the Principal Investigators / Supervisors responsibility to ensure that:

1. All serious and unexpected adverse events should be reported to the HREC with 72 hours.

2. Any changes to the protocol must be approved by the HREC by submitting a Modification Form prior to the research commencing or continuing.

3. All research participants are to be provided with a Participant Information Letter and consent form, unless otherwise agreed by the Committee.

For progress and/or final reports, please complete and submit a Progress / Final Report form:

www.acu.edu.au/465013

For modifications to your project, please complete and submit a Modification form:

www.acu.edu.au/465013

Researchers must immediately report to HREC any matter that might affect the ethical acceptability of the protocol eg: changes to protocols or unforeseen circumstances or adverse effects on participants.

Please do not hesitate to contact the office if you have any queries.

Kind regards,

Kylie Pashley

Ethics Officer | Research Services
Office of the Deputy Vice Chancellor (Research)
Australian Catholic University
Appendix 2: Pilot Study Email Invitation:

Dear Academic/Musician,

You are invited to participate in some research on literalness in music lyrics. This project is investigating the linguistic-structural parameters of songs selected to be analysed as potential experimental stimuli for a future study. It is being undertaken for a Master of Philosophy (Psychology) research project.

It is emphasised that participation in this study is for the purposes of data collection only. The data collected will be non-identifiable and non-intrusive. You will not have to undergo any procedure that will cause physical or psychological harm. As such there are no foreseeable risks to you as a participant.

You are not obligated to participate, and if you do not wish to participate please take no further action and delete this email. As there is no identifiable data being collected, your non-participation will not be recognised.

Attached is an information letter outlining the research project, its purpose, and its requirements.

Regards,

Mr. Shannon. S. Clark
Master of Philosophy (Psychology) Candidate
Postgraduate Diploma Psychology
Bachelor Psychological Science
Diploma Human Behaviours

The links below are the same as the ones presented in the attached information letter, these are provided here as a back-up should the links in the attachment not work.

https://www.surveymonkey.com/s/Pilot_LITERALNESS1

https://www.surveymonkey.com/s/Pilot_LITERALNESS2

Appendix 3: Pilot Study - Information Letter:
PARTICIPANT INFORMATION LETTER

PROJECT TITLE: Literalness in music lyrics: A pilot study to assess the stimuli for the research project “The Effects of Repeated Exposure to the Linguistic-Structural Parameters of Popular Music Lyrics on Adolescents’ Transient Cognitive Abilities”.

PRINCIPAL INVESTIGATOR: Dr. Giac Giacomantonio

STUDENT RESEARCHER: Shannon. S. Clark

STUDENT’S DEGREE: Master of Philosophy (Psychology)

Dear Participant,

You are invited to participate in the research project described below.

What is the project about?
The research project investigates the linguistic-structural parameters of the lyrics in songs which have been selected to be analysed as potential experimental stimuli for a future study. You have been recruited from the student researcher’s personal email list, and have been selected as you possess a tertiary level education or relevant musical background. The aim of this study is to procure at least five songs for each condition (i.e., 5 experimental and 5 control/neutral).

Who is undertaking the project?
This project is being conducted by Shannon Clark and will form the basis for the degree of Master of Philosophy (Psychology) at Australian Catholic University under the supervision of Dr. Giac Giacomantonio.

Are there any risks associated with participating in this project?
Participants will not have to undergo any procedure that will cause physical or psychological harm. As such there are no foreseeable risks to participants.

What will I be asked to do?
Participants will be asked to read a set of lyrics (without the musical accompaniment), answer three ‘tick and flick’ yes/no questions, and a single item scale rating pertaining to those lyrics, and their literalness/non-literalness (4 items per questionnaire). In total, there are approximately 40 sets of lyrics to be assessed with the same response criteria for each lyric set (172 items total).

How much time will the project take?
Testing will occur online through Survey Monkey at a time convenient to the participant. The expected time to complete participation requirements for this study is 45 minutes if completed in a single session.

What are the benefits of the research project?
There are no direct benefits to participants. Potential wider benefits for participants are that they will be contributing to research, which may be published (in the Journal of Psychomusicology: Music, Mind, and...
Analogical Reasoning & Figurative Language Exposure

Brain) to further explain factors that assist with understanding the effects of media (specifically music) on cognitive development.

**Can I withdraw from the study?**
Participation in this study is completely voluntary. You are not under any obligation to participate. If you agree to participate, you can withdraw from the study at any time without adverse consequences. However, due to the fact that data is non-identifiable, once completed you will no longer be able to withdraw your responses.

**Will anyone else know the results of the project?**
It is emphasised that participation in this study is for the purposes of data collection only. The data collected for this project will be non-identifiable, non-intrusive, and reported in an aggregated form only.

**Will I be able to find out the results of the project?**
The results of this project can be made available to participants upon request. This can be achieved by contacting the researcher directly.

**Who do I contact if I have questions about the project?**
The research can be explained in greater detail if you require. Any questions regarding this project should be directed to the Principal Investigator Dr. Giac Giacomantonio on (07) 3623 7645 or in person at FC.15 in the School of Psychology, McAuley Campus at the Australian Catholic University, 1100 Nudgee Road, Banyo Qld 4014

**What if I have a complaint or any concerns?**
The study has been approved by the Human Research Ethics Committee at Australian Catholic University (approval number 2012 283Q). If you have any complaints or concerns about the conduct of the project, you may write to the Chair of the Human Research Ethics Committee care of the Office of the Deputy Vice Chancellor (Research).

Chair, HREC  
c/o Office of the Deputy Vice Chancellor (Research)  
Australian Catholic University  
Melbourne Campus  
Locked Bag 4115  
FITZROY, VIC, 3065  
Ph: 03 9953 3150  
Fax: 03 9953 3315  
Email: res.ethics@acu.edu.au

Any complaint or concern will be treated in confidence and fully investigated. You will be informed of the outcome.

**I want to participate! How do I sign up?**
Thank you for considering participation in this study. To participate, please click on one of the following links, and by doing so you are giving your consent.

https://www.surveymonkey.com/s/Pilot_LITERALNESS1  
https://www.surveymonkey.com/s/Pilot_LITERALNESS2

**Appendix 4:**  
Pilot Study Materials - Online Instructions:
Dear Participant,

You are invited to participate in the research project described below.

The research project investigates the linguistic-structural parameters of the lyrics in songs which have been selected to be analysed as potential experimental stimuli for a future study. You have been recruited from the student researcher’s personal email list, and have been selected as you possess a tertiary level education or relevant musical background. The aim of this study is to procure at least five songs for each condition (i.e., 5 experimental and 5 control/neutral).

This project is being conducted by Shannon Clark and will form the basis for the degree of Master of Philosophy (Psychology) at Australian Catholic University under the supervision of Dr. Giac Giacomantonio. Participants will not have to undergo any procedure that will cause physical or psychological harm. As such there are no foreseeable risks to participants.

Participants will be asked to read a set of lyrics (without the musical accompaniment), answer three ‘tick and flick’ yes/no questions, and a single item scale rating pertaining to those lyrics, and their literalness/non-literalness (4 items per questionnaire). In total, there are approximately 40 sets of lyrics to be assessed with the same response criteria for each lyric set (172 items total). Testing will occur online through Survey Monkey at a time convenient to the participant. The expected time to complete participation requirements for this study is 45 minutes if completed in a single session.

There are no direct benefits to participants. Potential wider benefits for participants are that they will be contributing to research, which may be published (in the Journal of Psychomusicology: Music, Mind, and Brain) to further explain factors that assist with understanding the effects of media (specifically music) on cognitive development.

Participation in this study is completely voluntary. You are not under any obligation to participate. If you agree to participate, you can withdraw from the study at any time without adverse consequences. However, due to the fact that data is non-identifiable, once completed you will no longer be able to withdraw your responses.

It is emphasised that participation in this study is for the purposes of data collection only. The data collected for this project will be nonidentifiable, non-intrusive, and reported in an aggregated form only. The results of this project can be made available to participants upon request. This can be achieved by contacting the researcher directly.

The research can be explained in greater detail if you require. Any questions regarding this project should be directed to the Principal Investigator Dr. Giac Giacomantonio on (07) 3623 7645 or in person at FC.15 in the School of Psychology, McAuley Campus at the Australian Catholic University, 1100 Nudgee Road, Banyo Qld 4014

The study has been approved by the Human Research Ethics Committee at Australian Catholic University (approval number 2012 283Q). If you have any complaints or concerns about the conduct of the project, you may write to the Chair of the Human Research Ethics Committee care of the Office of the Deputy Vice Chancellor (Research).

Chair, HREC, c/o Office of the Deputy Vice Chancellor (Research) Australian Catholic University Melbourne Campus. Locked Bag 4115, FITZROY, VIC, 3065. Ph: 03 9953 3150 Fax: 03 9953 3315 Email: res.ethics@acu.edu.au

Any complaint or concern will be treated in confidence and fully investigated. You will be informed of the outcome.
Literalness in Music Lyrics Study

Thank you again for taking part in this research. Your assistance, time, and efforts are invaluable.

Your task is to read the sets of lyrics carefully, then answer the questions relating to those lyrics that follow.

Please be sure to answer every question.

- However, first can you fill in the blank space below to verify your applicability in participating.

1. What is your Tertiary qualification or Music background?
Appendix 4.2: Experimental Stimuli Literalness/Figurativeness Assessment:

Remember: Your task is to read the sets of lyrics carefully, and then answer the questions relating to those lyrics that follow.

Please be sure to answer every question.

ARTIST: The Violent Femmes

TITLE: "I Held Her In My Arms"

I'm gnawing on the knowledge that I have been burnt
And I'm learning things that I should've already learnt
Everyone I ever knew was so kind and coy
I was with a girl, but it felt like I was with a boy

I can't even remember if we were lovers, or if I just wanted to
But I held her in my arms, I held her in my arms
I held her in my arms but it wasn't you

I will not kill the one thing I love
In this world of wreckage, I look above
Help me, Lord, help me understand
What it means to be a boy and what it means to be a man
Appendix 4.3: Linguistic-Structural (i.e., Literalness/Figurativeness) Assessment:

Questions About The Lyrics:

1. Do you recognize the title and/or artist?
   YES _______ or NO _______

2. Can you get an idea about the MEANING of this these lyrics?
   YES _______ or NO _______

3. Could somebody else get a different meaning from these lyrics than the meaning you have gotten?
   YES _______ or NO _______

4. Rate the lyrics on their LITERALNESS/FIGURATIVENESS on the scale below, where 1 = extremely literal and 7 = extremely figurative.

   For example:

   (a) if the lyrics mean exactly what they say (i.e., “Out in the West-Texas town of Elpaso, I fell in love with a Mexican girl” – in reference to falling in love with a Mexican girl from Elpaso) – then they are 1, extremely LITERAL.

   or

   (b) if the lyrics are cryptic and need to be deciphered in order to get the meaning (i.e., “Darkness imprisoning me, all that I see is absolute horror, I cannot live, I cannot die, trapped in myself, body my holding cell” – in reference to a war victim blinded, deafened, and having all his limbs amputated by a landmine; and being kept alive by medical machinery) – then they are 7, extremely FIGURATIVE.

   CIRCLE ONE NUMBER ONLY

<table>
<thead>
<tr>
<th>Extremely Literal</th>
<th>Literal</th>
<th>Figurative</th>
<th>Extremely Figurative</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-----------------</td>
<td>2--------</td>
<td>3-----------</td>
<td>4-------------------</td>
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<tr>
<td>5-----------------</td>
<td>6--------</td>
<td>7-----------</td>
<td></td>
</tr>
</tbody>
</table>
Dear Applicant,

Principal Investigator: Dr Eric Marx

Student Researcher: Mr Shannon Clark (HDR Student)

Ethics Register Number: 2013 206V

Project Title: Examining the effects of exposure to specific linguistic-structural parameters of popular music lyrics on adolescents' cognitive performance

Risk Level: Low Risk 3

Date Approved: 14/03/2014

Ethics Clearance End Date: 30/06/2014

This letter is to advise that your application has been reviewed by the Australian Catholic University's Human Research Ethics Committee and confirmed as meeting the requirements of the National Statement on Ethical Conduct in Human Research subject to the following conditions:

Catholic Education and Principals of schools.

This project has been awarded ethical clearance until 30/06/2014. In order to comply with the National Statement on Ethical Conduct in Human Research, progress reports are to be submitted on an annual basis. If an extension of time is required researchers must submit a progress report.

Whilst the data collection of your project has received ethical clearance, the decision and authority to commence may be dependent on factors beyond the remit of the ethics review process. The Chief Investigator is responsible for ensuring that appropriate permission letters are obtained, if relevant, and a copy forwarded to ACU HREC before any data collection can occur at the specified organisation. Failure to provide permission letters to ACU HREC before data collection commences is in breach of the National Statement on Ethical Conduct in Human Research and the Australian Code for the Responsible Conduct of Research.

Decisions related to low risk ethical review are subject to ratification at the next available Committee meeting. You will only be contacted again in relation to this matter if the Committee raises any additional questions or concerns.

Researchers who fail to submit an appropriate progress report may have their ethical clearance revoked and/or the ethical clearances of other projects suspended. When your project has been completed please complete and submit a progress/final report form and advise us by email at your earliest convenience. The information researchers provide on the security of records, compliance with approval consent procedures and documentation and responses to special conditions is reported to the NHMRC on an annual basis. In accordance with NHMRC the ACU HREC may undertake annual audits of any projects considered to be of more than low risk.
It is the Principal Investigators / Supervisors responsibility to ensure that:

1. All serious and unexpected adverse events should be reported to the HREC with 72 hours.
2. Any changes to the protocol must be approved by the HREC by submitting a Modification Form prior to the research commencing or continuing.
3. All research participants are to be provided with a Participant Information Letter and consent form, unless otherwise agreed by the Committee.

For progress and/or final reports, please complete and submit a Progress / Final Report form:

For modifications to your project, please complete and submit a Modification form:

Researchers must immediately report to HREC any matter that might affect the ethical acceptability of the protocol eg: changes to protocols or unforeseen circumstances or adverse effects on participants.

Please do not hesitate to contact the office if you have any queries.

Kind regards,

Kylie Pashley

on behalf of ACU HREC Chair, Dr Nadia Crittenden

Ethics Officer | Research Services
Office of the Deputy Vice Chancellor (Research)
Australian Catholic University
INFORMATION LETTER TO CEOM
ARCHDIOCESE OF MELBOURNE

TITLE OF PROJECT:
Examining the Effects of Exposure to Specific Linguistic-Structural Parameters of Popular Music Lyrics on Adolescents’ Transient Cognitive Performance.

PRINCIPAL INVESTIGATOR: Dr. Eric Marx

HIGHER DEGREE RESEARCHER: Shannon. S. Clark

PROGRAMME ENROLLED IN: Master of Philosophy (Psychology)

Dear Archdiocese,

I am a research masters student (Psychology) with the Australian Catholic University (ACU) investigating the effects of popular music exposure on youth culture. As your organisation’s school, and all secondary schools, have a concentration of my target demographic – adolescents – I am inviting you to participate in some research (one of two studies) on the effects of figurative language in music lyrics on adolescent’s transient cognitive performance. It is being undertaken for the thesis component of a Master of Philosophy (Psychology) research project.

Nature of the Study - Background:
Adolescence can be a tumultuous period of development. Externally, adolescents are dealing with increased social stressors and risks, internally, physiological changes are occurring; spanning the entire developmental period.

The effects of environmental variables in adolescence are paramount to outcomes and can have lasting effects on adult functioning. Additionally, behavioural idiosyncrasies, knowledge structures, schemas, and or scripts acquired during adolescence are extremely hard to change; also, structures, schemas, and scripts not acquired during adolescence are much harder to acquire in adulthood. On this basis, variables effecting acquirement of structures, schemas, and scripts related to processes required for making positive life choices need to be recognised, elucidated, and investigated.
Media exposure is the most omnipresent phenomena experienced by adolescents (excluding eating and sleeping). It is so enthusiastic it may be the most influential environmental variable contributing to cognitive, affective, and behavioural development.

This theoretical premise was initially captured and tested using the General Learning Model (GLM) of media exposure, and continued use of the model in the literature consistently adds generalisability and validity. Both instrumental (i.e., the Mozart effect) and vocal declarative content both have well established links with effecting cognition, affect, and behaviour. However, with specificity to music lyrics, the extent of existent research is limited to declarative content (i.e., messages). Linguistic-structural parameters, such as metaphoricity and figurativeness, are yet to be addressed.

Whereas some music lyrics have been defined as akin to poetry and non-literal language (i.e., high in metaphoricity/figurativeness), others have been defined as purely literal (i.e., not containing plurality of meaning). Repeated exposure to metaphoric/figurative language comprehension tasks has been associated with superior cognitive abilities. Superior cognitive abilities may assist adolescents with positive, logical, rational decision making surrounding life choices.

**Method:** Participants are intended to be recruited from Catholic Education of Melbourne Schools in the Melbourne metropolitan area. Participants will register online (in their own homes) by filling out registration questionnaires. Participants will then be pre-tested on cognitive abilities (Phase 1), exposed to the music stimuli and post-tested on that same cognitive ability (Phase 2).

**NB:** For the schools randomly allocated to STUDY-1, a third phase will be required (Phase 3), this will be a replication of Phase 2 at a later date.

*Testing phases will occur in the respective schools’ computer lab, and online through Survey Monkey.*

The Human Research Ethics Committee at the Australian Catholic University has approved this study (2013 206V) to be conducted, and I am seeking approval to be granted from the Archdiocese of Melbourne for this research to be conducted in Melbourne Catholic schools. It is emphasised that participation in this study is for the purposes of data collection only. The data collected will be non-identifiable and non-intrusive. Participants will not have to undergo any procedure that will cause physical or psychological harm. As such there are no foreseeable risks to participants.

The potential benefits for participants are that their school will be able to get a non-diagnostic assessment of their students’ reading ability, figurative language comprehension, general intelligence and analogical reasoning ability – a stipulation outlined in the CEOM research guidelines. This may assist with structuring future curriculums and activities. Students participating in this study will be available to enter a draw to win a share of $1000 worth of Apple Store vouchers. Both participants and the schools will also be contributing to research, which may be published to further explain factors that assist with understanding the effects of media (specifically music) on adolescent cognitive development. Participation in this research project is voluntary, and participants can withdraw from the study at any stage without giving a reason.
The research can be explained in greater detail if you require. Any questions regarding this project should be directed to the Principal Investigator Dr, Eric Marx on (07) 3623 7436 or in person at FC.12B in the School of Psychology, McAuley Campus at the Australian Catholic University, 1100 Nudgee Road, Banyo Qld 4014

In the event that you have any complaint, concern, or query that the Higher Degree Researcher and Staff Supervisor will not be able to satisfy, you may write to:

Chair, Human Research Ethics Committee  
C/- Research Services  
Australian Catholic University – Brisbane Campus  
PO Box 456  
Virginia QLD 4101  
Tel: 07 3623 7429  
Fax: 07 3623 7328

Any complaint will be treated in confidence and will be fully investigated. Thank you for considering participation in this study.

Shannon Clark & Dr Eric Marx
Appendix 5.2:  

Main Study - CEOM Ethics Approval:

GE14/0009  

Project # 2006 Clark  

Date: 8/4/2014  

Mr Shannon Clark  
12 Northumberland Rd  
Pascoe Vale.  
Vic. 3044  

Dear Mr Shannon Clark  

I am writing with regard to your research application received on 07/02/2014 concerning your forthcoming project titled ‘Examining the Effects of Exposure to Specific Linguistic-Structural Parameters of Popular Music Lyrics on Adolescents’ Transient Cognitive Performance’. You have asked approval to involve a Catholic school in the Archdiocese of Melbourne, as you wish to involve students.  

I am pleased to advise that your research proposal is approved in principle subject to the eight standard conditions outlined below.  

1. The decision as to whether or not research can proceed in a school rests with the school’s principal, so you will need to obtain approval directly from the principal of the school that you wish to involve. You should provide the principal with an outline of your research proposal and indicate what will be asked of the school. A copy of this letter of approval, and a copy of notification of approval from the organisation’s/university’s Ethics Committee, should also be provided.  

2. A copy of the approval notification from your institution’s Ethics Committee must be forwarded to this Office, together with any modifications to your research protocol requested by the Committee. You may not start any research in Catholic Schools until this step has been completed.  

3. A Working with Children (WWC) check – or registration with the Victorian Institute of Teaching (VIT) – is necessary for all researchers visiting schools. Appropriate documentation must be shown to the principal before starting the research in the school.  

4. No student is to participate in the research study unless s/he is willing to do so and informed consent is given in writing by a parent/guardian.  

5. Any substantial modifications to the research proposal, or additional research involving use of the data collected, will require a further research approval submission to this Office.
6. Data relating to individuals or the school are to remain confidential.

7. Since participating schools have an interest in research findings, you should consider ways in which the results of the study could be made available for the benefit of the school community.

8. At the conclusion of the study, a copy or summary of the research findings should be forwarded to the Catholic Education Office Melbourne. It would be appreciated if you could submit your report in an electronic format using the email address provided below.

I wish you well with your research study. If you have any queries concerning this matter, please contact Ms Alison Jansz-Senn of this Office.

The email address is apr@ceomelb.catholic.edu.au.

Yours sincerely

Anna Rados
MANAGER ANALYSIS, POLICY & RESEARCH

Appendix 6: Main Study- Recruitment Documents: Email Invitation (Tertiary):
The School of Psychology warmly invites you to participate in a research project on:

**Exposure to Different *Music Lyrics*, and the Brain: is your music making you SMARTER?**

Dear fellow Students,

The semester is fast coming to an end, and YES there are still HDR students bombarding you with ‘Research Participation’ opportunities? So, I am a Masters student completing my research project for a thesis on the effects of *differences in music lyrics on the brain*. Specifically, the project is investigating the effects of exposure to specific linguistic-structural parameters of popular music lyrics on cognitive performance. Essentially, we are interested in the relationship between lyrical music exposure and intelligence, and we hope that the project will lead to a more comprehensive understanding of the influence lyrical music exposure has on cognitive development.

As this study involves multiple testing sessions, ACU psychology undergraduate students will be offered *3% course credit* towards their end of semester grade by participating in this study. Participants not receiving course credit for participation will go in to a draw to win a share of *$1,000 worth of Apple Store vouchers*, with a first prize of $500 – it doesn’t take a (Apple) genius to figure out the benefits of a new educational device (i.e., iPad, Laptop etc.). In addition, just to let you know, I will stop collecting data when I reach the required sample size (which gives the participant a 3-in-120 chance to win).

**What do Participants need to do?**

- You will be asked to participate in three (3) separate testing phases:
  1. **First**, you will have to register online, this can be done at your home and is expected to take up to 20 mins.
  2. **Second**, you will have to come in to a computer lab here at the university for the first face-to-face testing sessions (this is expected to take up to 50 mins). This session involves being Pre-tested on some cognitive measures.
  3. **Third**, you will have to return to the computer lab on a separate occasion (within 7 days) to be exposed to some experimental music stimuli, and undergo a Post-test cognitive measure. This session is expected to take up to 35 minutes, and completes the study requirements.

**Who can participate?**

- Participation in this study is completely voluntary
- People who are aged between **18-24 years**
- Responses are confidential and will remain anonymous

*The project has been approved by the Australian Catholic University Human Research Ethics Committee (2013 206V)*

To participate in this research, please read the attached ‘Information Letter’ and ‘Consent Form’.

By clicking on the Hyperlink in the Consent Form, you are giving consent.

*Thank you for considering participating in my research*

Shannon Clark
Master of Philosophy Candidate (Psychology)
St Patrick’s campus ACU

Appendix 6.1: *Main Study - Recruitment Documents: Email Invitation (Principal):*
Dear Principal,

With approval from CEOM, we are contacting a list of secondary schools provided by the Archdioceses of Melbourne who may be able to provide assistance early in Term 1 2015. Under the Supervision of Professor John Gleeson and Professor Peter Wilson at the Australian Catholic University, Shannon Clark is a Research Masters student looking to recruit adolescents (14-17yo) for his thesis project. As such, we would like to invite your school to participate in some research with the ACU Psychology faculty. This research is looking at adolescents’ experience of music listening, and its associations with cognitive development. Attached is a copy of the research proposal and an information letter outlining the nature of the project and how to participate.

To provide a summary of the project;
Students will have to register online at home (20 mins), and then come in to a computer lab (preferably at their school) for a further 2 testing sessions (between 35-50 mins for each session and on separate days). This study involves being Pre-tested on some cognitive measures, exposure to some experimental or control music, and a Post-test cognitive measure. Specifically, we are interested in the relationship between certain lyrical music and analogical reasoning.

As an incentive, all participants will go into the draw to win a share of $1,000 in Apple Store vouchers (redeemable for educational devices such as an iPad for example). Furthermore, schools are able to obtain aggregated data of their student’s results – with the intent to assist with continued curriculum development.

Thank you for considering participating with the ACU and this project

Kind Regards,

Prof. John Gleeson
Prof. Peter Wilson
Mr Shannon Clark
Appendix 6.2: Main Study Recruitment Documents: Tertiary Campus Flyer:

Win a share of $1,000 worth of Apple Store vouchers, with a first prize of $500

By participating in a research project on:

Exposure to Different Music Lyrics, and the Brain: is your music making you SMARTER?

The project is investigating the effects of exposure to specific linguistic-structural parameters of popular music lyrics on cognitive performance. Essentially, we are interested in the relationship between lyrical music exposure and intelligence.

As this study involves multiple testing sessions, participants will go in to a draw to win a share of $1,000 worth of Apple Store vouchers, with a first prize of $500 – it doesn’t take a (Apple) genius to figure out the benefits of a new educational device (i.e., iPad, Laptop etc.).

What do Participants need to do?

You will be asked to participate in three (3) separate testing phases:

1. First, register online, this can be done at your home and is expected to take up to 20 mins.
2. Second, come in to a computer lab at the ACU for a face-to-face testing session, which is expected to take up to 50 mins.
3. Third, return to the computer lab on a separate occasion (within 7 days) to be exposed to some experimental music stimuli, and undergo a Post-test cognitive measure. This session is expected to take up to 35 minutes, and completes the study requirements.

Who can participate?

- Participation in this study is completely voluntary
- People who are aged between 18-24 years
- Responses are confidential and will remain anonymous

The project has been approved by the Australian Catholic University Human Research Ethics Committee (2013 206V).

To participate in this research, email ssclar005@myacu.edu.au for an ‘Information Letter’ and ‘Consent Form’.
PARTICIPANT INFORMATION LETTER

PROJECT TITLE: The Effects of Exposure to Specific Linguistic-Structural Parameters of Popular Music Lyrics on Adolescents’ Transient Cognitive Performance.

PRINCIPAL INVESTIGATOR: Prof John Gleeson

STUDENT RESEARCHER: Mr Shannon. S. Clark

STUDENT’S DEGREE: Master of Philosophy (Psychology)

Dear Participant,

You have been invited to participate in some research on figurative language in music lyrics.

What is the project about?
This project is investigating the effects of exposure to specific linguistic-structural parameters (e.g., poetry, metaphoric language) in popular music lyrics, on cognitive performance.

Who is undertaking the project?
This project is being conducted by Shannon Clark and will form the basis for the degree of Master of Philosophy (Psychology) at Australian Catholic University under the supervision of Dr Eric Marx.

Are there any risks associated with participating in this project?
It is emphasised that participation in this study is for the purposes of data collection only. The data collected will be non-identifiable and non-intrusive. Participants will not have to undergo any procedure that will cause physical or psychological harm. As such there are negligible risks to participants.

What will I be asked to do?
Participants will partake in 3 phases of the research project. The initial phase (titled ‘Registration’) will be the online registration, completed at home after receiving the information letter. This will involve assigning a ‘Participant Code’ (see Consent Form), and responding to demographic and other questionnaires (i.e., Figurative Language Comprehension assessment, and Music Investment
assessment). The second phase will be a reading ability assessment, a general intelligence assessment, and an analogical reasoning ‘Pre-test’. The third phase will be the actual experiment (exposure to music), and a ‘Post-test’ analogical reasoning assessment.

How much time will the project take?
This project will take place over a two week period. Testing will occur in the home (‘Registration’ phase), and at the participants’ university (Phases I & II). Each time a response/action is required of the participant, it will be done online in their universities computer lab; through Survey Monkey. The initial (Registration) phase is expected to take up to 20 minutes. The first face-to-face phase (Phase I) is expected to take up to 50 minutes including instructions. The second face-to-face phase (Phase II) is expected to take up to 35 minutes including instructions.

What are the benefits of the research project?
Participants will be contributing to research, which may be published to further explain factors that assist with understanding the effects of media (specifically music) on adolescent cognitive development.
*Participants, who complete all the required phases of the research project, will go in the draw to win a share of $1,000 in Apple Store vouchers (drawn after the data collection phase).

Can I withdraw from the study?
Participation in this research project is voluntary, you have no obligation to give consent, and no obligation to participate. Participants can withdraw from the study at any stage without reason or consequence*.

Will anyone else know the results of the project?
The results of this project are expected to be published in the Journal of Psychomusicology: Music, Mind, and Brain (PMMB). The data collected will be non-identifiable with the use of ‘Participant Codes’, and the aggregation of the data. Participants’ identities will therefore not be identified in publications. Data will be stored on lockable computer storage devices in the offices of the principal researcher.

Will I be able to find out the results of the project?
The results of this project are expected to be published in the Journal of Psychomusicology: Music, Mind, and Brain (PMMB).

Who do I contact if I have questions about the project?
The research project can be explained in greater detail if you require. Any questions regarding this project should be directed to the Principal Investigator Professor John Gleeson via email john.gleeson@acu.edu.au.

What if I have a complaint or any concerns?
The study has been approved by the Human Research Ethics Committee at Australian Catholic University (approval number 2013 206V). If you have any complaints or concerns about the conduct of the project, you may write to the Chair of the Human Research Ethics Committee care of the Office of the Deputy Vice Chancellor (Research).
Email: res.ethics@acu.edu.au

Any complaint or concern will be treated in confidence and fully investigated. You will be informed of the outcome.

_I want to participate! How do I sign up?_  
Thank you for considering participation in this study. See the attached consent form for details on how to give informed consent, and how to register.

Yours sincerely,

Shannon S. Clark

Prof John Gleeson
PARENT INFORMATION LETTER

PROJECT TITLE: The Effects of Exposure to Specific Linguistic-Structural Parameters of Popular Music Lyrics on Adolescents’ Transient Cognitive Performance.

PRINCIPAL INVESTIGATOR: Prof. John Gleeson

STUDENT RESEARCHER: Mr Shannon. S. Clark

STUDENT’S DEGREE: Master of Philosophy (Psychology)

Dear Parent/Carer,

Your child has been invited to participate in some research on figurative language in music lyrics.

What is the project about?
This project is investigating the effects of exposure to specific linguistic-structural parameters (e.g., poetry, metaphoric language) in popular music lyrics, on cognitive performance.

Who is undertaking the project?
This project is being conducted by Shannon Clark and will form the basis for the degree of Master of Philosophy (Psychology) at Australian Catholic University under the supervision of Dr Eric Marx.

Are there any risks associated with participating in this project?
It is emphasised that participation in this study is for the purposes of data collection only. The data collected will be non-identifiable and non-intrusive. Participants (your child) will not have to undergo any procedure that will cause physical or psychological harm. As such there are negligible risks to participants.

What will I be asked to do?
Participants will partake in 3 phases of the research project over a two week period. The initial phase (titled ‘Registration Phase’) will be the online registration, completed at home after receiving the
Analogical Reasoning & Figurative Language Exposure

information letter. This will involve assigning a ‘Participant Code’ (see Consent Form), and responding to online demographic and other questionnaires (i.e., Figurative Language Comprehension assessment, and Music Investment assessment). The second phase (titled ‘Phase I’) will be a reading ability assessment, a general intelligence assessment, and an analogical reasoning ‘Pre-test’. The third phase (titled ‘Phase 2’) will be the actual experiment (exposure to music), and a ‘Post-test’ analogical reasoning assessment.

How much time will the project take?
This project will take place over a one-two week period. Testing will occur in the home (‘Registration’ phase), and at the participants’ school (Phases I, and II). Each time a response/action is required of the participant, it will be done online in their school’s computer lab; through Survey Monkey. The initial (Registration) phase is expected to take up to 25 minutes. The first in-school phase (Phase I) is expected to take up to 55 minutes including instructions. The second (Phase II) is expected to take up to 35 minutes including instructions. On each occasion, the participant (your child) will be required for the same amount of time on average as their usual class time.

What are the benefits of the research project?
Participants will be contributing to research, which may be published to further explain factors that assist with understanding the effects of media (specifically music) on adolescent cognitive development.

*Participants, who complete all the required phases of the research project, will go in the draw to win a $500.00 (1st prize), $300 (2nd prize), or $200 (3rd prize) Apple Store voucher (drawn after the data collection phase).

Can I withdraw from the study?
Participation in this research project is voluntary, you (as parent/carer) have no obligation to give consent, and your child has no obligation to participate. Participants can withdraw from the study at any stage without reason or consequence*.

Will anyone else know the results of the project?
The results of this project are expected to be published in the Journal of Psychomusicology: Music, Mind, and Brain (PMMB). The data collected will be non-identifiable with the use of ‘Participant Codes’, and the aggregation of the data. Participants’ identities will therefore not be identified in publications. Data will be stored on lockable computer storage devices in the offices of the principal researcher.

Will I be able to find out the results of the project?
The results of this project are expected to be published in the Journal of Psychomusicology: Music, Mind, and Brain (PMMB).

Who do I contact if I have questions about the project?
The research project can be explained in greater detail if you require. Any questions regarding this project should be directed to the Principal Investigator Mr. Shannon Clark on 0433 585 717 or ssclar005@myacu.edu.au
What if I have a complaint or any concerns?
The study has been approved by the Human Research Ethics Committee at Australian Catholic University (approval number 2013 206V). If you have any complaints or concerns about the conduct of the project, you may write to the Chair of the Human Research Ethics Committee care of the Office of the Deputy Vice Chancellor (Research).

Chair, Human Research Ethics Committee  
C/- Research Services  
Australian Catholic University – Brisbane Campus  
PO Box 456  
Virginia QLD 4101  
Tel: 07 3623 7429  
Fax: 07 3623 7328  
Email: res.ethics@acu.edu.au

Any complaint or concern will be treated in confidence and fully investigated. You will be informed of the outcome.

I want to participate! How do I sign up?
Thank you for considering participation in this study. See the attached consent form for details on how to give informed consent, and how to register your child.

Yours sincerely,

Shannon. S. Clark
Dear Principal,

I am a research Masters student (Psychology) with the Australian Catholic University (ACU), and I am investigating the effects of popular music exposure on youth culture. It is being undertaken for the thesis component of a Master of Philosophy (MPhil - Psychology) research project. As your school has a concentration of my target demographic (i.e., adolescents), I am inviting you to participate in some research on the effects of figurative language exposure through music lyrics on adolescent’s transient cognitive performance. I am recruiting as many as 350 participants aged 14-24 for this project. The 18-24 year old will be recruited through the university (ACU), and the 14-17 years will be recruited across a number of metropolitan secondary schools.

TITLE OF PROJECT:
Examining the Effects of Exposure to Specific Linguistic-Structural Parameters of Popular Music Lyrics on Adolescents’ Transient Cognitive Performance.

HIGHER DEGREE RESEARCHER:
Shannon. S. Clark

PRINCIPAL INVESTIGATOR:
Prof. John Gleeson

PROGRAMME HDR ENROLLED IN:
Master of Philosophy (Psychology)
Nature of the Study - Background:
Adolescence can be a tumultuous period of development. Externally, adolescents are dealing with increased social stressors and risks, internally, physiological changes are occurring; spanning the entire developmental period.

The effects of environmental variables in adolescence are paramount to outcomes and can have lasting effects on adult functioning. Additionally, behavioural idiosyncrasies, knowledge structures, schemas, and or scripts acquired during adolescence are extremely hard to change. Furthermore, structures, schemas, and scripts not acquired during adolescence are much harder to acquire in adulthood. On this basis, variables effecting acquirement of structures, schemas, and scripts related to processes required for making positive life choices need to be recognised, elucidated, and investigated.

Media exposure is the most omnipresent phenomena experienced by adolescents (excluding eating and sleeping). It is so enthusiastic it may be the most influential environmental variable contributing to cognitive, affective, and behavioural development.

This theoretical premise was initially captured and tested using the General Learning Model (GLM) of media exposure, and continued use of the model in the literature consistently adds generalisability and validity. Both instrumental (i.e., the Mozart effect) and vocal declarative content both have well established links with effecting cognition, affect, and behaviour. However, with specificity to music lyrics, the extent of existent research is limited to declarative content (i.e., messages). Linguistic-structural parameters, such as metaphoricity and figurativeness, are yet to be addressed.

Whereas some music lyrics have been defined as akin to poetry and non-literal language (i.e., high in metaphoricity/figurativeness), others have been defined as purely literal (i.e., not containing plurality of meaning). Repeated exposure to metaphoric/figurative language comprehension tasks has been associated with superior cognitive abilities. Superior cognitive abilities may assist adolescents with positive, logical, rational decision making surrounding life choices.

Method:

Initially: Participants will be recruited through a letter and consent for sent home to the parent/carer. Participants will register online by filling out registration questionnaires. This can be completed in their own homes, and at their convenience.

For Students participating in the STUDY: This is a Between Groups Study

- Participants will be pre-tested on several cognitive abilities (Phase 1 - This is expected to take approximately 50 minutes), before being exposed to the music stimuli in the second session; and then post-tested on a cognitive ability (Phase 2 - This is expected to take approximately 35 minutes).

Testing phases will occur in the respective schools’ computer lab, and will be conducted online through Survey Monkey. The Human Research Ethics Committee at the Australian Catholic University has approved this study (2013 206V) to be canvassed to secondary schooling institutions, and to be conducted with this age group. The Archdiocese of Melbourne has also
Analogical Reasoning & Figurative Language Exposure

granted approval for this research to be conducted in Melbourne Catholic schools (Project #2006). It is emphasised that participation in this study is for the purposes of data collection only. The data collected will be non-identifiable and non-intrusive. Participants/students will not have to undergo any procedure/task that will cause them physical or psychological harm. As such this project is judged to have no foreseeable risks to participants/students.

**Student/Participant Requirements:**
The students will have three encounters with the study:

i. The first encounter will be the **Registration Phase**.
   - Participants will be given an information letter and permission slip to take home, on which their parent/carer either afford or deny consent on the permission slip.
   - If consent is afforded, the child (the participant) is assigned a “participant code” (their first & surname initials and the first two digits of their birthdate).
   - This will be recorded on a “tear off” section on the consent form, and is to be returned to the school and given to the researcher. This “participant code” will also serve as a ‘log-in’ for future testing phases.
   - There is no identifiable information on this return slip; however, it will be kept by the researcher as an ethical requirement (This slip may have an email address attached in order for the competition winner to be notified).
   - The participant will then register online with SurveyMonkey by completing the registration questionnaires (at home) – This completes the **Registration Phase** (expected time = 30min).

ii. The second encounter will be **Phase 1**.
   - The participant will present to a computer lab at their school.
   - Participants will then be directed to a computer and told to await instructions.
   - The first instruction participants receive will be to enter their “participant code”.
   - Once participants are ‘online’ they will be given instruction to begin the first task – a timed (35 min) two-part reading test.
   - Participants will be instructed when to stop part one and start part two of the reading test.
   - Upon finishing the reading test, participants will be given instructions to complete a 15 minute intelligence test.
   - After the intelligence test, participants will attempt an analogical reasoning task, be thanked for attending, and reminded of the timing for their next testing session (i.e., Phase 2) – This completes **Phase 1**.

iii. The third encounter will be **Phase 2**.
   - The participant will again present to a computer lab.
   - Participants will then be directed to a computer and told to await instructions.
   - As with Phase 1, the first instruction participants receive will be to enter their “participant code”.
   - Once participants are ‘online’ they will be given instruction for the experimental procedure, and then undergo the experimental procedure – exposure to music.
   - Finally, participant will take a post-test analogical reasoning task.
   - Participants will be thanked for attending - This completes **Phase 2**, and the overall participation requirements.
Instructor/Teacher Requirements:
This project could be run by either having the principal researcher (Shannon Clark – Working with Children Check: 0168542A 01) come into the school and conduct the studies, or the school could use their own staff and take responsibility for conducting the study. The first option would require very little school staff requirements/involvement. The latter option would require greater school staff requirements/involvement. In either case, the episodes of testing require minimal effort of the instructor/teacher:

Initially:
- School staff (i.e., teachers) will have to disseminate the information and consent letters, as well as collect permission/registration slips.

During Phase 1:
- Instructors will be responsible for collecting permission slips from participants and directing them to computers.
- The instructor will give instruction, regarding procedure and time limit(s), and permission to commence testing.
- At the first time interval (after 15min - part 1 of reading test) the instructor will need to alert participants to this and stop testing.
- Instructions will then be given for, and to commence, the second part of the reading test.
- At the second time interval (after 20min – part 2 of reading test) the instructor will need to alert participants to this and stop testing.
- Instructions will then be given to commence the intelligence test (15 minutes timed).
- The final instruction is to complete the pre-test analogical reasoning task.
- Once the testing phase is complete (approximately 50 minutes) participants will be given their time & date for Phase 2.

During Phases 2:
- Instructors will be responsible for greeting participants (confirming, at the same time, their Phase 1 participation), handing out material, and directing participants to their computers.
- Instructions will need to be given regarding the stimuli exposure (this may require greater attendance on the instructors’ part. For example starting & stopping the music).
- Finally, instructors/teachers give instructions for the analogical reasoning task (post-test).
- Instructors will then check that competition entry requirements have been met and dismiss participants.

(NB: Full instructor guidelines will be sent out with a ‘Recruitment Package’)

The potential benefits for participants are that their school will be able to get a non-diagnostic assessment of their students’ reading ability, figurative language comprehension, general intelligence and analogical reasoning ability. This may assist with structuring future curriculums and activities. Students participating in this study will be available to enter a draw to win a share of $1000 worth of Apple Store vouchers. Both participants and the schools will also be contributing to research, which may be published to further explain factors that assist with understanding the effects of media exposure (specifically music) on adolescents’ cognitive
development. Participation in this research project is voluntary, and participants can withdraw from the study at any stage without giving a reason.

The research project can be explained in greater detail if you require, and any questions regarding this project should be directed to the Higher Degree Researcher Shannon Clark by phone on 0433 585 717 or by e-mail on ssclar005@myacu.edu.au. The Principal Investigator Professor John Gleeson can also be contacted on (03) 9953 3108 or in writing/person at level 5, room 5.47 in the School of Psychology – The Daniel Mannix Building, St Patricks Campus at the Australian Catholic University.

In the event that you have any complaint, concern, or query that the Higher Degree Researcher and Staff Supervisor may not be able to satisfy, you may write to:

Chair, Human Research Ethics Committee  
C/- Research Services  
Australian Catholic University – Brisbane Campus  
PO Box 456  
Virginia QLD 4101  
Tel: 07 3623 7429  
Fax: 07 3623 7328

Any complaint will be treated in confidence and will be fully investigated. Thank you for considering participation in this study.

Regards,

Shannon Clark
CONSENT FORM
(To be returned to the instructor)

TITLE OF PROJECT: The Effects of Exposure to Specific Linguistic-Structural Parameters of Popular Music Lyrics on Adolescents’ Transient Cognitive Performance.

PRINCIPAL INVESTIGATOR: Prof John Gleeson

HIGHER DEGREE RESEARCHER: Mr. Shannon. S. Clark

I………………………………………………………………., have read (or, where appropriate, have had read to me) and understood the information provided in the ‘Information Letter to Participants’. Any questions I have asked have been answered to my satisfaction. I consent to participating in the online questionnaires/assessments and music exposure as outlined in the nominated research project, realising that I can withdraw consent at any time (without comment or penalty/without affecting my future studies/relationship with researchers etc). I agree that research data collected for the study may be published or may be provided to other researchers in a form that does not identify me in any way.

Once you consent to participation, you need to be registered. This can be achieved by visiting the weblink below, and returning the below section of this form. By entering Survey Monkey you are acknowledging that you understand the nature of the research project and are agreeing to your child participating. Registration can be performed immediately.

To assign a “Participation Code’ take your first, middle, and last initial, and the first two numbers of your birthdate (i.e., John James Smith born 23/11/1975 would have the “participation code’ - J J S 2 3).

Signed:……………………………………………………………….........................

Click on either of the links below to register

https://www.surveymonkey.com/s/ACUstudy_REGISTRATION_1
\ https://www.surveymonkey.com/s/ACUstudy_REGISTRATION_2
CONSENT FORM

TITLE OF PROJECT: The Effects of Exposure to Specific Linguistic-Structural Parameters of Popular Music Lyrics on Adolescents’ Transient Cognitive Performance.

PRINCIPAL INVESTIGATOR: Dr. John Gleeson
HIGHER DEGREE RESEARCHER: Mr. Shannon. S. Clark

I ………………………………………….. (parent/carer name) consent to my child ………………………………………….. (Child’s name), participating in the online questionnaires/assessments and music exposure as outlined in the nominated research project, ‘The Effects of Exposure to Specific Linguistic-Structural Parameters of Popular Music Lyrics on Adolescents’ Transient Cognitive Performance’.

I ………………………………………….. (Child’s name) consent to participating. YES□ NO□

My child has completed the ‘Registration’ phase, online at Survey Monkey, and has been given the assigned “Participant Code”: ___ ___ ___ ___

I am providing the following e-mail address ………………………………………………... so as to be notified if my child is the winner of the Apple store voucher competition.

Signed: …………………………………… Date…………/………/………

THIS FORM IS TO BE HANDED BACK TO YOUR TEACHER/RESEARCHER

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1. Study ID:

This will be your alphanumeric sequence containing your initials and birthdate (i.e., if your name is John Adam Smith and you were born on the 23rd day of the month then your Study ID would be JAS23) *

**Demographics**

1. Age:

2. Year level at School/Uni:

3. Highest year achieved at school/uni:

4. Gender:

5. Parents Annual Income (if known):

6. Parents Job Title:

7. Do you do extracurricular activities outside school/uni (i.e., sports, dance, music lessons):

8. What were your grades for your last completed term/semester of education/do you agree to sharing you grades with the researchers?:

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Appendix 8: Main Study Materials – Phase 1: Pre-Testing - Analogical reasoning Task:

This part of the study requires you to complete as many analogical reasoning questions as possible in the time provided - **15 minutes**.

Each question follows the same format, and requires a single word answer.

**NB:** You will be required to **fill in the blank space** that replaces the question mark.

**An example question:**

- i.e., **FATHER** is to **SON** as **MOTHER** is to __?__?
- The correct response to this question would be **DAUGHTER**. ✓
- "**FATHER** is to **SON** as **MOTHER** is to **DAUGHTER**".

➤ You would type **DAUGHTER** into the blank space provided ❯

Click ‘Next’ when instructed to begin the test.
Appendix 8.1: Main Study Materials – Phase 1: Pre-Testing - Analogical reasoning Task:

- Remember each question requires only a **SINGLE** word answer.

Please attempt every question, and keep in mind that correct spelling is **NOT** the focus of this task.

If you finish before the time expires please check your response and attempt any questions you may have skipped.

BEGIN TESTING

1. barometer is to pressure as thermometer is to?

2. basket is to picnic as holster is to?

3. basketball is to hoop as soccerball is to?

4. bear is to cave as Martian is to?

5. blindness is to sight as poverty is to?

~ 109 ~
## Appendix 8.2: Main Study Materials – Phase 1: Pre-Testing - Analogical reasoning Task:

### Analogical Reasoning Task Items

<table>
<thead>
<tr>
<th>Pre-Test: (Phase-1)</th>
<th>Post-Test: (Phase-2)</th>
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<td>heart:cardiologist::engine:mechanic</td>
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<td>juice:grapefruit::milk:cow</td>
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<td>juice:grapefruit::cider:apple</td>
</tr>
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<td>kitten:cat::puppy:dog</td>
</tr>
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<td>kitten:cat::spark:fire</td>
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<td>lambchop:lamb::chapter:book</td>
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<td>orchard:apple::neighborhood:apartment</td>
</tr>
<tr>
<td>cannon:cannonball::hose:water</td>
<td>pen:pig::coop: chicken</td>
</tr>
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<td>carpet:floor::wallpaper:wall</td>
<td>pen:pig::reservoir: water</td>
</tr>
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<td>perimeter:rectangle::circumference: circle</td>
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<td>perimeter:rectangle::lakeshore:lake</td>
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<td>plumbing:water::wiring:electricity</td>
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<td>plumbing:water::artery: blood</td>
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<td>sugar: cane:: cornmeal: corn</td>
</tr>
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<td>diesel:truck::gasoline:car</td>
<td>sugar: cane:: diamond: coal</td>
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<tr>
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<td>saxophone:jazz:: cello: classical</td>
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<td>sweater: wool:: candle: wax</td>
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<tr>
<td>father:son:: inventor: invention</td>
<td>taco: tortilla:: burger: bun</td>
</tr>
<tr>
<td>flock:goose:: wolfpack: wolf</td>
<td>taco: tortilla:: book: cover</td>
</tr>
<tr>
<td>flock:goose::constellation: star</td>
<td>theater: director:: orchestra: conductor</td>
</tr>
<tr>
<td>foot: footprint:: finger: fingerprint</td>
<td>theater: director:: kingdom:: king</td>
</tr>
<tr>
<td>foot: footprint:: meteorite: crater</td>
<td>tile: mop:: rug: vacuum</td>
</tr>
<tr>
<td>foresight: future::hindsight: past</td>
<td>tile: mop:: tooth: toothbrush</td>
</tr>
<tr>
<td>foresight: future:: x-ray: bone</td>
<td>trimmer: mustache:: razor: beard</td>
</tr>
<tr>
<td>furnace: coal:: woodstove: wood</td>
<td>trimmer: mustache:: lawnmower: lawn</td>
</tr>
<tr>
<td>furnace: coal:: stomach: food</td>
<td>vinyard: wine:: brewery: beer</td>
</tr>
<tr>
<td>glove: hand:: scarf: neck</td>
<td>vinyard: wine:: lawschool: lawyer</td>
</tr>
<tr>
<td>glove: hand:: pillowcase: pillow</td>
<td>watermelon: rind:: orange: peel</td>
</tr>
<tr>
<td>gully: hill:: valley: mountain</td>
<td>watermelon: rind:: ozone: Earth</td>
</tr>
<tr>
<td>gully: hill:: sadness: happiness</td>
<td>whiteout: pen:: eraser: pencil</td>
</tr>
<tr>
<td>head: helmet:: knee: kneepad</td>
<td>whiteout: pen:: amnesia: memory</td>
</tr>
</tbody>
</table>
Appendix 9: Main Study Materials – Phase 2: Music Exposure & Pre-Testing:

Linguistic-Structure Assessment:

Adopted in part from Greenfield et al., (1987)

Please answer the following questions about the song that you have just heard.

1. Did you understand the lyrics of this song?

2. What kind of song is this? Sad, happy, angry, silly, serious, other

3. What do you think the meaning of this song was? (Please write your answer).

4. Do you think someone else could get a different meaning from this song, other than the meaning that you’ve got?

5. Rate, on the 5-point scale below, the degree to which you think the meaning of this song was figurative (i.e., you had to read into the words to get meaning), or literal (i.e., the words mean exactly what they said).

<table>
<thead>
<tr>
<th>Literal</th>
<th>Figurative</th>
</tr>
</thead>
<tbody>
<tr>
<td>1--------</td>
<td>2-----------</td>
</tr>
</tbody>
</table>

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Appendix 10:  

Main Study Results – ANOVA: 

A factorial between groups analysis of variance (ANOVA) was used to investigate the effects of lyric condition, age group, gender, and extracurricular activity participation on transient cognitive performance change scores. The ANOVA revealed a statistically significant main effect for the lyric condition only, $F(1,18) = 20.54, p < .001$, partial $\eta^2 = .093$. There were no significant main effects for age group ($F[1,18] = .128, p = .725$, partial $\eta^2 = .007$), gender ($F[1,18] = .145, p = .708$, partial $\eta^2 = .008$), or extracurricular activity participation ($F[1,18] = 7.24, p = .204$, partial $\eta^2 = .088$). In addition, there were no significant interactions between, age group and lyric condition ($F[1,18] = .128, p = .725$, partial $\eta^2 = .007$), gender and lyric condition ($F[1,18] = .128, p = .725$, partial $\eta^2 = .007$), or extracurricular activity participation and lyric condition ($F[1,18] = .128, p = .725$, partial $\eta^2 = .007$). As such, there were no follow-up tests performed. The nature of these interactions are illustrated in Figure 1 (age*lyric condition), Figure 2 (gender*lyric condition), and Figure 3 (extracurricular activity*lyric condition).
Variable Interactions

**Figure 1.**
Gender and lyric condition.

**Figure 2.**
Age and lyric condition.

**Figure 3.**
ECAP and lyric condition.
Appendix 10.1:  

**Main Study Results – ANCOVA:**

Furthermore, an analysis of covariance (ANCOVA) was conducted to assess whether there was a significant difference in overall ‘transient cognitive performance change scores’ of adolescents exposed to different lyrical conditions (i.e., figurative and literal) after controlling for pre-existing cognitive performance of analogical reasoning and practice effects of analogical reasoning task exposure. Analogical reasoning pre-test scores were operationalised as ‘pre-existing cognitive ability’, and the ‘Literal Lyric’ condition’s mean transient cognitive performance change score ($M = 2.80, SD = 2.01$) was operationalised as ‘practice effects’, and were thus included as a covariates to partial out from the analysis.

Examination of the Shapiro-Wilk statistics and histograms for each group indicated that the ANCOVA assumptions of normality were supported. Scatterplots indicated that the relationship between the covariate (practice effects) and the dependent variable (transient cognitive performance change score) was linear. Finally, the assumptions of homogeniety of regression slopes and homogeniety of variances were supported by the absence of a significant IV-by-covariate interaction $F(1, 27) = 0.00, p > .05$, and a non-significant Levene’s test, $F(1, 29) = .096, p = .759$. The ANCOVA indicated that, that after accounting for the effects of pre-existing cognitive performance of analogical reasoning and analogical reasoning task practice-effects, there was a statistically significant effect of ‘lyric condition’ on transient cognitive performance change scores, $F(1,28) = 33.89, p < .001$, partial $\eta^2 = .548$. 

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