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Popular Music-Evoked Autobiographical Memories - Developing a Database of Songs and Studying the Role of Cue Emotionality and Relevance on Recalled Memories

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Abstract

In Study 1, undergraduate students rated popular music songs on several factors. A database of knowledge was created for popular music autobiographical memory (AM) cueing research. Study 2 examined the role of emotional experience and relevance associated with a popular music AM cue on recalled AMs. In Phase 1, undergraduate participants described AMs to short music clips or a blank computer screen (control). In Phase 2, participants answered questions about these AMs. In Phase 3, participants rated musical clips (including Phase 1 stimuli). Unexpectedly, music-cued memories were less salient and did not differ emotionally from control-cued, but contained more perceptual and leisure content. When examining only participants cued by music, the emotional experience associated with listening to the cue was congruent with that of the produced memory. In addition, memories evoked to highly relevant music were rated as more salient and emotional than those evoked to less personally relevant music.

Keywords: Autobiographical Memory, Popular Music Cueing, Emotion, Stimuli Selection, Popular Music Cueing Database

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Chapter 1

1 Introduction

Both in public and private, popular music is heavily intertwined with our lives. In fact, we spend about a third of our waking day encountering music (Juslin, Liljeström, Västfjäll, Barradas, & Silva, 2008). In stores, at the gym, in our cars, popular music is difficult to avoid. Beyond this public exposure, the increase in personal music technology and accessibility (e.g. listening-enabled cellular phones) in recent years arguably allows for a more individualized, mobile, and private listening experience. Substantial proportions of adults report either sometimes or often listening to music during normal day to day activities including bathing, exercising, relaxing, eating, and socializing (with proportions ranging between .42 and .94, Juslin & Laukka, 2004). Because of this presence in everyday life, one can ask: How is music tied to other aspects of our lives? Here we ask how music is associated with our memories of our past.

Anecdotally, individuals often claim that a specific song transports them to a different time and place. This could be as broad as a specific era from their past (e.g. high school) or as specific as a meaningful past event (e.g. high school prom). Experimentally, it has been shown that popular music successfully cues personal event memories (autobiographical memories, AMs, e.g. Janata, Tomic, & Rakowski, 2007; Zator & Katz, 2017), though we know very little about what role the music itself plays in evoking these memories.

One possible hypothesis is that a link between music and the evocation of autobiographical memories is related to the emotional functions that popular music serves in our lives. These functions are hypothesized to include evoking, regulating, maintaining, and altering emotion (Hargreaves & North, 1999; Juslin & Laukka, 2004; Juslin & Västfjäll, 2008; Juslin et al., 2008). In addition, music's functions are especially pronounced cross-culturally in young adults and have been attributed to personally relevant music in this population (Boer & Fischer, 2010; Labbé, Schmidt, Babin, & Pharr, 2007; Lippman & Greenwood, 2012; McFerran, Garrido, O'Grady, Grocke, & Sawyer, 2015; Schäfer, Tipandjan, & Sedlmeier, 2012; Tarrant, 2000). Specifically,

Lippman and Greenwood (2012) found that when asked to comment on why a self-selected memorable song was meaningful, about one third of surveyed undergraduate students responded with some reference to a positive event memory. Thus, emotional significance and personal relevance are important factors in music listening in young adults that deserve further study. These factors will be examined in Study 2 in this thesis.

Empirical research demonstrates that popular music can both convey and induce emotions in listeners (e.g. Juslin et al. 2008; Song, Dixon, Pearce, & Halpern, 2016), though to our knowledge this relationship's connection to evoked personal memories has yet to be examined experimentally. In one naturalistic survey study of young adults, an emotional response (typically positive) was reported for about two thirds of music encountered in day-to-day life and one in seven of these instances was attributed to a specific AM by the participant (Juslin et al., 2008). Additionally, of encountered music, 76% was familiar and 62% was specifically participant-chosen (Juslin et al., 2008). A more recent neurobiological study by Pereira et al. (2011) also demonstrated that listening to familiar music activated emotion and reward centers in the brain to a greater degree than unfamiliar music. Thus, the personal relevance of a piece of music might be of special importance to AM given first the prevalence of emotions evoked to familiar and chosen music and second, the association of personal relevance to the emotional functions of music in young adults. The role played by music relevance in AM will be directly studied in Study 2.

The general aim of this thesis will be to examine in more depth the relations between popular music and the evocation of autobiographical memories, examining in particular, the role played by emotional valence (the degree of positive or negative affect experienced when listening to the music cue), emotional intensity (the strength of the emotion experienced during listening) and personal relevance (based on individual experience with the cue). Two studies are reported. Study 1 addresses a limitation in this field, namely, creating a quality experimenter-selected stimuli list. Study 1 does so by surveying many popular music songs on variables of interest (e.g. emotion). The main aim for the purposes of this thesis will be to use the resulting database of songs to select items for use in Study 2, the AM cueing study. Because the database can be of use for

future research projects, some initial analyses of the stimulus list will be provided. Using a cueing task, Study 2 addresses how both emotionality and relevance of a cue are related to the evoked personal memories.

A brief overview of the autobiographical memory (AM) literature, including emotion retrieval models, and popular music cueing history are reviewed below, followed by a more detailed review of the current studies.

1.1 Autobiographical memory

Autobiographical memory (AM) refers both to information about the self and to the re-experiencing of our past (Baddeley, 1992; Brewer, 1986; Williams, Conway, & Cohen, 2008). Specific event autobiographical memories, sometimes referred to as personal memories, are the type of AM of interest to the current study. These memories involve re-experiencing specific events from our past that occurred over a short period of time in a specific place (Brewer, 1986; Brewer, 1994; Conway & Pleydell-Pearce, 2000; Williams et al., 2008). Autobiographical memory shares some functions with music: identity creation, understanding, and stability of the self (Addis & Tippet, 2008; Baddeley, 1992; Bluck & Alea, 2008; Brewer, 1994; Williams et al., 2008). Autobiographical memories allow us to situate our past events across our lifespan and it is claimed that, through this lens, we understand who we are (Conway, Singer, & Tagini, 2004; Williams et al., 2008). It is because of this identity function that deterioration of AM contributes to the debilitating and disorienting symptoms of memory disorders such as seen with Alzheimer's disease (e.g. Addis & Tippett, 2004).

Unlike a computer document, saved and then retrieved unchanged whenever needed, AM theorists propose that personal memories are not statically stored as whole recollections (e.g. Conway & Pleydell-Pearce, 2000). In contrast, they are reconstructed at recall from pieces of autobiographical information stored in long-term memory (Conway & Pleydell-Pearce, 2000). Thus, the context in which a memory is retrieved should affect its reconstruction. The Self-Memory System (SMS; Conway & Pleydell-Pearce, 2000) is the most prominent explanatory constructivist theory of AM, consisting of two interacting mechanisms working reciprocally to store and reconstruct memories (Conway &

Pleydell-Pearce, 2000). The autobiographical knowledge base (AKB) is the storage system of AM information, whereas the "working self" is a transitory representation of a person's current goals and state (Conway, 2005; Conway & Pleydell-Pearce, 2000). The SMS strives to maintain a stable sense of self (Conway, 2005). When processing an event, the current "working self" influences what information is encoded in the AKB for later use, as well as what can be extracted from that information in the AKB at retrieval (Conway & Pleydell-Pearce, 2000). Thus, the retrieving working self may prevent access to specific AKB information if conflicting with the goals and state of the encoding working self (Conway, 2005; Conway & Pleydell-Pearce, 2000).

We argue here that music could, in principle, influence both the encoding and retrieving of memories through the working self. Here we examine the role played by emotion evoked to music. As popular music can induce a felt emotion (e.g. Juslin et al., 2008; Song et al., 2016), emotion may be a salient factor in the organization of memories associated with popular music songs. In this thesis, we will examine the role played by popular music in the evocation and nature of elicited AMs, and whether emotional factors are central both in eliciting memories and in the nature of the memories evoked. The role of emotion in AM retrieval is discussed below, followed by a review of the literature on popular-music cued AM.

1.1.1 Emotion and retrieval

Based on Conway and Pleydell-Pearce's (2000) Self-Memory System, current felt emotion would be expected to affect AM retrieval via influence on the working self's access to autobiographical information in the AKB. Given that the working self regulates retrieval based on a given person's self-concept and current goals, it is difficult to predict how emotion may affect retrieval. One proposal is that a felt emotion may lead to an AM of similar emotional quality. The empirical data are supportive of this proposition inasmuch as individuals generally recall AM events congruent with their current felt emotion (Holland & Kensinger, 2011; Levine & Pizarro, 2004). Bower (1981) theorizes that such effects obtain because encoded information (including AMs) is organized in associative networks categorized by emotion. Upon feeling a specific emotion, events consistent with that emotion may be retrieved via these networks (Blaney, 1986; Bower,

1981). On the other hand, Conway and Pleydell-Pearce's (2000) more recent model is more nuanced than Bower's (1981). For instance, Conway and Pleydell-Pearce (2000) argue that one goal of the working self is to avoid experiencing intense and negative emotions and thus the AMs typically induced in the laboratory tend not to be highly emotional and when emotional, tend to be mildly positive memories. However, in regulating a negative stimulus one can, in principle elicit a positive memory (Conway et al., 2004). Although this thesis is not a test of a theory *per se*, nonetheless, in examining the role of emotional aspects of a song and how this is associated with autobiographical memory, one can see whether the data obtained here is consistent with either model. Bower (1981) argues for strong congruency effects wherein, for instance a sad song would induce a sad memory and a positive song would induce a positive memory. Conway and Pleydell-Pearce's (2000) model makes the same prediction for positive songs (e.g. evoke a positive AM to maintain a positive mood) but suggests that with negative songs, different results might obtain; this model also predicts that the emotions evoked will not be overly intense. These models are not necessarily incompatible, but instead suggest that emotion-congruent AM retrieval may be stronger for positive musical cues (as seen in non-music emotion-congruency AM literature, e.g. Levine & Pizarro, 2004) and musical cues experienced as less intense.

Descriptions of how emotion is measured in AM studies are described after a brief description of AM cueing methods.

1.1.2 Cueing autobiographical memory

Autobiographical memories can be evoked via one of two cueing routes: internally (e.g. emotions or thoughts) or externally (i.e. via a stimulus; Rubin, 1998). Autobiographical memory research commonly uses external cueing stimuli targeting a specific sensory modality, to evoke memories. For example, a visual stimulus may include faces (e.g. Belfi, Karlan, & Tranel , 2016) or, in a musical context, an album cover (e.g. Cady, Harris, & Knappenberger, 2008), a verbal stimulus may include the traditional Galton-Crovitz word cue referencing a common noun (e.g. "shoe", Crovitz & Schiffman, 1974; Galton, 1879), a specific use of words (e.g. direct and indirect reference to past lifetime periods, Zator & Katz, 2017), or in the musical context, typed musical lyrics (e.g. Cady et

al., 2008), and finally, an auditory stimulus may include instrumental music or sound (e.g. Foster & Valentine, 1998; Foster & Valentine, 2001; Sheldon & Donahue, 2017) or popular music (e.g. Zator & Katz, 2017). The current study uses the latter, popular music (an external auditory stimulus) though we recognize that music may also internally cue music via evoking an emotion. There is no established control condition with which to contrast the effects of popular music cueing. In Study 2 of this thesis we use a no-music control condition in which, when looking at a computer screen, participants produce an AM as soon as possible after a blank screen appears.

Aside from emotion, which is described below in detail, the participant experience of the recalled memory can be measured by obtaining subjective ratings of the memories evoked. The subjective measures of interest may include some variation of one or many of the following variables: vividness (clarity of recalled event), frequency (how often a memory is thought of in everyday life), age in memory (how old the participant was in the recalled event), and importance (e.g. Brewer, 1996; Cady et al., 2008; Ford, Addis, & Giovanello, 2012; Holland, 1992; Rubin & Schulkind, 1997; Sheldon & Donahue, 2017; Talarico, LaBar, & Rubin, 2004). Frequency has been associated with vividness (e.g. Holland, 1992), and importance with both frequency and vividness (e.g. in self-defining memories, McLean & Thorne, 2003) and thus, we will refer to these three variables as the "memory saliency" measures throughout. Except for the "age in memory" variable, these measures are typically indexed with Likert type rating scales. In the current study, subjective participant ratings of memory saliency (importance, frequency, and vividness) and recency (age in memory) were assessed.

1.2 Emotion and autobiographical memory: Measurement

Emotionality of an evoked AM can be assessed both subjectively (i.e. self-reports as described above) and objectively (i.e. content of the written reports). Both measures are employed in Study 2. Subjectively, two memory characteristics of emotion are typically assessed by participant self-report ratings (e.g. Cady et al., 2008; Ford et al., 2012; Schulkind & Woldorf, 2005; Sheldon & Donahue, 2017): valence (the quality of emotion in the AM; negative, positive, or neutral) and arousal (the intensity of emotional memory experience; low to high). Emotional experience is often described by these two concepts

(Holland & Kensinger, 2011). Both characteristics independently contribute to how emotion affects reported qualities (e.g. vividness) of recalled memories (Ford et al., 2012). Arousal is referred to as "intensity" in the current thesis to be consistent with the wording in our experimental questions. In the music-cueing literature, positive valence has been associated with higher specificity and vividness of recalled memory, whereas negative valence has been associated with greater specificity (e.g. Ford et al., 2012). Additionally, participant-rated higher emotional arousal of a recalled memory has been associated with higher reported vividness of reported music-cued memories (e.g. Ford et al., 2012; Sheldon & Donahue, 2017).

Objectively, emotional content can be measured via analysis of written reports of the remembered event. The LIWC program (Pennebaker, Francis, & Booth, 2001) is used here, as it has in a few other studies (e.g. Bohanek, Fivush, & Walker, 2005; Kahn, Tobin, Massey, & Anderson, 2007; Zator & Katz, 2017). This program reports proportions of total words in a text sample that are composed of a given category of words (e.g. positive emotion words). The LIWC uniquely allows for objective measurement of the information evoked by the cues, minimizing response bias (i.e. participant ability to present the memories to reflect a desired image). In the current thesis, Study 2 employs the most recent version of the program: LIWC 2015 (Pennebaker, Booth, Boyd, & Francis, 2015). Interpretations of LIWC word categories are provided in Tausczik and Pennebaker (2010) and updated information for new and altered categories in the 2015 version, in Pennebaker, Boyd, Jordan, and Blackburn (2015).

Of interest to this thesis, an overall "affective process" category exists in the LIWC, in addition to 5 subcategories of emotional content: positive, negative, anxiety, anger, and sadness. In Study 2 we use the overall affective category (composed of all words in all subcategories) as an objective analogue to our subjective emotional intensity measure, and as in prior literature (e.g. Bohanek et al., 2005), the various subcategories for our subjective emotional valence measure.

In the non-music cueing AM literature, both Bohanek, Fivush, and Walker (2005) and Kahn, Tobin, Massey, and Anderson (2007) examined word use using the LIWC, analyzing positive and negative memory event descriptions. Both studies found a congruency effect for negative and positive events between event valence and word use (greater use of negative and positive word use, respectively). Bohanek et al. (2005) also reported that highly intense and negative memory events were described with more words than less intense and positive memory events, respectively, and that negative events were described with greater use of cognitive process words.

In the music-cueing clinical literature, El Haj, Postal, and Allain (2012) found that memories cued to familiar music contained greater use of positive, and lower use of negative words than those cued in silence in a population with Alzheimer's Disease. In a healthy young adult population, Zator and Katz (2017) found no evidence for greater use of positive words used to describe events cued to popular music relative to those cued to words, but they did find a lower use of negative words compared to memories cued to words directly referencing a past life-time period. We conclude there is some evidence of less negative emotion in those memories cued to popular music, and, when observed, is an effect seen both in clinical and healthy populations. We examine this further in Study 2 as a function of participant experience and interaction with a cue.

1.3 Music-cued autobiographical memory studies

1.3.1 Music and emotion: Classical music

Although it has long been acknowledged that music can convey emotions both in participant-reported (e.g. Juslin et al., 2008) and neuro-biological studies (e.g. see Koelsch, 2010 for review), this claim is almost entirely based on using instrumental, often classical, music to induce emotions experimentally (e.g. Schulkind & Woldorf, 2005; Sheldon & Donahue, 2017). Normed catalogues of classical music exist for this purpose (e.g. Vieillard, Peretz, Gosselin, Khalfa, Gagnon, & Bouchard, 2008 as used and cited in Sheldon & Donahue, 2017), though to our knowledge, no such experimentally-derived catalogue exists for popular music. Study 1 provides this database, including not only information on emotional experience of popular music songs, but additional

information (e.g. knowledge, familiarity, etc.) of potential interest to popular music researchers. Relevant experimental studies are described next.

Schulkind and Woldorf (2005) had both young and old adults recall AMs to classical music normed on emotional valence (negative or positive) and arousal (high or low; again, analogous to our "intensity" measure). Schulkind and Woldorf found a congruency effect only for cue valence. Additionally, they found that cue valence influenced many aspects of the recalled memories, concluding that valence, not arousal was the main AM organizational factor of emotion. Cues experienced positively led to quicker recall, and specifically, were more likely to lead to highly arousing memories compared to negative cues. They did however, find that highly arousing cues evoked memory events more quickly than low arousal cues.

Similarly, Sheldon and Donahue (2017) presented undergraduate students with novel classical music cues normed on emotional valence (positive and negative) and emotional arousal (high and low). The frequency with which each type of song evoked a memory was compared to the type of memories produced. Like Schulkind and Woldorf (2005), Sheldon and Donahue found support for memories congruent only in valence, but not in arousal, concluding that valence is a stronger direct emotion-congruency retrieval factor. Contrary to Schulkind and Woldorf (2005), Sheldon and Donahue (2017) found that arousal affected many measured memory qualities. High arousal cues led to memories rated lower on saliency measures: vividness and uniqueness (a measure of how common the type of event had occurred in their life), while valence did not affect any saliency qualities. Sheldon and Donahue also found that both high arousal and positive cues led to more socially-rated memories. They conclude that, like Schulkind and Woldorf (2005), valence is a stronger factor in retrieval of emotionally similar memories. They also conclude that arousal and valence are associated with non-emotional memory qualities, and arousal with saliency specifically. As in Schulkind and Woldorf (2005), Sheldon and Donahue also found that positive and highly arousing cues evoked memories quickly, suggesting that these cue qualities may lead to more direct access to AMs.

Though we see clear effects of emotional aspects of classical music cues in the above studies, participants tend to be less familiar with this genre than with popular music (Song et al., 2016). Further, both Schulkind and Woldorf (2005) and Sheldon and Donahue (2017) used classical music that was purposely novel to the participants tested.

The use of popular music permits one to extend the understanding of the effects of music on AMs from that based on classical music in several ways. The first is familiarity with a cue. The unfamiliarity of the music employed in the studies cited above might have obscured the importance of cue familiarity in evoking AMs. As such, use of more familiar musical cues, in this case popular music, could provide insights into the role of musical familiarity and AM. Thus, the effect of music familiarity requires examination, and will be a factor studied in this thesis. Second, for most people, popular music is experienced in day-to-day situations and as such might acquire personal relevance to a greater degree than found with classical music. Music tastes differ and reactions to music are quite idiosyncratic (to anticipate slightly we find large individual differences in Study 1). It should be noted that both studies described above were unable to examine individual variability in the personal relevance of their music cues because of the limitation of the normed data they employed. In Study 2 of this thesis, we will examine the individualized personal relevance of the music cues by choosing from the Study 1 database, music with sufficient variability that subjective reports on the relevance of a cue to the individual can be assessed. We will then examine the role that personal relevance plays in the memories produced, examining, for instance, whether especially salient and emotional memories obtain with highly relevant music.

1.3.2 Popular music and autobiographical memory

Despite the prevalence of popular music throughout recent history, research into its role in autobiographical memory began only two decades ago. Before this, popular music was used to examine long-term memory ability, with researchers looking at participants' memory for aspects of the music (e.g. title, artist, lyrics, rhythm, and year of popularity, see Bartlett & Snelus, 1980; Schulkind, 1999; Schulkind, Hennis, & Rubin, 1999). This literature demonstrated that individuals can successfully retain knowledge (e.g. title) and rhythmic information about songs from across their lifespan, and that (rather intuitively)

familiarity with a cue was associated with such information (Bartlett & Snelus, 1980; Schulkind, 1999).

In Study 1 we will provide data on identifying attributes of popular music songs (e.g. title) in a sample of young adults using music that covers their entire lifetime, to contact this earlier literature with an aim of providing information for use by other researchers. Study 1 should thus be useful in item selection for future research in which memory is cued by popular music. To date, there is a limited literature examining the nature of autobiographical memories elicited by popular musical cues (e.g. Belfi et al., 2016; Cady et al., 2008; Janata et al., 2007), though two distinct threads of research have emerged. The second thread, the study of popular music cueing in healthy populations will be discussed in more detail as it is the focus of Study 2.

The first thread of AM-popular music research is the use of popular music to study AM deficiencies in clinical populations. The bulk of this research samples participants with Alzheimer's Disease. Several studies find support for improvement of AM deficits in the presence of music (e.g. enhanced recall overall, AM specificity, etc., see Foster & Valentine, 1998; El Haj, Antoine, Nandrino, Gély-Nargeot, & Raffard, 2015; El Haj, Fasotti, & Allain, 2012; El Haj, Postal, & Allain, 2012). Some effects are greater for music chosen by the participant based on familiarity or importance (e.g. El Haj et al., 2015; El Haj, Fasotti, & Allain, 2012; El Haj, Postal, & Allain, 2012). The role of personal relevance of the music will be examined here with a sample of young healthy individuals in Study 2.

The second thread refers to the use of popular music cueing in healthy populations. Most of this work is behavioural though there is the odd brain imaging study (e.g. Ford, Addis, & Giovanello, 2011; Janata, 2009). We situate the research to-be-reported in the behavioural tradition. Platz, Kopiez, Hasselhorn, and Wolf (2015) discovered that popular music evokes memories in a fashion similar to that found with other cue methods employed. They find, for instance, a reminiscence bump such that the frequency of evoked memories peak around young adulthood. In contrast to focusing on similarities to traditional memory retrieval literature, many popular music cueing studies (e.g. Belfi et

al., 2016; Cady et al., 2008; Zator & Katz, 2017) explore unique aspects of these memories. This literature is reviewed below.

One of the earliest studies of popular music-cued memories by Janata, Tomic, and Rakowski (2007) found low evocation of AMs (successful in only about 30% of presented cues) using experimenter-selected Top 40-style music. Familiarity and emotional significance (especially positivity) of the cue was related to higher recall (Janata et al., 2007). Janata et al. also found that the most common emotions reported when listening to a song that evoked a memory were: “happiness”, “youthful”, and “nostalgic”.

In recent years, the study of popular music-cued memories has evolved to compare events cued to popular music to other methods of cueing. For example, Cady, Harris, and Knappenberger (2008) examined popular music-cued memories relative to music-related cues of other modalities (i.e. visual album cover, typed lyrics) over childhood and adolescent periods. In contrast to Janata et al. (2007), Cady et al. (2008) had participants select cues from a pre-piloted list. They found no evidence for especially different memories cued to music (i.e. specificity, emotionality, vividness). Unfortunately, this study is marred in several ways: although they did include a control condition, they noted a limitation in the chronological presentation of the cues. Additionally, participants pre-selected music cues based on a strong positive memory, which limited the research to positive memories and also confounded the AM retrieval process.

More recently, Zator and Katz (2017) compared how AMs cued to popular music were described relative to AMs cued by more traditional word-cueing methods. Zator and Katz employed cues targeting three past lifetime periods (similar to Cady et al., 2008), using words to both directly and indirectly target pertinent life-time periods. Music-cued memories were described with more perceptual and embodiment-related words, and with less use of cognitive and words related to seeing, than those cued to one or both types of words (Zator & Katz, 2017). No relevant differences in affective words or effects of lifetime period were found. Zator and Katz attributed these effects to sensory cue-appropriate embodied effects, less use of cognition in popular music cueing, and at least

no evidence that hypothesized emotional effects of music-cueing seep into the descriptions of recalled events.

In recognition of music's ability to evoke emotions, Belfi, Karlan, and Tranel (2016) compared memory event descriptions cued to popular music to those cued to familiar faces (e.g. politicians) from the same time period as the musical cues, in an adult sample (M = 55.1 years old), concluding that popular music evokes more vivid memories. In contrast to a subjective rating of vividness, Belfi et al. examined memory descriptions for internal details (i.e. those that reference central events and re-experiencing) and external details (i.e. those that reference details unrelated to central events) of the event. They also focused on one subtype of internal details, perceptual details, which refers to sensory aspects of the memory and are thought to correlate with vividness of re-experiencing. Belfi et al. found that memory descriptions evoked to popular music contained both a greater ratio of internal to overall details and more perceptual details, whereas those evoked to faces contained more of the less relevant external details. Noted here is the similar finding to Zator and Katz (2017) of greater perceptual detail in music-cued memories versus those cued to words. We investigate in Study 2 whether perceptual features are especially associated with music-cued memories, both as measured by objective analysis of the memory report, and by subjective measures (such as rated vividness).

In Study 2, similar to Sheldon and Donahue (2017)'s examination of emotional aspects of an AM cue, rather than only exploring simply the nature of the memory events or comparing music-cued memories to those evoked by other cue methods, the main aims of this thesis are instead on understanding facets of the cue itself and the relation of these facets to the characteristics of the memories produced. We offer a few novel aspects. First, we examine cue effects both objectively (as in Zator & Katz, 2017) and subjectively (as in Sheldon & Donahue, 2017). Second, we also compare the effects of popular music to a no-music control cue, to see if there are aspects of one's AMs found with AMs induced musically not found when induced non-musically. In Zator and Katz (2017) differences were relative to word cues, and in Belfi et al. (2016) relative to facial cues. That is, it is unclear in these studies whether observed differences are due to the

presence of music or the presence of the word cue or facial cue. In Sheldon and Donahue (2017), no comparison cue was examined and hence there is no baseline with which to compare any unique aspects of the AMs produced. Here we opt for an unrestricted control condition in which upon a neutral cue (onset of a blank screen) participants are asked to provide a specific AM as a means of examining AMs especially induced by popular music.

Finally, a related paper has some relevance to the current study. Michels-Ratiff and Ennis (2016) studied which aspects of popular music cues evoked a nostalgic listening experience in young adults (M = 23 years old). Using multiple regression, Michels-Ratliff and Ennis found that participant ratings of familiarity, meaning, positive affect, and the extent to which a participant felt an AM connection to the song, most significantly predicted a nostalgic response to the song. Negative affect, how much a participant liked the song, and how emotionally arousing the song was experienced, were less associated with reported nostalgia. The current study uses similar methodology to predict aspects of a recalled memory evoked to popular music, rather than nostalgic listening experience.

1.4 Summary of purpose of thesis

This thesis aims to address two gaps in the literature. First, we will address a lacuna in the literature and, in Study 1, create a database of popular music. We envision this database will be of use for the research community. For this thesis, selected stimuli from this database will be used in Study 2 to examine whether AMs cued to popular music are especially emotional and which (if any) aspects of the music cue affect the AMs produced. Specifically, the possible effects of music cue valence, music cue emotional intensity, and personal relevance of the music cue will be studied.

Chapter 2

2 Study 1

As noted in the general introduction, there is no standard method to choosing appropriate music-cueing stimuli. This lack of standardization has been variously addressed in the extant literature by choosing music cues chosen as relevant to the participant (Cady et al., 2008; to some extent, Michels-Ratliff & Ennis, 2016) or chosen by the experimenter assuming they should be known to most of their test sample (e.g. Janata et al., 2007; Zator & Katz, 2017).

Unique advantages and disadvantages are present when choosing to use either participant- or experimenter-selected stimuli. Participant-selected cues (e.g. Cady et al., 2008) ensure that the popular music is familiar and important to the participants (factors associated with enhanced recall, e.g. El Haj et al., 2015; El Haj, Fasotti, & Allain, 2012; El Haj, Postal, & Allain, 2012; Janata et al., 2007), but with such cues, AM recall is non-spontaneous and potentially confounded with expectations. In contrast, experimenter-selected cues offer this missing spontaneity but, given that popular music exposure and preference is so varied in individuals, do so potentially at the expense of individual variability in familiarity and personal relevance.

Experimenter-selected stimuli are usually chosen from mainstream Billboard Top charts as this source is assumed to offer greater chance of familiarity for a larger audience (e.g. Belfi et al., 2016; Janata et al., 2007; Zator & Katz, 2017). However, this method is not consistent in evoking a high number of AMs, with reports ranging from AMs evoked to only approximately 30% of experimenter-chosen cues (e.g. Belfi et al., 2016; Janata et al., 2007) to nearly 100% of cues (Zator & Katz, 2017). Recently, in recognition of the limitations of this method, online musical services have been used to select stimuli based on specific factors. For example, in studying if emotions can be both conveyed and evoked, Song et al. (2016) selected songs based on user emotion tags on the Last.FM[1]

[1] Online service can be found at: https://www.last.fm

online music service. The most promising use of online databases has been Michels-Ratliff and Ennis's (2016) use of Pandora[2], an online service that uses participant-selected songs to generate a selection of songs that are similar (e.g. in genre and theme), an advance that, unfortunately, does not maximize personal familiarity. While these online services may provide a benefit above simply using Billboard charts, these methods have not been rigorously tested.

In response to this literature gap, Study 1 provides a large database that experimentally marries the strengths of the experimenter- and participant-chosen approaches through a large-scale norming study of Top 40 music from the past 20 years (as in experimenter-based approaches) but assesses in addition, factors important in the participant-based approach (e.g. by measuring qualities such as emotional valence and personal relevance). Thus, the database can help guide choice of popular music from archival sources containing information about individual variability.

Given the need for a database of popular music cueing stimuli, a large-scale study of 149 popular music songs was conducted. Several variables that may be of interest to future researchers were examined via Likert scale: emotional valence, emotional intensity, negative emotion, positive emotion, relevance, familiarity, and enjoyment. Text-box questions about knowledge of the music information (e.g. title, as seen in studies such as Schulkind, Hennis, & Rubin, 1999) were also surveyed.

2.1 Method

Recall the aim of this study was to create a database of popular music stimuli for use in Study 2 and in future research.

2.1.1 Participants

Two hundred and forty-seven participants (145 female) were recruited and tested from the University of Western Ontario psychology undergraduate participant pool. Each

[2] Online service can be found at: https://www.pandora.com/

participant received a one-hour credit in compensation for his or her participation. The mean age of participants was 18.59 years (*SD* = 0.88). One participant did not report their age.

Participants were asked to provide their age, gender, and first language before the experiment (see Appendix A). Only participants aged 18 to 25 years old were eligible to participate. Given that the aim of this study was to create a database of stimuli for future study of memories cued by music (e.g. to target specific lifetime periods from an individual's past), this age range was chosen so that for each participant, music cues were from well-matched time periods and so that across participants, approximately the same amount of time had gone by since these ages. Additionally, only participants raised in North America in an area that would have exposed participants to popular music at the time it was popular, could participate. This criterion ensured that the music could have been experienced at the time it was originally popular and was also motivated by the goal to use the songs as cueing stimuli to target past life periods. Finally, only participants without a diagnosed hearing disability could participate. No participants were excluded from analyses based on these criteria.

Each participant was assigned to one of six song lists (as described below). Participants were tested individually in lab rooms in the psychology department at the University of Western Ontario from February to April 2016.

2.1.2 Materials

2.1.2.1 Musical cues

Given a lack of database for popular music-cueing, a large sample of popular music songs from the years of 1996-2015 was selected for norming (see Appendix B for a list of the songs employed). From the Billboard charts for the years 1996-2015, 7 or 8 songs were chosen for the study, creating a database of 149 songs total.[3] As noted above, the

[3] 15 songs per year were first chosen. Care was taken to select songs for genre, gender, and artist variety. These lists were narrowed down to 7 or 8 per year with the intention of selecting 150 unique songs total. In addition to the Billboard charts, songs associated with popular culture phenomena from the past of our participants were also included (e.g. High School Musical). Due to a regrettable error in list construction, 151 songs were selected, including 2 songs

primary aim was to provide a database for use in cueing autobiographical memories. A secondary aim was to permit the creation of a database for future use by researchers interested in popular music more generally. The reported analyses below address both aims.

The stimuli were selected from the Billboard Top 100 charts for the years of interest (1996-2015). Additional criteria were employed to ensure diversity in music selection and acknowledge the increasing presence of technology: YouTube view counts, iTunes top sellers for each year (when available), and varying genres. According to the fair use of commercial properties and sections 29, 29.1, and 29.2 of the Copyright Act of Canada, commercial music may be used for research and education purposes. Consistent with the Copyright Act and the archival literature (e.g. Janata, 2009), the song clips presented to participants were 30 seconds or less in length and created from the iTunes preview track available for customer listening without purchase. To achieve the highest likelihood of being recognized, the chorus of each song was used. This portion of the song is commonly repeated. The song clips presented to participants from all songs containing explicit vulgar content were created using the "clean" iTunes version, eliminating such language.

2.1.3 Procedure

The computer-based task was run using E-prime software (Schneider, Eschman, & Zuccolotto, 2002). Six song lists were created, each with 24 to 27 song clips. A separate program was constructed for each list. Upon arrival to the lab, participants reviewed the

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appearing on two song lists. Thus, only 149 total songs were surveyed and two of our song lists are imbalanced in number of tracks. The years 1996 to 2015 were assigned numbers from 1 to 20. To determine which years would have 8 tracks, a Random Number Generator was used (https://www.random.org) to generate 10 numbers from 1 (1996) to 20 (2015). The years corresponding to the 10 randomly selected numbers were assigned 8 songs for the stimuli list. The remaining 10 calendar years were assigned 7 tracks total. To determine which of the pre-selected 15 songs per year would be on the final stimuli list, the songs were numbered from 1 to 15. Then, the same random number generator was used to generate 7 or 8 (depending on how many tracks were to be eliminated, see above) numbers from 1 to 15. Tracks corresponding to the randomly selected numbers were eliminated from the lists, leaving either 7 or 8 tracks per list (151 total). This process left "Hey Ya!" by Outkast and "Apologize" by One Republic on 2 song lists. The total 151 songs were divided into 6 song lists (including the two repeated songs), to which each of the participants were randomly assigned. Within each song list, either 1 or 2 songs were randomly selected from each year for 24 to 27 songs per list. A random number generator was used to determine which years would be represented twice within each song list.

Letter of Information, were provided with the opportunity to ask questions, and provided an informed consent form to read and complete. Upon completion of study documents, participants were randomly assigned to one of the song lists. Each song clip was rated by 38 to 85 participants.[4] Demographic information for each list is presented in Table 1.

Table 1. Study 1: Group demographics.

Song List	N	Mean Age (Years)	Gender Split
1 (25 songs)	40	18.60 (0.96)	24 female
2 (25 songs)	41	18.73 (1.07)	22 female
3 (24 songs)	41	18.37 (0.66)	28 female
4 (25 songs)	45	18.67 (0.80)	22 female
5 (25 songs)	41	18.58 (1.01)	28 female
6 (27 songs)	39	18.56 (0.72)	21 female

Note. Age standard deviations provided in brackets.

Participants were seated individually in front of a computer and keyboard in separate laboratory testing rooms. Participants were instructed to follow all instructions on the screen and ask for clarification as necessary throughout the experiment. Prior to listening to the musical clips, participants completed demographic questions, which were followed by visually presented instructions in which each participant was told they would listen to short clips of 24 to 27 songs (see Appendix C for song lists) and answer a few questions about their knowledge (e.g. title) and experience of the song (e.g. familiarity, personal relevance). Participants were then presented two practice tasks where they listened to two musical cues ("Say Something" by the musical group A Great Big World featuring Christina Aguilera and "Wake Me Up" by Avicii), and completed a practice question.

After the practice task, participants were provided the opportunity to ask questions with a prompt on screen before continuing onto the experimental task. For each of the musical clips, participants first saw a fixation ("*") point in the center of the computer screen followed by the 30-second musical clip. Participants were instructed to listen to the entire clip after which they were asked to press the space bar to continue onto the questions. The full list of questions is provided in Table 2 below. Similar questions were addressed

[4] Most song clips were rated by 39 to 45 participants. Two song clips were rated by two groups.

Table 2. Study 1: Items.

Item Type	Item	Item Wording	Item Response Format
Knowledge	Title	To the best of your knowledge, what is the title of the song?	Text Box
	Artist(s)	To the best of your knowledge, who is/are the artist(s) of the song?	Text Box
	Year of Popularity	To the best of your knowledge, what year was this song originally popular in?	Text Box
Experience	Familiarity	How familiar are you with this song?	Likert: 1 (*very unfamiliar*) to 9 (*very familiar)*
	Enjoyment	Rate your level of enjoyment of the song	Likert: 1 (*strongly dislike)* to 9 (*strongly enjoy*)
	Emotional Valence	What is your overall emotional reaction to this song?	Likert: 1 (*very negative)* to 9 (*very positive*)
	Emotional Intensity	How emotionally intense was your experience of this song?	Likert: 1 (*not intense at all*) to 9 (*very intense)*
	Positive Emotion	How emotionally positive was your experience of this song?	Likert: 1 (*not positive at all*) to 9 (*very positive)*
	Negative Emotion	How emotionally negative was your experience of this song?	Likert: 1 (*not negative at all)* to 9 (*very negative)*
	Emotional Experience	If none of the questions above captured your emotional experience of the music, can you describe briefly (one to two sentences) how listening to the song made you feel?	Text Box
	Overall Perception	Is there anything else about your experience of listening to the music or your perception of it that you would like to comment on?	Text Box
	ABM Evoked (Yes/No)	Did the song clip evoke a specific memory? Note that a specific memory consists of a memory of a specific event occurring at a specific time in a specific place over a short period of time (e.g. Less than 4 hours). If the song evoked a memory, can you please describe this specific memory briefly (one to two sentences)?	Text Box
	Nostalgia	Did any of the previous songs evoke a nostalgic response? Note: "Nostalgia" is defined as, "a sentimental longing or wistful affection for the past, typically for a period or place with happy personal associations", ("Nostalgia", New Oxford American Dictionary, 2005). If so, please list each song and comment briefly on your experience in one or two sentences.	Text Box

Note. Items are reported in order of appearance. The emotional experience and perception open-ended questions are not reported on below due to poor response rate and content.

in various previous work on popular music and AM (Bartlett & Snelus, 1980; Schulkind et al., 1999; Ford, Rubin, & Gianovello, 2016; Platz, Kopiez, Hasselhorn, & Wolf, 2015). Some of these questions were presented in a 9-point Likert scale format (e.g. familiarity), and some were answered in a text box (typed, e.g. artist of song, emotional response elaboration). For the text box questions, participants pressed the space bar to open a text box. Participants then typed their response in the box, and pressed enter when they were finished, which moved the program onto the next question. For Likert-scale questions, the numbers at the top of the keyboard were used to input an answer and the response "0" was offered for "not sure or prefer not to answer" when applicable. When all questions were answered for each song, the program advanced to the next song. Within each program, the songs were presented by E-prime randomly one at a time. At the end of presentation of all songs, participants were asked whether any songs evoked a nostalgic response. A definition of nostalgia was provided and participants were asked to briefly describe any songs that may have evoked this response.

2.2 Results and discussion

Recall that the major aim of the study was to identify items to use in cueing autobiographical memories (AMs) with short clips of popular music. To provide context to meet this aim, some demographic variables will be presented first followed by analyses of the memory-relevant variables.

2.2.1 Demographic questions

2.2.1.1 Listening habits and preferences of young adults

Participants were asked about how they typically access music and their genre preferences. Both questions were open-ended with participants free to list multiple responses; some participants did not provide an answer. Moreover, participants were not required to rank responses in order of preference. All answers were categorized. The number of participants endorsing a specific response was tallied and then averaged based on the number of participants providing a response for the given question. Tabulated responses are depicted in Table 3.

Table 3. Study 1: Reported means of access to popular music.

Means of Access	Percentage of Total Participants (%)	Participants in Subsection (%)
Internet-Dependent Resource	83.26	-
YouTube	35.15	42.21
iTunes or Downloading	15.48	18.59
Reddit	2.09	2.51
Social Media (e.g. Facebook)	1.67	2.01
Music Streaming Services and Applications	43.10	51.76
Spotify	26.36	61.17
Soundcloud	7.95	18.45
Apple Music	7.11	16.50
8tracks	3.35	7.77
Google Play	2.09	4.85
Other	1.26	2.91
Radio	60.30	-
Word of Mouth (i.e. friends, family, events)	46.44	-
TV or Movies	4.60	-

Note 1. Participants could report as many means of access as they wished.
Note 2. Any music applications under 1% were grouped into "Other": iMusic, Autoplay, and Shazaam.

As seen, 83.26% of participants reported accessing new music through an internet-dependent resource (e.g. music application or streaming service). Within the internet-dependent resources, just over a third of participants accessed music commonly through YouTube and almost half through some sort of music streaming service. Spotify was listed most frequently, reported by just over one quarter of participants and over 60% of participants reporting using a music application or streaming service. The next two most common means of access were radio (60.30%) and word of mouth (e.g. family, friends, 46.44%). A small group of participants reported accessing new music through television or movies (4.60%, e.g. "Grey's Anatomy").

2.2.1.2 Genre preferences

As seen in Table 4, only 2.48% of participants reported no genre preference. For other participants, a wide range of genres were listed as one's favourites. The top 3 preferred genres (of the 30 reported) were: popular music or Top 40 endorsed by 40.91% of

respondents, hip hop or rap (39.67% of participants), and rock or classic rock (22.31% of respondents).

Table 4. Study 1: Genre preference of participants.

Genre Preference	Percentage of Participants (%)
No Preference	2.48
Pop or Top 40	40.91
Hip Hop or Rap	39.67
Rock or Classic Rock	22.31
Alternative	18.18
Indie	18.18
Electronic Dance Music (EDM) or House	17.36
Country	14.05
R & B	10.74
Other	7.74
Classical	4.96
Jazz	4.13
Folk Rock	3.72
Acoustic or Singer-Songwriter	2.48
Metal	2.48
Blues	1.65
Reggae	1.65
Soul	1.65
Soundtrack/Scores	1.65

Note. All genres endorsed by 1.5% or less of participants were grouped into other. These included: religious, pop punk, Korean pop, Doo-wop, Disco, Chinese pop, Bollywood, Punjabi, punk rock, psychedelic, soundtrack/scores, tropical, folk, and dance.

2.2.2 Memory – Relevant measures

2.2.2.1 Knowledge of the musical clip

In this section, data relevant to how much information the sample could recall about the music is provided. Participants were also asked about their knowledge of the music: title, artist, and year the song was released. These questions were responded to in text-box format. The title and artist data were analyzed by quantifying the response as either 2 (*completely correct*), 1 (*partially correct*, e.g. part of title or artist name), or 0 (*incorrect*). For the accuracy measure of year of popularity (as per the Billboard chart year), the response was converted to an absolute value away from the correct year. For example, if a song was popular in 2005 and one participant entered “2007” and another entered “2003”, both participants’ responses would be converted to 2. This accuracy variable is now referred to as “years away”. The descriptive statistics for these variables are reported

below, but these data were also used for correlational analyses presented in Appendix D. An additional variable was computed and included in the correlational analyses. This variable, "song recency" was computed as the year of popularity subtracted from the current year to index how old a song stimulus was.

For title accuracy, 57.2% of participants were correct, 9.0% were partially correct, and 33.7% were entirely incorrect across all songs. For artist accuracy, 56.4% of participants were correct, 1.4% were partially correct, and 42.1% were entirely incorrect. Finally, on average, participants guessed that a song was released 2.52 years (*SD* = 2.96) from the actual release year. Participants who did not report a year for this response were excluded from these analyses (16.96%) and thus, this value is only reflective of those providing a response.

2.2.2.2 Experience of the musical clip

A central question of interest in Study 2 is the relation of affective reactions on hearing the musical clip and the emotional aspects of the memory cued. Participant experience of the music was indexed by the following 9-point Likert-scale variables: familiarity, personal relevance, emotional valence, negative emotion, positive emotion, enjoyment, and emotional intensity. Participants were also given the option to elaborate on emotional experience (open-ended), and, if an autobiographical memory was evoked, to briefly elaborate. For these open-ended items, not all participants responded. For these analyses, data from participants who did not respond to a given item for any of the songs provided were not included in the analyses for that question. Recall that except the emotional valence question, which was rated from 1 (*very negative*) to 9 (*very positive*), all Likert-scale questions were answered on a scale of 1 (*low*) to 9 (*high*). The data for the Likert scales variables are presented next followed by data on reports of the autobiographical memory evoked.

Table 5 presents the mean ratings and standard deviations for all data (all clips rated irrespective of participant or song) and for measures based on the aggregated data for each of the songs. The database for each song is depicted in Appendix E. This database is aggregated by track (song clip). Recall that participants were asked to listen to 30-second

music clips. Data for every song clip listened to for 2 seconds or less were eliminated from analyses, resulting in the elimination of data associated with 27 individual song clips. As a result, the number of participants rating a given song range from 38 to 85.

Table 5. Study 1: Music experience means overall and by aggregated track.

Variable	Mean (SD) All Data	Mean (SD) by Aggregated Track
Emotional Valence	5.78 (2.11)	5.77 (0.71)
Emotional Intensity	4.20 (2.47)	4.19 (0.82)
Negative Emotion[5]	2.20 (1.80)	2.20 (0.44)
Positive Emotion	5.58 (2.47)	5.57 (0.87)
Personal Relevance	4.52 (2.69)	4.50 (1.20)
Enjoyment	6.00 (2.35)	5.99 (0.93)
Familiarity	6.44 (2.79)	6.43 (1.85)

Note 1. Likert scale questions ranged from 1 (*very low*) to 9 (*very high*) in all cases except emotional valence that ranged from 1 (*very negative*) to 9 (*very positive*).
Note 2. Column 1 presents the M(SD) of all data. The point of this is to show how the data varies over all participants. Column 2 presents the M(SD) of songs aggregated by track. This accounts for the variance in number of participants ranking each song, but eliminates the participant variance data.

As seen in Table 5, the music clips are rated as generally albeit on average, moderately positive, familiar, enjoyable, only moderately emotionally intense, and moderately personally relevant. The fairly large standard deviations indicate considerable variability. Thus, the database contains stimuli that can be orthogonally varied in experimental studies.

If participants reported that the music evoked a specific AM, answers were first coded as 1 (*specific event AM evoked*) or 0 (*non-specific AM or no memory evoked*) based on the quality of the memory response provided and the experimenter's knowledge of a specific event autobiographical memory (i.e. describes a distinct event occurring over a short period of time). Caution should be taken in interpreting these responses and subsequent analyses as only about a third of responses indicated a specific event AM. Of the 6185 instances of listening to one song, 2214 songs led to a specific event memory evoked (35.8%).

[5] Negative emotion and positive emotion responses may be of use to those interested in Nostalgia. Further data on these variables are presented in correlational analyses below.

The inter-correlations of the Likert-scale variables and the likelihood a song evoked an autobiographical memory are presented in Table 6. Recall that most Likert scale questions ranged from 1 (*low*) to 9 (*high*) and that emotional valence ranged from 1 (*very negative*) to 9 (*very positive*). Recall also, that the AM variable was dichotomized: 0 (*non-specific AM or no memory evoked*) and 1 (*specific event AM evoked*). The correlation matrix of all the variables analyzed in Study 1 is provided in Appendix D with only select relations discussed here.

The reactions to the music tend to be moderately inter-correlated, with highest associations between familiarity and personal relevance ($r = .66$, $p < .01$), and personal relevance and having an enjoyable and positive reaction ($r = .63$ and .57, respectively, both $p < .01$). Moreover, evocation of a specific event AM is associated with positive valence, higher familiarity, music experienced as intense, higher personal relevance, and higher enjoyment of a song, with *r*s ranging from .17 to .38 (all $p < .01$) but is not associated with negative emotion ($r = -.02$). Platz et al. (2015) found similar, though weaker, positive associations between recall of specific memories and familiarity and positive valence of the musical cue in their sample of older adults.

Table 6. Study 1: Inter-correlations of all Likert-scale ratings as well as likelihood of evoking an AM.

	VAL	FAM	INT	AM	NEG	POS	REL	ENJ
VAL	-	.48**	.30**	.28**	-.28**	.72**	.57**	.73**
FAM		-	.26**	.38**	-.05**	.51**	.66**	.59**
INT			-	.17**	.05**	.31**	.36**	.29**
AM				-	-.02	.28**	.37**	.29**
NEG					-	-.28**	-.04**	-.25**
POS						-	.57**	.76**
REL							-	.63**
ENJ								-

Note 1. VAL – emotional valence, FAM – familiarity, INT – emotional intensity, AM – likelihood of evoking a specific autobiographical memory, NEG – negative emotion, POS – positive emotion, REL – relevance, ENJ – enjoyment.
Note 2. ** - $p < .01$, * - $p < .05$.

These data (consistent with the past literature, e.g. Janata et al., 2007; El Haj et al., 2015) indicate that familiar and relevant music tend to lead to higher recall of AMs. Thus, these variables were incorporated into choosing the stimuli for use in Study 2.

2.2.3 Supplementary analyses

In addition to reporting whether or not the music evoked an autobiographical memory, participants were provided with the option to elaborate on any emotional experience engendered and, if an autobiographical memory was evoked, comment upon it. A similar option was provided when people elaborated on emotional reactions and nostalgic reactions in listening to the music. Because this option was completely voluntary, it is important to note that only a subset of participants responded.

Of the 4462 emotional elaboration responses, 1998 responses (44.78% of elaborations; 32.30% of all song responses) described a felt emotion. These responses were categorized into positive (e.g. happy), negative (e.g. sad), neutral, nostalgic, or mixed (e.g. both positive and negative, "weird", includes nostalgic). Many participants referred specifically to music's ability to evoke emotions (e.g. "made me feel"). All responses were separately tallied. The frequencies and percentage of comments out of 1998 that endorsed various emotional responses are provided in Table 7. Consistent with the literature (e.g. Song et al., 2016), these data suggest that music can evoke emotions.

Table 7. Study 1: Open-ended emotional response categorized.

Categorized	Number of Responses	Percentage of Total Emotional Elaborations (of 1998, %)
Positive	1112	55.66
Negative	547	27.38
Neutral	228	11.41
Mixed	227	11.36
Nostalgic	131	6.56
"Made Me Feel"	714	35.74

Note. Positive responses included: happy, excited, pumped, etc. Negative responses included: sad, angry, agitated, uncomfortable, confused. Neutral responses included: calm, neutral. "Made me feel" tallied responses that specifically attributed the music to the change in emotion or mood.

The content of the reported elaboration was also examined with the Linguistic Inquiry and Word Count (LIWC) 2015 program (Pennebaker, Booth, et al., 2015). As mentioned previously, the LIWC reports proportions of words in different categories (e.g. affective, cognitive, etc.) of total words in a text sample, and the reports are taken as reactions to text relatively free of self-presentational characteristics. The following categories of interest are reported on for each question: affective processes, personal pronouns, cognitive processes, social processes, relativity, time orientations, leisure, and perceptual

processes. Most of these categories were examined in Zator and Katz (2017). The social processes and leisure categories were added in recognition of the social functions and social contexts in which music is typically encountered in day to day life (e.g. Hargreaves & North, 1999; Juslin et al., 2008) and because Sheldon and Donahue (2017) reported that classical music-cued memories differed in social content depending on the emotionality of the cue. Additionally, increased perceptual (especially hearing) words found in music-cued memories may indicate an interaction with the popular music in a given memory and increased vividness of recall (Belfi et al., 2016). We find increased use of these features in memory descriptions in past work (Belfi et al., 2016; Zator & Katz, 2017).

LIWC analyses of these three open-ended response items relative to the means of all memories in Zator and Katz (2017) and the "grand mean" of the text samples used to generate the LIWC 2015 category data (Pennebaker, Boyd, et al., 2015) are presented in Table 8. Before text analysis, all text samples were edited for spelling and grammar.

Relative to the LIWC 2015 library, a larger proportion of affective words were produced in the participants' elaborative emotional responses, with roughly twice as many positive words used than were negative words. Within negative words, a higher abundance of sadness words was seen. This combination of increased positive and sadness words may provide evidence for some nostalgic responses (see Barrett et al., 2010; Michels-Ratliff & Ennis, 2016). Analysis of nostalgia is presented in the next section. Additionally, a larger proportion of present-oriented words were seen, possibly reflective of the fact that most people respond about emotions that they are currently feeling, which is also reflected in the large proportion of feeling words seen. This also supports the assertion that popular music can not only convey, but evoke emotions (Song et al., 2016). Similarly, a large proportion of cognitive and perceptual process words and a lower proportion of social words were seen. This may all be due to the reflective nature of the emotional responses, many focusing on feeling a particular way when listening to a song and reflecting on the nature of that feeling, with less emphasis on the context where the music was encountered if it had been encountered in the past. We examine this possibility below.

Table 8. Study 1: LIWC analyses of open-ended responses.

	Study 1 Responses			Comparisons	
	ABM Responses	Emotional Responses	Nostalgia Responses	Zator and Katz (2017)	LIWC 2015
LIWC Category					
Affective Processes	3.62	17.89	4.48	4.77(0.34)	5.57(1.99)
Positive Emotion	2.81	11.87	3.64	4.04(0.33)	3.67(1.63)
Negative Emotion	0.81	5.56	0.66	0.74(0.16)	1.84(1.09)
Anxiety	0.10	0.65	0.24	0.19(0.09)	0.31(0.32)
Anger	0.25	1.41	0.06	0.20(0.06)	0.54(0.59)
Sadness	0.21	2.53	0.24	0.25(0.09)	0.41(0.40)
Personal Pronouns	11.16	11.56	12.66	11.35(0.51)	9.95(3.02)
Social Processes	10.20	3.99	7.41	9.15(0.57)	9.74(3.38)
Family	1.52	0.11	1.02	1.58(0.30)	0.44(0.63)
Friends	1.57	0.15	0.84	1.90(0.20)	0.36(0.40)
Time Orientations					
Past Focus	6.37	8.38	7.89	5.98(0.54)	4.64(2.06)
Present Focus	2.53	11.58	4.54	1.85(0.29)	9.96(2.80)
Future Focus	0.30	0.23	0.36	0.35(0.09)	1.42(0.90)
Relativity	19.61	6.65	15.71	20.74(0.68)	14.26(3.18)
Motion	4.03	1.41	2.63	3.56(0.28)	2.15(1.03)
Space	8.55	3.00	5.62	9.02(0.49)	6.89(1.96)
Personal Concerns					
Leisure	10.01	7.14	6.03	8.69(0.45)	1.35(1.08)
Cognitive Processes	6.59	21.86	14.34	12.93(0.72)	10.61(3.02)
Perceptual Processes	8.82	13.64	7.29	5.24(0.45)	2.70(1.20)
See	1.71	0.24	0.42	0.73(0.33)	1.08(0.78)
Hear	6.76	6.79	5.56	4.14(0.29)	0.83(0.62)
Feel	0.29	6.45	1.25	0.39(0.11)	0.64(0.52)

Note 1. LIWC 2015 = LIWC 2015 Grand Mean. LIWC 2015 reports M(SD) for this Grand Mean.
Note 2. The LIWC program does not give standard deviation measurements for analyzed text samples. Zator and Katz (2017) reported M(SE) resulting from aggregated means of individual memory LIWC reports.
Note 3. Some categories were not reported on in Zator and Katz (2017). These figures are provided from the authors' data.

In the AM responses, we find similar proportions in all categories of interest as in Zator and Katz (2017). Despite what we might expect given the comprehensive emotional responses, we see no evidence of this emotional experience in affective word use in AM descriptions (as seen also in Zator & Katz, 2017). We do see similar evidence of greater use of perceptual and relativity process words which Zator and Katz attributed to evidence of embodied response to musical listening when retrieving AMs. We see less cognitive words than both Zator and Katz and the LIWC 2015 grand mean of all text samples used to generate the 2015 library. However, in the LIWC 2015, the cognitive process category substantially changed (Pennebaker, Boyd, et al., 2015). The 2015 cognitive process word grand mean is 30% less than the prior version employed by Zator and Katz, possibly accounting for some of the deviance from their numbers. Our number is still lower than the LIWC 2015 grand mean, supporting Zator and Katz's assertion that less cognition may be involved in describing a memory when listening to popular music and more focus may be given to the motor-spatial-perceptual features of the music.

2.2.3.1 Nostalgia response themes and descriptions

Recall that, after listening to all songs and completing subsequent questions, participants were asked to comment on if any songs evoked nostalgia. A broad modern conceptualization of nostalgia is a fond longing for earlier experiences (Sedikides, Wildschut, Arndt, & Routledge, 2008). Regrettably, the responses to these questions relied on the memory of the participants of the songs presented to them in the previous hour. Reflective of this, 8.98% of participants simply put "many" or some form of this response. However, 62.45% of participants reported experiencing nostalgia at some point during the experiment, even if a specific song or songs could not be reported. Likewise, 382 (6.18%) specific song clips were endorsed as producing a nostalgic response either in the emotional elaboration response or in this last question. The choice to have this as a final question after presentation of all songs was meant to avoid having participants focus on nostalgia as a possible emotional response during the main listening task and completion of associated items. Despite this, as seen in the emotional responses, nostalgia was an elaboration response to the emotional experience question without even drawing attention to it as a possibility for emotional response.

As seen in Table 8 above, of all the LIWC proportions, there are smaller proportions of all emotion words than seen in the emotional responses. However, we see slightly more positive word and lower negative word use than those in the AM responses and more focus on the past, perhaps indicating a nostalgic longing for positive experiences from this time. The frequencies of themes in the responses (many focused on past events) given by participants who expanded on why the songs they endorsed as nostalgia-provoking, provoked nostalgia, are presented in Table 9. Although only produced by a limited subset of respondents (65), 69.23% of responses referenced past memory events, 61.54% referenced childhood specifically, 23.08% referenced family, 23.08% referenced friends, 6.92% referenced adolescence or high school, and 30.77% referenced a positive emotion attached to something related to the song.

Table 9. Study 1: Nostalgia themes.

Theme	Percentage of Responses (%)
Past memories	69.23
Childhood	61.54
Positive Emotion	30.77
Family	23.08
Friends	23.08
Adolescence or high school	16.92
Hockey	3.08
Association of song to specific location	3.08

2.2.4 What predicts AM recall?

Recall that the main aim of Study 1 for this thesis is to create an appropriate stimulus set for the recall AM cueing task in Study 2. To support the use of familiarity and relevance as main criterion for stimuli selection, a multiple regression with all predictor variables entered simultaneously was conducted using familiarity, relevance, emotional intensity, emotional valence, negative emotion, positive emotion, enjoyment, and song recency (how old a song is, in years) to predict if a specific AM was evoked. Stepwise analyses were not employed due to lack of *a priori* expectations of predictive strengths of the respective measures. The multiple regression results are presented in Table 10. Effect sizes are presented with Sr^2.

Table 10. Study 1: Regression analysis: Ability to evoke a specific event autobiographical memory with popular music rating measures as predictor variables.

	AM EVO	FAM	REL	INT	VAL	NEG	POS	ENJ	SNG REC	*US B*	*S b*	Sr^2
FAM	**.38****	-								**.039****	.227	.022
REL	**.38****	**.66****	-							**.035****	.194	.016
INT	**.16****	**.26****	**.36****	-						.003	.018	<.001
VAL	**.28****	**.48****	**.57****	**.30****	-					**.016****	.071	.002
NEG	-.02	-.05**	-.04*	.05**	**-.28****	-				.004	.014	<.001
POS	**.28****	**.51****	**.56****	**.31****	**.72****	**-.28****	-			.008	.043	<.001
ENJ	**.28****	**.59****	**.63****	**.29****	**.73****	**-.25****	**.76****	-		**-.012***	-.059	.001
SNG REC	**-.17****	**-.48****	**-.28****	**-.16****	**-.15****	-.04*	**-.16****	**-.21****	-	.000	.004	<.001
										I -.15**		
M	0.36	6.45	4.51	4.20	5.78	2.20	5.57	6.00	11.46	R^2	.18	
SD	0.48	2.78	2.68	2.46	2.10	1.80	2.46	2.35	5.72	R^{2adj}	.18	
										R	.42	

Note 1. AM EVO = specific event autobiographical memory evoked, FAM = familiarity, REL = relevance, INT = emotional intensity, VAL = emotional valence, NEG = negative emotion, POS = positive emotion, ENJ = enjoyment, SNG REC = song recency.
Note 2. ** - $p < .001$, * - $p < .01$.
Note 3. I = intercept.

The regression was statistically significant (R = .42), $F(8, 5916) = 157.65$, $p < .001$, R^2 = .18. The regression model equation is as follows: predicted score = -.15 + .039 (cue familiarity) + .035 (cue relevance) + .016 (cue emotional valence) - .012 (cue enjoyment). As can be seen, familiarity and relevance were the highest predictors of AM evocation (b = .039 and .035, respectively, both $p < .001$), accounting for about 2.2% and 1.6% of the variance in if an AM was evoked or not. We also see that positive valence and lower levels of enjoyment predict evoking an AM, albeit to a lesser degree. Thus, based on the findings here and reported above, familiarity and relevance were used as prime factors in selecting the study stimuli for Study 2. Emotional intensity, negative emotion, and positive emotion did not significantly predict if an autobiographical memory was evoked.

2.2.5 The database

As mentioned above, we present in Appendix D, a correlation matrix of the relations between all variables covered above (including categorized open-ended responses). Only participants who provided a response for these open-ended items were included in this subset. The responses were coded 1 for a "yes" response reflecting the variable (e.g. nostalgic response, positive emotion response, specific AM evoked), and 0 for a "no" response reflecting the variable (e.g. no nostalgic response, no positive emotion response, no specific AM evoked). For nostalgia, a "yes" response was also indicated for a given song if a participant specifically mentioned nostalgia in their emotional elaboration response for that given song.

In Appendix E, aggregated track means on all music rating variables of interest (e.g. familiarity, relevance, etc.) are presented as the database. That is, for each song, the averages of responses for each of the variables were calculated using all participants that rated the given song (i.e. averaged scores of all participants rating "Ironic" by Alanis Morrisette in Song List 1). The purpose of these data is to provide information for future researchers to choose stimuli appropriate to their needs in studying popular music.

In summary, Study 1 provides a database for subsequent research into the study of popular music into various aspects of everyday activity. We find that higher familiarity

with and relevance of a popular music cue are the strongest predictors of evoking a specific event AM. The specific interest in this thesis is the application of the data provided here to the study of autobiographical memory cued by popular music.

Chapter 3

3 Study 2

A tailored stimulus set rated high on relevance and familiarity was selected from the Study 1 database to examine personal memories cued to popular music. There are two main aims to Study 2.

First, due to the theorized emotion regulation function of popular music and the ability for popular music to evoke emotion in listeners, we examine empirically whether popular music is tied to especially emotional memories. Specifically, we test whether popular music automatically cues emotional memories (relative to memories evoked with the non-music control cue condition). Such an effect would be shown if the memories to the music (relative to control cueing case) were rated as, for instance, more positive, and more intense on subjective ratings of the evoked memories and were objectively described with a greater frequency of affect-relevant terms. Here we also examine in what other ways our popular music-cued AMs might differ from those compared to a no-music control.

Second, and related to the first aim, we examine which (if any) aspects of the music cue itself may inform the popular-music evoked memories. We do so via correlational and regression techniques examining whether memory ratings of emotional valence and emotional intensity (measured both subjectively and objectively) and saliency, are predicted by participant ratings of the musical cues themselves.

Within our second aim, we examine specifically whether congruence obtains between the emotional nature of the cues and emotionality of the AM, both as described and rated by the participant. Related to this, we also examine how memories evoked to positive cues and to negative cues and to highly and less emotionally intense cues differ, and how these compare to those cued to the control (as a baseline).

Finally, also within our second aim, given the variability in music tastes and personal experiences, and the connection between emotional, personal, and social functions of

music to personal relevance of a popular music song in young adults, we examine the role personal relevance of a cue plays in the production, content, and qualities of the memories evoked. Again, the role of relevance will be addressed using both participant subjective measures of recalled memory experience and objective measures in typed descriptions of the cued memory events. As in our emotionality analyses, we also compare the memories evoked to songs rated highly on relevance to those rated as less relevant, and examine how these compare to those evoked to the baseline control cue.

Although the main factor studied involves the contrast between AMs produced to popular music cues versus AMs cued without music, we also introduce an instructional manipulation. We ask half of the participants (in both the popular music and control cueing conditions) to either think of an emotional memory whereas the other half of the sample are given instructions silent on the nature of the AM to-be-produced (i.e. recall a "memory"). The aim here is to examine further whether music automatically cues emotional memories. If they do, then the number and nature of AMs should be similar whether instructed to give emotional memories or not whereas, for the control conditions, emotional memories would occur primarily when instructed to do so.

We examine our aims with a few novel methodological aspects.

In contrast to prior work based largely on classical musical stimuli, we use an empirically informed database (from Study 1) to derive a stimulus set composed of familiar and personally relevant popular music. Moreover, in contrast to earlier work that employed an emotion-normed stimulus set, we ask the participants to rate their experience of the popular music cues after the cueing task. This point is especially important since even with normed music there is likely to be large individual differences on how each individual reacts to the music, especially for popular music originally encountered in everyday situations. In fact, Song et al. (2016) found that while individuals could consistently rate the perceived emotion of a popular music song, when rating the felt emotion induced by the music, these responses were more varied. Experimentally, Sheldon and Donahue (2017) noted that participants rated music normed as negative as more enjoyable than music normed as positive and thus, noted a possible limitation in

their results due to a disconnect between normed emotions and felt emotions from the study's participants. By having participants rate each cue, we are accounting for this possible limitation in emotional experience while also considering individual differences in relevance of a popular music song. Thus, while normed emotional data (e.g. emotion-normed classical music) may be useful to some extent, individuals experience music in a variety of ways. Finally, in contrast to past literature that either uses one or the other, we employ both common subjective measures of memory experience and objective measures of recalled memories (content analyses of memory descriptions provided by participants). The subjective measures include those most commonly found in studies of AM (e.g. vividness, emotional valence) and the objective measure will be an analysis of the memory reports using the LIWC, a non-intrusive measure employed in some studies of AM that minimizes a self-presentational response bias.

3.1 Method

3.1.1 Participants

One hundred and thirty-four participants were recruited and tested from the University of Western Ontario Psychology undergraduate participant pool. As noted presently, 11 participants were eliminated prior to analyses. Each participant received a one-hour credit in compensation for his or her participation. Participants were asked to provide their age, gender, and first language prior to starting the experiment. Only participants aged 18 to 20 years old were eligible to participate. Additionally, only participants raised in North America in an area that would have exposed them to the study's popular music songs at the time they were released could participate. This ensured that the music had been experienced at the time it was originally popular. Similarly, only participants whose first language was English could participate. This was necessary as the lyrics of all songs were in English and this element of the music could conceivably affect the memories produced. Additionally, only participants without a diagnosed hearing disability could participate. Except for having a narrower age range, all other criteria were the same as in Study 1.

Eleven participants were eliminated from analyses. One participant withdrew from the study before completing all tasks, one participant was excluded due to an E-prime system crash, two participants failed to meet the study's criteria, and the remaining seven participants failed to attend to experimenter instructions or completed the tasks too quickly (under 15 minutes). It was expected that all tasks would take at the very least, 20 minutes to complete seriously. One hundred and twenty-three (59 female) participants' data were analyzed. The mean age of the participants was 18.47 years (*SD* = 0.66). One participant did not report their age.

The basic design consisted of four groups in a 2 cue type (received a popular musical cue or cued by a blank screen) X 2 instruction type (asked to provide an "emotional memory" or given instructions that did not emphasize memory emotionality, i.e. recall a "memory"). Group demographics are provided in Table 11.

Table 11. Study 2: Group demographics.

Current Study Manipulations				
Cueing Type	**Instruction Type**	N	Age (Years), *M*(*SD*)	Gender Split
Control	Memory	30	18.57 (0.68)	17 female
Control	Emotional Memory	31	18.50 (0.68)	14 female
Popular Music	Memory	31	18.45 (0.62)	13 female
Popular Music	Emotional Memory	31	18.35 (0.66)	15 female

Note. Age standard deviations provided in brackets.

3.1.2 Materials

3.1.2.1 Musical cues

Seven songs from the database described in Study 1 were chosen to cue memories. An additional 3 songs were chosen for subsequent experimental tasks as described below. A list of these 10 songs can be found in Appendix F. Songs were primarily chosen based on database aggregated means of familiarity and relevance, two factors associated with recall ability in healthy participants and enhanced recall in clinical populations (e.g. El Haj et al., 2015; Janata et al., 2007), and as per our correlation and regression analyses in Study 1, respectively. Recall that Sheldon and Donahue (2017) compared memories cued

to classical music songs normed on valence (negative, positive) and arousal (high, low) and that one aim of the current study was to examine this in popular music. Therefore, emotional valence and intensity (our term for "arousal" in the current study) were also considered. The same 30-second song clips for the chosen songs presented to Study 1 participants were presented in the Memory-Generation Phase (Phase1) and the Music Cue-Rating Phase (Phase 3) here. All song lists were randomized for each participant in each phase.

3.1.2.1.1 Familiarity and relevance

Songs in the database described in Study 1 were first organized by familiarity from highest to lowest aggregated mean. Since songs were rated on average as highly familiar – over half of songs were rated as 7 or higher - relevance was weighted more in selection. Nonetheless an average rating of 7.5 was used as a cut off for familiarity to ensure high familiarity for songs to be used as cues. Songs were then organized by relevance from highest to lowest. Appendix G shows the 25 songs with the highest average relevance rating for reference. Selected stimuli are marked on this table. That is, each song was chosen for inclusion as a music cue based on being amongst the most highly relevant, with at least an aggregated mean of 7.5 for familiarity.

3.1.2.1.2 Emotional valence and emotional intensity

As seen in Study 1, most songs in the database were rated, on average, more positively, and only somewhat intense in emotional experience. Thus, care was taken to avoid choosing exclusively highly positive songs. For example, Adele's "Someone Like You" was chosen because it fit our relevance and familiarity criteria, but also had one of the lower emotional valence and highest negative emotion aggregated averages.

3.1.2.1.3 Other factors

Songs were also chosen to reflect diversity in gender of artist, as well as genre of music. Additionally, as seen in Appendix G, a handful of songs meeting our criteria were eliminated and the reasons for applicable songs are marked. Even though the ability to evoke a memory was not used as a main factor in stimulus selection for Study 2, the

responses to this Study 1 item allowed us to eliminate songs that were associated with large popular culture events, films, or potentially conversation-provoking content (which could take away from an AM cueing task). For example, Smashmouth's "All Star" was commonly associated with the "Shrek" movie, and Wiz Khalifa's "See You Again" (ft. Charlie Puth) was frequently associated with a "The Fast and the Furious" movie and the death of one of the main actors. Songs fitting these exclusion criteria were not considered for potential Study 2 inclusion regardless of relevance or familiarity responses.

3.1.3 Procedure

Study 2 also used the E-prime software environment (Schneider et al., 2002) on lab-installed computers at the University of Western Ontario. Data were collected between March and April 2017. Recall that the basic design is a 2 cue type (received a popular musical cue or cued by a blank screen) X 2 instruction type (asked to provide an "emotional memory" or given instructions that did not emphasize memory emotionality, i.e. recall a "memory") between-subjects design. A separate program was constructed for the random generation of the cues for each of the two cueing conditions and within each cue program, an additional program was created for each of the two instruction type conditions ("emotional memory" and non-specific "memory" instruction types) for four unique E-prime testing programs total.

Upon arrival at the lab, participants read a Letter of Information, were provided with the opportunity to ask questions as necessary, and provided informed consent. Following completion of these study documents, participants were randomly assigned to either the popular music or control cues and subsequently randomly assigned to either the non-specific memory or emotional memory instructions. There were three phases to the study. Due to the complexity of the design, the hypotheses of each phase are described below their procedural description.

3.1.3.1 Memory-Generation Phase (Phase 1).

Participants were presented either the short popular music clips (popular music cue type) or a blank screen (control cue type) with instructions to retrieve either a "memory" (control instruction type) or an "emotional memory" (emotional instruction type). All

participants received seven cues. Participants were seated individually in front of a computer and keyboard in a separate testing room in the laboratory. Prior to beginning the memory recall task, participants completed demographic questions (see Appendix H) and were subsequently presented with overall instructions for the memory recall task visually (see Appendix I). Instructions were confirmed and emphasized verbally with the experimenter and again, differed slightly based on cue type and instruction type condition. Care was taken to emphasize that participants respond when the first specific memory came to mind regardless of what it was. In the music-cued condition, participants were encouraged to retrieve the first specific AM that came to mind and told that the AM did not have to involve the music. Figure 1 displays the experimental task.

Participants first engaged in two practice tasks. Those assigned to the popular music cueing condition listened to short clips of both LMFAO's "Party Rock Anthem" (feat. Lauren Bennett and GoonRock) and Katy Perry's "California Gurls" (feat. Snoop Dogg). Both songs were rated highly in Study 1 on important relevance and familiarity criteria, so practice songs were similar in these respects to the testing stimuli.

Participants assigned to the control cueing condition were presented with two blank screens to practice recalling a memory. Following the practice tasks, participants were provided the opportunity to ask the experimenter questions before moving onto the experimental task. After the practice task, the researcher left the testing room and experimental trials began. For each of the seven cues, participants first saw a fixation ("*") point in the center of the computer screen followed by a condition-relevant cue. After each cue presentation, participants pressed the space bar as soon as a specific event memory came to mind. This initiated the appearance of a text box on the computer screen where participants entered a typed description of the memory event evoked. Response time from the initial presentation of cue to the space bar press was recorded in E-Prime. When participants finished typing a memory description to a given cue, they pressed the enter key to receive the next cue. This continued until all seven cues were presented, after which participants received instructions for Phase 2 (see Appendix J).

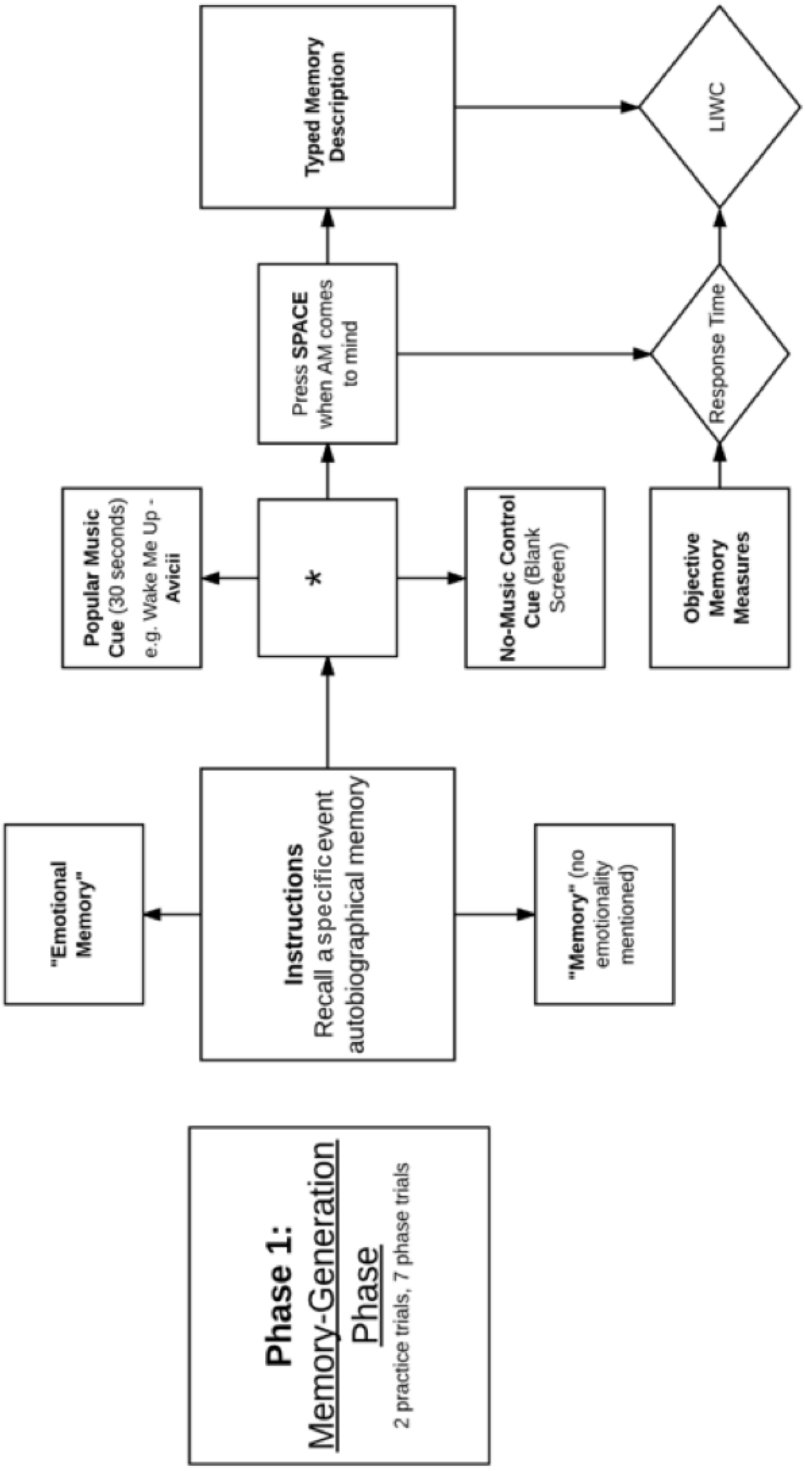

Figure 1. Phase 1 (Memory-Generation Phase). Participants were presented with 7 cues, one at a time, and asked to provide a typed description of the recalled event (either an "emotional memory" or a "memory" with no emotional instruction mentioned).

For ease of comprehension, we provide here details on how the memories provided in the Memory-Generation Phase were measured. To measure the objective nature of memories, the content of the reports of the evoked memories were examined by submitting each report to the LIWC (Pennebaker, Booth, et al., 2015). We limited analysis to theoretically or empirically relevant categories. Given the focus on emotion in this thesis, LIWC categories that index affect were examined. Also, given past research on AM (Belfi et al., 2016; Zator and Katz, 2017), that memories cued by music were described with more perceptual detail than AMs cued in other ways, categories dealing with perceptual information were examined. LIWC categories relevant to social interactions were also examined given social functions of music (Hargreaves & North, 1999), the prevalence of music in important life events (e.g. weddings, Hargreaves & North, 1999), and findings that rated sociality of memory was higher for more arousing and positive music cues (Sheldon & Donahue, 2017).

3.1.3.2 Memory-Rating Phase (Phase 2).

Following the Memory-Generation Phase, participants read a separate instruction page on the computer (see Appendix J) and initiated Phase 2, the Memory-Rating Phase, with the space bar. In this phase, participants were presented back their memory reports one at a time, were asked to think back to when they recalled the given event, and were asked several questions about their experience of recalling it. To measure the participant's subjective experience of their recalled memories, several 7-point Likert-scale AM questions were administered. For the current study these included: a measure of emotional intensity (how strong the emotional experience was), emotional valence (the type of emotional experience, e.g. negative), frequency (how often the event comes to mind in day to day life), importance (how important the memory is in the context of the participant's life), and vividness (how clear the memory is re-experienced). Except for emotional valence, rated as 1 (*very negative*) to 7 (*very positive*), all mentioned questions were rated from 1 (*low*) to 7 (*high*). For these Likert-scale questions, participants could indicate a "0" response for unsure or prefer not to answer responses. Participants were also asked about the age they were in the memory event recalled. Except the "age in memory" question (which was indicated via text box response), all questions were

answered on Likert scales, with responses indicated using the keyboard. The procedure for Phase 2, a list of the memory ratings assessed, and an example item are provided in Figure 2. The complete list and wording of these items are presented in Table 12.

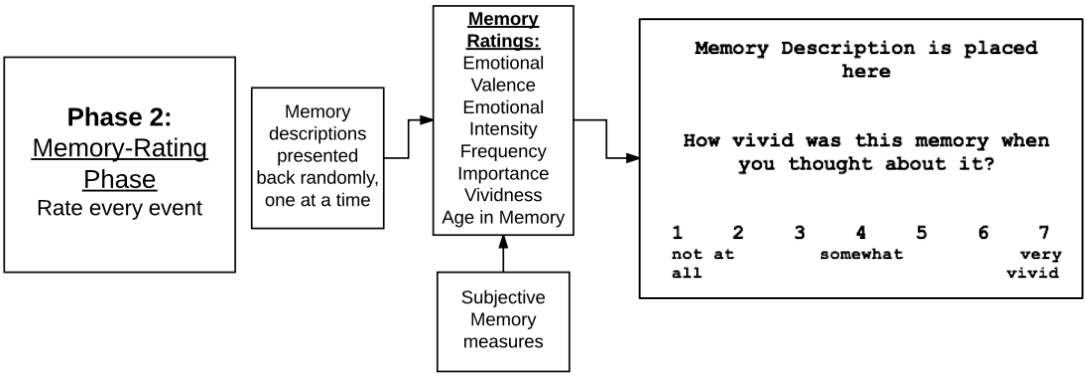

Figure 2. Phase 2 (Memory-Rating Phase). Procedure and example item presentation. Participants were presented with their Phase 1 memory descriptions one at a time and asked a series of questions about each event (subjective memory ratings). When all questions were answered for a given memory, the next memory appeared until all 7 memory events were presented.

Table 12. Study 2: Phase 2 (Memory-Rating) items.

Item	Item Wording	Item Response Format
Emotional Valence	What was your overall emotional experience when thinking about this memory during the previous task?	Likert: 1 (*very negative*) to 7 (*very positive*)
Emotional Intensity	How emotionally intense was your experience of thinking about this memory during the previous task?	Likert: 1 (*not intense at all*) to 7 (*very intense*)
Importance	How important is this memory to you?	Likert: 1 (*not at all*) to 7 (*very important*)
Vividness	How vivid was this memory when you thought about it?	Likert: 1 (*not at all*) to 7 (*very vivid*)
Frequency	How frequently do you experience recalling this memory in day to day life?	Likert: 1 (*have not thought about in years)* to 7 (*comes to mind frequently in everyday life*)
Age in Memory	Please estimate how old you think you were in the described memory.	Text box

Note 1. Items are reported in order of appearance.
Note 2. All Likert scale items could be answered with 0 to indicate a "prefer not to answer" or "unsure" response and text-box questions could be skipped by pressing Enter.

3.1.3.3 Music Cue-Rating Phase (Phase 3)

In this phase, the focus was on perceived characteristics of the popular music cues themselves. Instructions for Phase 3, the Music Cue-Rating Phase, are provided in Appendix K. All participants, regardless of Phase 1 cue type assignment, were presented with ten 30-second song clips, one at a time, and then asked four questions about their experience of the musical cues. These four questions were a subset of the questions asked of participants in Study 1. Seven of these clips were employed as cueing stimuli for participants assigned musical cueing in Phase 1. The additional 3 songs were taken from the Study 1 database, also high on relevance and familiarity and were designed to partially mask the goal of Phase 3. Participants were instructed to press space to initiate the first 30-second clip of Phase 3. The 10 songs were randomized for presentation to participants. After each song, participants pressed space to move onto questions, an example of which is shown on Figure 3. All participants were asked to report using 7-point Likert scales (indicated by using the numbers on the top of the keyboard), on the personal relevance and familiarity of the presented song as well as the emotional valence and intensity of emotion experienced during listening. As in Phase 2 (Memory-Rating Phase), except emotional valence, rated from 1 (*very negative*) to 7 (*very positive*), these questions were responded to using a 1 (*low*) to 7 (*high*) scale and participants could indicate an "unsure" or "prefer not to answer" response with "0". The procedure and one example of item presentation are presented in Figure 3. The full list and wording of Phase 3 items are provided in Table 13.

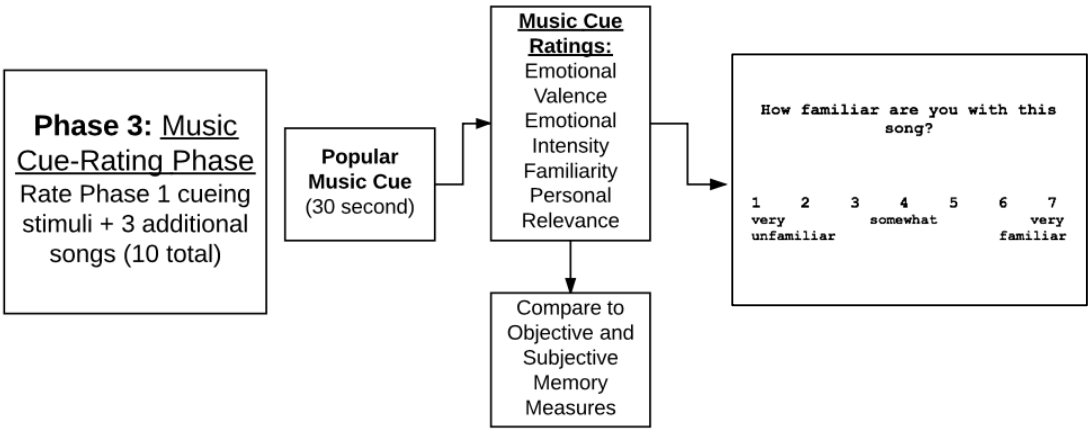

Figure 3. Phase 3 (Music Cue-Rating Task): Procedure and example item presentation. All participants received 10 song cues (7 used in Phase 1). Participants rated songs on 4 variables using a 7-point Likert scale. As depicted, the song was played, and then questions appeared on the top of the screen, with a labeled Likert scale underneath.

Following these questions, only those participants who had served in one of the music-cueing conditions in Phase 1 completed two more questions: one about the role of the music in evoking the recalled AMs and the second about the role of the music in the recalled AMs themselves (e.g. playing in a car). Prior to receiving these two questions, music-cued participants were provided with a list of the stimuli to refresh their memory about the songs that were presented. The wording of these questions is provided in Table 13. These questions were designed to obtain additional insight into the role of the music and emotion in evoking the memory.

The purpose of Phase 3 was to obtain data on how the participants experienced the music (emotionality) and what connection they had to the songs (relevance, familiarity). These data were used to examine the effects of cue aspects on recalled AMs. First, these data were used to examine the effect of a participant's emotional experience of a cue on the recalled AMs. This included examining emotion congruency with both the objective measures obtained from the Phase 1 generated memory descriptions and the subjective measures obtained from the Phase 2 memory ratings. Second, this enabled examination of relevance as a retrieval factor. Given the emotional functions of music (e.g. Juslin & Laukka, 2004; Juslin & Västfjäll, 2008), the ability of music to convey and evoke emotions (e.g. Song et al., 2016), data from classical music studies (e.g. Schulkind &

Table 13. Study 2: Phase 3 (Music Cue-Rating) items.

Item	Item Wording	Item Response Format
Emotional Valence	What was your overall emotional experience while listening to this song?	Likert: 1 (*very negative*) to 7 (*very positive*)
Emotional Intensity	How emotionally intense was your experience of listening to this song?	Likert: 1 (*not intense at all*) to 7 (*very intense*)
Familiarity	How familiar are you with this song?	Likert: 1 (*very unfamiliar*) to 7 (*very familiar*)
Personal Relevance	How personally relevant is this song to you?	Likert: 1 (*not relevant at all*) to 7 (*very relevant*)
Music-Cued	Participants Only	
Role of Music in Memory Itself	Does the song you heard when you recalled any of the memories play a role in the memory itself? (e.g. listening to the song somewhere – car, room, etc.)? If so, please described BRIEFLY (1-2 sentences). Please indicate the song or artist if you cannot remember the song name, and then provide an explanation. If there are multiple songs, please describe all briefly.	Text Box
Role of Music in Evoking the Memory	Did the experience of listening to the song that evoked any of the memories influence the memory that came to mind? If so, please explain BRIEFLY (1-2 sentences). If you believe that the music directly evoked the memory/memories that came to mind, please indicate this here. Please indicate the song or artist if you cannot remember the song, and then provide an explanation. If there are multiple songs, please describe all briefly.	Text box

Note 1. Items are reported in order of appearance. Music-cued only questions were presented after Phase 3 questions for participants cued to popular music only.
Note 2. Likert scale items could be answered with 0 for a "prefer not to answer" or "unsure" response.

Woldorf, 2005; Sheldon & Donahue, 2017), it is hypothesized that emotion congruency between participant experience of the music and the subsequent memories will emerge in both objective LIWC analyses and subjective participant ratings of emotional intensity and valence. Additionally, given past non-music cueing AM literature (e.g. Levine & Pizarro, 2004), this effect may be stronger for positive musical cues. We also anticipate that songs rated higher on relevance will evoke more salient and emotional memories.

This data also enables examination of cue effects relative to control-cued AMs. Participant-rated positive and negative cues, high intensity songs and low intensity songs, and high relevance and low relevance songs are compared to a control baseline. It is expected that control cues will fall intermediate to high and low intensity song-cued AMs on emotional intensity and saliency ratings, to positive and negative song-cued AMs on emotional valence ratings, and to highly and less relevant song-cued AMs on saliency and emotionality ratings.

After completion of all Phase 3 questions (depending on cue type condition), a thank you screen appeared telling participants to retrieve a debriefing form from the researcher. The participants were thanked for their time and dismissed. The entire study took less than one hour.

3.2 Results and discussion

Recall the two main questions addressed in the study: (a) are the AMs produced to music cues especially emotional when compared to a no-music control cue and how do these memories differ in other ways compared to the no-music control cue, (b) which (if any) cue properties influence the emotionality (intensity and valence) and salience of the reported memory (importance, vividness, frequency)? The second aim is broken into two parts, cue emotionality and relevance: (1) do the popular music cues elicit AMs congruent with an individual's emotional experience of the music (congruent in emotional intensity and valence) and how do negative and positive, and highly and less intense cues differ, and compare to the AMs evoked to the no-music control cue and (2) is the personal relevance of a cue a potent retrieval factor, with higher relevance resulting in more salient or emotionally-varied memories.

The results section is organized as follows. First, we present basic recall statistics and information about the dependent variables to be employed, as well as some manipulation checks. These analyses will be of the data, with data collapsed across cue-type and in some cases, across instructional manipulation. Then, the two larger questions noted above will be examined in order. These analyses focus mainly on differences in Phase 2 participant memory ratings (saliency and emotion) and a small subset of linguistic analyses of the Phase 1 memory descriptions (proportion of affective, social, leisure, cognitive, and perceptual words).

3.2.1 Preliminary analyses: Recall statistics, information on the dependent measures, and manipulation checks

3.2.1.1 Percentage of memories evoked

We find specific event memory recall near ceiling for all conditions. The blank screen control conditions elicited a specific "memory" 100% of the time and a specific "emotional memory" 99.1% of the time. Popular music elicited a specific "memory" 97.0% of the time and a specific "emotional memory" 99.1% of the time. Examples of the types of memories reported are presented in Table 14. The instances where no memory was reported (e.g. "no memory came to mind") and those that did not describe a specific AM (e.g. "this song reminds me of my ex-girlfriend") were excluded from all subsequent analyses.

3.2.1.2 Dependent variables from the Memory-Generation Phase (Phase 1)

Recall that in the Memory-Generation Phase (Phase 1), participants were asked to recover either "emotional memories" or "memories" (with no reference to emotion) to either 7 short popular music clips or 7 blank computer screens. The following data were extracted.

Table 14. Study 2: Example memory descriptions.

Cue Type	Cue Presented	Instruction Type	Memory Description
Popular Music	"Love the Way You Lie" – Eminem and Rihanna (2010)	Emotional Memory	"Not making the provincial level team in 2009. On a family vacation in Mexico, we were sitting out by the pool and my Mom got the email that I hadn't made the cut, she didn't tell me until we got home because she didn't want to upset me. I was still overcome with sadness when I found out and was also upset she didn't tell me right away."
Popular Music	"All of Me" – John Legend (2014)	Control "Memory"	"This song brings back a memory of Valentine's Day in middle school when someone asked me to be their valentine in front of everyone and brought me roses and chocolates."
Control	Blank screen	Emotional Memory	"When I was very young, one of the first times my family visited my Mom's extended family in Nova Scotia resulted in a very vivid memory for me. We were at the beach with all my aunts and uncles and my cousins loved to tease the cousins from Ontario. They liked to collect small starfish from the ocean and chase us around with them. I was sitting in the sand and my aunt placed a tiny, squishy, purple starfish on my shoulder. Of course, I reacted by tilting my head and moving my shoulder to my ear. This resulted in the little starfish being squished. I was horrified that I had killed the innocent creature and that I had slimey purple guts all over myself."
Control	Blank screen	Control "Memory"	"I was going up a ski chairlift in Ellicottville, New York. It was at Holimonts private ski resort. It was a very cold day and I could feel the wind burning my face on my way up the hill. I was with my twin brother and my older brother. This was during reading week."

Note. All memories were edited for spelling and grammar before LIWC analyses.

3.2.1.2.1 Response time

The time (in seconds) taken from cue presentation until the participant pressed the space bar to indicate that a memory was evoked was measured. The average response time to cue a memory with popular music was 17.32 s (*SD* = 8.54 s) and with the no-music control cue was 5.83 s (*SD* = 9.35 s). The control cue response time is consistent with reported average response times to cue an AM in the AM literature (5 to 7 s; Haque & Conway, 2001). The music-cued response times here are similar to those observed to classical music cues (Sheldon & Donahue, 2017; Schulkind & Woldorf, 2005) and shorter than those cued to popular music in Zator and Katz (2017).

Zator and Katz attributed their response times to the specific instructions in demanding a written report of a detailed specific event memory. The shorter RTs found here relative to that of Zator and Katz (2017) may be due to the care taken in the present study to encourage retrieval of the first specific memory that came to mind. For participants assigned to the popular music-cue condition, the experimenter also emphasized that the memory did not have to involve the music cue nor were participants required to listen to the entire clip and instead, they were encouraged to press the space bar as soon as possible.

3.2.1.2.2 Word count

Total word count has been associated with emotional memory narratives (Bohanek et al., 2005), thus this is examined here. Similar to Zator and Katz (2017), the average word count for the memory descriptions produced to popular music was 39.44 words (*SD* = 23.85). In the no-music control condition, the average number of words in the memory descriptions was 50.20 (*SD* = 35.54). As in Zator and Katz (2017), participants were limited to the text box on the screen, which held about 175 5-letter words. No participants reached this maximum. This limit was imposed both to constrain the time participants spent in the study and also to ensure that the memory descriptions could be presented back in their entirety to participants (fit on the screen) in the Memory-Rating Phase (Phase 2).

3.2.1.2.3 Content of open-ended response: Music's role in the memory itself

Recall that participants cued to popular music were provided the opportunity to remark both on if the musical cue played a role in the memory that it evoked (e.g. playing in car) and if the participants believed that the musical cue itself was responsible for evoking the memory. Participants were asked to briefly elaborate on their responses.

Out of the 62 participants in the music cue condition, 45 (72.58%) explicitly endorsed that the music played a role itself in the memories evoked. The responses of these 45 participants were organized thematically in Table 15. Forty-one participants (91.11%) referred to a specific event or location where the music was played in the recalled event, and twenty-five (55.56%) referred specifically to some social event or interaction where the music was played. Of these social responses, twenty-three participants (51.11%) referenced family or friends (e.g. wedding), and small subsets of these participants mentioned school, parties, concerts, or other events (e.g. sports competitions). Twenty-one participants (46.67%) mentioned listening to the music in a car (driving or radio reference). Smaller subsets of participants mentioned dancing and bars, listening to the

Table 15. Study 2: Thematic analyses of responses to the role the music played in the memory itself (if any).

Themes	Number of Participants	Percentage of Responses (%)
Reference to specific event or location where music was played	41	91.11
Social events	25	55.56
Mention of family or friends	23	51.11
School	5	11.11
Parties	2	4.44
Concert	4	8.89
Other (e.g. sports events)	6	13.33
Driving or car	21	46.67
Dance, dancing, or bars	11	24.44
Home	7	15.56
Watching music video	6	13.33
Performing	3	6.67
Travel	2	4.44

music at home, watching the music video, performing the music, or traveling as contexts where the music was encountered in their recalled events.

The LIWC data for the open-ended written response are presented in Table 16. In addition to the thematic analyses above, we find evidence to support that the popular music-cued memories most likely involve contexts where the music was listened to (e.g. while driving) or viewed (e.g. concert or music video) and that this interaction with the music was in a leisure context. That is, the high proportion of all perceptual process categories (overall, seeing, hearing) relative to the LIWC 2015 Grand Mean and to Zator and Katz's (2017) findings supports the assertion that a high proportion of participants

Table 16. Study 2: LIWC analyses of open-ended question: Role of the music in the recalled memory itself.

	Current Study	**Comparisons**	
LIWC Category	**Role in Memory Itself**	**Zator & Katz (2017)**	**LIWC 2015**
Affective Processes	3.98	4.77 (0.34)	5.57 (1.99)
Positive Emotion	3.21	4.04 (0.33)	3.67 (1.63)
Negative Emotion	0.66	0.74 (0.16)	1.84 (1.09)
Anxiety	0.04	0.19 (0.09)	0.31 (0.32)
Anger	0.07	0.20 (0.06)	0.54 (0.59)
Sadness	0.40	0.25 (0.09)	0.41 (0.40)
Social Processes	8.57	9.15 (0.57)	9.74 (3.38)
Family	0.51	1.58 (0.30)	0.44 (0.63)
Friends	0.84	1.90 (0.20)	0.36 (0.40)
Personal Concerns			
Leisure	8.90	8.69 (0.45)	1.35 (1.08)
Cognitive Processes	11.57	12.93 (0.72)	10.61 (3.02)
Personal Pronouns	11.27	11.35 (0.51)	9.95 (3.02)
Perceptual Processes	8.79	5.24 (0.45)	2.70 (1.20)
Seeing	1.28	0.73 (0.33)	1.08 (0.78)
Hearing	6.93	4.14 (0.29)	0.83 (0.62)
Past Focus	7.00	5.98 (0.54)	4.64 (2.06)
Relativity	15.72	20.74 (0.68)	14.26 (3.18)
Motion	2.59	3.56 (0.28)	2.15 (1.03)
Space	8.61	9.02 (0.49)	6.89 (1.96)

Note 1. LIWC 2015 = LIWC 2015 Grand Mean.
Note 2. Some Zator and Katz (2017) data was obtained from our earlier data analyses not reported in the *Memory* (2017) paper. The LIWC does not give SDs for text analyses. The SEs provided in Zator and Katz (2017) were computed as a result of aggregating the means of several memory reports.

who answered this question endorsed that music playing a role in the memory. We also see a high proportion of leisure and friend words compared to the LIWC 2015 Grand Mean, a finding similar to the Zator and Katz (2017) data, which supports the notion that social events and relaxation are also associated with the memory context.

3.2.1.2.4 LIWC: Content of specific autobiographical memories produced in the Memory-Generation Phase (Phase 1)

As in Zator and Katz (2017), the LIWC was used also to analyze the text of the 840 memory descriptions generated in Phase 1. Participants who produced descriptions averaging 5 or less words were eliminated from LIWC analyses; only 4 participants were eliminated from LIWC analyses due to this criterion. Before analyses, all descriptions were edited for spelling and grammar. Due to the large number of categories (including subcategories) of words analyzed by the LIWC, a subset of theoretically-relevant categories was chosen based on the main research aims, namely affective, social, leisure, perceptual, and cognitive process words.

To examine our emotional aims, all six affective process categories were examined: overall affective processes, positive, negative, anger, anxiety, and sadness. To examine whether these memories may be of a more social, carefree nature, and involve interaction with the popular music cue, the overall social category (including two subcategories: friends and family), a personal concerns category that may be associated with social activities: leisure words (e.g. “cook”, “chat”, “movies”), and perceptual process categories (overall, seeing, hearing) that may be associated with an individual’s encounter with the music itself in the memory, were examined. Similar to total word count, use of cognitive process words has been associated with emotional memory narratives (Bohanek et al., 2005) and is also examined here.

The means of LIWC category usage in the memory descriptions cued specifically to popular music are presented in Table 17. The purpose of this information is to compare our music-cued reports to both those in Zator and Katz (2017) and the LIWC 2015 mean for the categories used in both studies.

Table 17. Study 2: Comparisons of LIWC word use in popular music-cued memory reports to Zator and Katz (2017) and LIWC 2015 grand mean.

	Current Study	Comparisons	
LIWC Categories	**Music-Cued Memory Reports**	**Zator & Katz (2017)**	**LIWC 2015**
Social Processes	10.51(3.34)	9.15(0.57)	9.74(3.38)
Family	1.27(1.40)	1.58(0.30)	0.44(0.63)
Friend	1.86(1.38)	1.90(0.20)	0.36(0.40)
Personal Concerns			
Leisure	8.23(4.07)	8.69(0.45)	1.35(1.08)
Perceptual Processes	6.72(2.96)	5.24(0.45)	2.70(1.20)
See	1.64(1.71)	0.73(0.33)	1.08(0.78)
Hearing	4.59(2.45)	4.14(0.29)	0.83(0.62)
Cognitive Processes	6.56(3.81)	12.93(0.72)	10.61(3.02)
Affect Processes	4.36(2.07)	4.77(0.34)	5.57(1.99)
Positive Emotion	3.07(1.38)	4.04(0.33)	3.67(1.63)
Negative Emotion	1.24(1.12)	0.74(0.16)	1.84(1.09)
Anxiety	0.24(0.48)	0.19(0.09)	0.31(0.32)
Anger	0.31(0.51)	0.20(0.06)	0.54(0.59)
Sadness	0.46(0.68)	0.25(0.09)	0.41(0.40)
Relativity	20.87(5.71)	20.74(0.58)	14.26(3.18)
Motion	3.87(2.02)	3.56(0.28)	2.15(1.03)
Space	9.41(3.41)	9.02(0.49)	6.89(1.96)
Personal Pronouns	11.53(4.22)	11.35(0.51)	9.95(3.02)
Past Tense	7.17(3.58)	7.04(0.37)	4.64(2.06)

Note 1. LIWC 2015 = LIWC 2015 Grand Mean.
Note 2. Zator and Katz (2017) reported M(SE). All other data report M(SD).

We see similar proportions of words for popular music-cued memories here and in Zator and Katz (2017) for all categories with one exception: cognitive process words. As noted before, the average use of cognitive process words was about 30% higher in the 2007 library versus the new 2015 library, which may explain the discrepancy in means. Thus, overall the results found here are consistent with those reported in Zator and Katz.

Further contrasts to Zator and Katz involving the effects of relativity, motion, space, personal pronouns, and past tense can be found in Appendix L for comparison purposes

or those interested in replication. These three categories will not be discussed further in this thesis as they are not of immediate relevance to the aims of Study 2.

The 2 cue type (popular music vs. control cues) X 2 instruction type (recall an "emotional memory" vs. recall a "memory", no emotionality mentioned) analyses of variance (ANOVAs) of non-affective LIWC categories are reported below and presented in Table 18. Due to the large number of comparisons, a Bonferroni correction was applied and only effects at $p < .02$ are reported as significant. Given the focus of the thesis, the ANOVAs for affective categories are presented separately in the main analyses section that follows presently. On average, memory descriptions contained more social (M = 9.88, SD = 3.40), family (M = 1.56, SD = 1.51), and friend words (M = 1.56, SD = 1.35) than the LIWC 2015 grand mean, indicating that AMs generally tend to contain a large proportion of social words. In partial agreement with expectations, two significant effects emerged such that descriptions of memories cued to music contained more friend words: $F(1, 115) = 6.46$, $p = .012$, $n_p^2 = .05$, and leisure words: $F(1, 115) = 30.22$, $p < .001$, $n_p^2 = .21$, than those cued to a blank screen.

One anticipated effect approached significance: descriptions of music-cued memories contained more social process words than those cued by a blank screen ($p = .035$). No cue type effect was found for cognitive process words. All three categories of perceptual words: overall, seeing, and hearing, were used with greater proportion in music-cued memory descriptions compared to control-cued reports: $F(1, 115) = 81.15$, $p < .001$, $n_p^2 = .41$, $F(1, 115) = 7.49$, $p = .007$, $n_p^2 = .06$, and $F(1, 115) = 91.09$, $p < .001$, $n_p^2 = .44$, respectively. The latter effects are consistent with aspects of the data reported in Zator and Katz (2017). No effects of instruction type or interactions were found for the social process, cognitive processes, leisure, or perceptual process categories. That is, we find some evidence of increased sociality and interaction with the music in the memory descriptions in response to popular music relative to a blank screen.

Table 18: Study 2: General ANOVA: Social, personal, perceptual, and cognitive process LIWC categories (Phase 1 Memory-Generation).

	Current Study Manipulation				**Comparisons**	
	Cue Type		**Instruction Type**			
	Control	Music	Memory	Emotional Memory	Zator & Katz (2017)	LIWC 2015
Social Processes	9.20(3.36)	10.51(3.34)[1]	9.97(3.03)	9.77(3.76)	9.15(0.57)	9.74(3.38)
Family	1.87(1.58)	1.27(1.40)[1]	1.74(1.61)	1.37(1.40)	1.58(0.30)	0.44(0.63)
Friend	**1.24(1.14)**	**1.86(1.38)***	1.51(1.45)	1.60(1.25)	1.90(0.20)	0.36(0.40)
Personal Concerns						
Leisure	**4.23(3.80)**	**8.23(4.07)*****	6.18(4.09)	6.40(4.74)	8.69(0.45)	1.35(1.08)
Perceptual Processes	**2.66(1.73)**	**6.72(2.96)*****	4.41(3.27)	5.08(3.06)	5.24(0.45)	2.70(1.20)
See	**0.94(0.89)**	**1.64(1.71)****	1.19(1.15)	1.84(2.00)	0.73(0.33)	1.08(0.78)
Hearing	**0.96(1.54)**	**4.59(2.45)*****	2.69(2.88)	2.95(2.62)	4.14(0.29)	0.83(0.62)
Cognitive Processes	6.56(3.81)	6.89(3.83)	6.15(3.71)	7.30(3.85)	12.93(0.72)	10.61(3.02)

Note 1. LIWC 2015 = LIWC 2015 Grand Mean.
Note 2. All significant differences bolded.
Note 3. *** - $p < .001$, ** - $p < .01$, * - $p < .02$, [1] – approached significance ($0.2 < p < .06$).
Note 4. Means from Zator and Katz (2017) are provided for reference. Zator and Katz figures report M(SE). All other measures are M(SD).

3.2.1.3 Dependent measures from the Memory-Rating Phase (Phase 2): Participant ratings of evoked memories

In Phase 2, participants were randomly presented their Phase 1 memory descriptions, one at a time, and asked six questions about the experience of recalling the event. These are typical of the self-report measures used in AM studies (e.g. Brewer, 1996; Cady et al., 2008; Ford et al., 2012; Rubin & Schulkind, 1997; Schulkind & Woldorf, 2017; Sheldon & Donahue, 2017). Recall that the ratings included five 7-point Likert-scale questions rated as 1 (*low*) to 7 (*high*), namely experienced; vividness, frequency (how often a memory is recalled in everyday life), importance, and emotional intensity; emotional valence, was rated as 1 (*very negative*) to 7 (*very positive*). The final question asked participants to report the age they were when the recalled event occurred. To index the recency of the memory, reported age when memory was experienced was subtracted from the participant age reported in demographics to create a new variable called "memory recency". A smaller number indicates a more recent memory. To avoid confusion with the Music Cue-Rating Phase (Phase 3) ratings of emotional experience of the musical cues per se, when labeling variables in tables below, Phase 2 "emotional intensity" and "emotional valence" measures are labeled as "memory intensity" and "memory valence". Any "unsure" or "prefer not to answer" 0 responses for the Likert items were eliminated from analyses. This resulted in the removal of 5 data points. Memory recency data could not be computed for two participants. One did not report a current age and another provided memory ages greater than their reported current age.

As seen in Table 19, on average, the AMs produced were relatively recent and rated as somewhat important, somewhat emotionally intense, not frequently experienced in

Table 19: Study 2: Phase 2 memory ratings of all participants.

Phase 2 (Memory-Rating) Variables	Mean (SD) of Total Participants
Memory Intensity	4.34(1.71)
Memory Valence	4.79(1.87)
Frequency	3.14(1.69)
Importance	4.31(1.96)
Vividness	5.35(1.87)
Memory Recency	3.56(3.68)

everyday life, and slightly positive in emotional valence. Thus, memories on average were not especially salient or emotional. The only exception is vividness, which was rated fairly high on average.

3.2.1.4 Dependent measures from the Music Cue-Rating phase (Phase 3): Participant ratings of musical stimuli

Recall that in Phase 3 (Music Cue-Rating), all participants were presented with 10 musical clips (7 were Phase 1 cueing stimuli), and asked four questions about their experience and relationship to the songs, which were a subset of questions asked to participants in Study 1: personal relevance, familiarity, emotional intensity, and emotional valence. That is, the questions were directed not to their memories but their experience of the music *per se*. These responses were rated on 7-point Likert scales from 1 (*low*) to 7 (*high*), except emotional valence that was rated from 1 (*very negative*) to 7 (*very positive*). Only the data for the 7 music cueing stimuli are presented below. To avoid confusion with Phase 2 (Memory-Rating) emotion ratings, in all charts, Phase 3 "emotional intensity" and "emotional valence" ratings of the popular music cues are labeled as "music cue intensity" and "music cue valence".

3.2.1.4.1 Manipulation check of the music cues

Given the suggestion in past literature and in Study 1 that high familiarity and personal relevance of the musical cue are associated with higher recall or enhancement of specific event memories (e.g. El Haj et al., 2015; El Haj, Fasotti, & Allain, 2012; El Haj, Postal, & Allain, 2012; Janata et al., 2007), we check whether these musical stimuli were experienced as familiar and contained sufficient variability in relevance to assess the role of cue-relevance in producing specific AMs in the main analyses. Accordingly, Phase 3 (Music Cue-Rating) responses from all participants to the seven stimuli used as cues to evoke AMs in Phase 1 are analyzed here. Recall that the stimuli were rated as highly familiar and moderately relevant in Study 1. It was expected that on average, all songs would not be rated as highly relevant but a large range of scores would exist (1 to 7 on our 7-point Likert scale). For each participant, we expected that at least one song from the seven would be rated as highly relevant (6 to 7 on our 7-point scale) and at least one,

lower on relevance (1 to 5 on our 7-point scale). This was necessary to permit examination of if relevance of a popular music song influences memory retrieval in healthy adults.

As seen in Table 20, as expected, the cueing stimuli were rated on average, as highly familiar and somewhat relevant (on our 7-point Likert scale). Both variable responses ranged from 1 to 7. Thus, the selection of stimuli from the database was successful in achieving both high familiarity and moderate relevance with a complete range and large spread of responses across the 1 to 7 range (as demonstrated by the large relevance SD).

Table 20. Study 2: Music cue rating manipulation check.

Phase 3 (Music-Rating) Measures	Mean (SD) of Total Participants
Familiarity	6.44 (1.10)
Music Cue Intensity	4.28 (1.80)
Music Cue Valence	4.95 (1.58)
Personal Relevance	4.07 (1.97)

Note. All variables were rated on 7-point Likert scales. Excluding the emotional valence question that was rated from 1 (*very negative*) to 7 (*very positive*), all variables were rated from 1 (*low*) to 7 (*high*).

3.2.1.4.2 Comparisons between groups

Data from Phase 3 (Music-Cue Rating) also permit examining if cue and instruction type manipulations affected the experience of the music. Raw data for the seven musical cues of interest were aggregated for each participant to give a participant mean for each of the four Phase 3 (Music-Rating) responses. Several 2 cue type (Popular Music vs. Control cue) X 2 instruction type ("emotional memory" vs. "memory", no emotionality mentioned) ANOVAs were conducted.

Only one effect was found: participants in the control cueing condition (blank screen) rated the songs as more familiar than those cued by music: $F(1, 119) = 7.10$, $p = .009$, $n_p^2 = .06$, as seen in Table 21. However, more importantly, both groups rated songs as highly familiar on average, well over 6.0 on the 7 point-scale. No other differences were found. Thus, participants experienced the cueing stimuli similarly regardless of group

assignment[6].

Table 21. Study 2: Musical cue ratings by experimental group.

Current Study Manipulation		Phase 3 (Music-Rating) Variables				
Cue Type	**Instruction Type**	Familiarity	Music Cue Intensity	Music Cue Valence	Relevance	N
Control	Control ("Memory")	6.62 (0.62)	4.06 (1.14)	5.00 (0.75)	4.07 (1.02)	30
Control	"Emotional Memory"	6.61 (0.57)	4.21 (1.19)	5.10 (0.80)	4.03 (1.22)	31
Popular Music	Control ("Memory")	6.22 (0.94)	4.29 (1.20)	4.90 (0.83)	3.96 (1.16)	31
Popular Music	"Emotional Memory"	6.30 (0.77)	4.56 (0.83)	4.79 (0.85)	4.24 (1.19)	31

Note. Means provided with standard deviations in brackets.

3.2.1.5 Preliminary analyses: Summary

In summary, the preliminary analyses reported above confirm: (a) both the music and control (blank screen) cues successfully evoke specific autobiographical memories, (b) the number of words in the autobiographical memories, and response time (RT) to evoke an autobiographical memory are consistent with those found in Zator and Katz (2017) and other past music-cueing work; the slightly faster RT here is due, we speculate, to better control of the musical cues in this study, (c) overall analyses of the content of the memory reports indicated some differences between popular music-cued and control-cued memories, generally consistent with those observed in Zator and Katz (2017), with novel findings indicating the importance of memories associated with leisure content, (d) on average, the memories evoked were relatively recent and rated as somewhat important, emotionally intense, vivid, infrequently experienced, and slightly positive in emotional valence and finally, (e) the music cues were rated as highly familiar in all conditions, and only moderately relevant, with fairly large range of scores. This last finding is especially important because it suggests that personal relevance differs even for

[6] The data for the other three Phase 3 stimuli were analyzed. No cue type, instruction type, or interaction effects were found. For ease of presentation, the specifics are not reported here.

songs that are highly familiar. The role of individual differences in relevance will be examined presently.

3.2.2 The main analyses: Emotion, cue emotionality, relevance

The analyses relative to the two main aims are presented below. Due to the large number of comparisons, effects were only considered significant at small *p*-values. For bivariate correlational analyses, only relationships accounting for more than 2% of variance ($r > .15$) and significant at $p < .01$ are reported as significant. For analyses of variance (ANOVAs), Bonferroni corrections were applied and only effects at $p < .02$ are reported as significant. Where applicable, Greenhouse-Geisser adjustments were applied. For theoretically hypothesized effects, those approaching significance ($0.2 < p < .06$) are marked as such. Effect sizes are reported as n_p^2. In addition to ANOVAs for the emotion-congruency analyses, and to provide comparison with Sheldon and Donahue's (2017) categorical analysis of emotion-congruent memories, chi-square analyses are provided and reported as significant if $p < .02$. Several multiple regression models are provided using each participant's ratings of the musical cues per se as predictor variables and variables are reported as significant predictors if $p < .01$.

3.2.2.1 Are autobiographical memories cued by popular music more emotional in nature than those cued without music?

Recall that regardless of instruction type, it was expected that music would cue highly emotional memories automatically, thus providing support for popular music's hypothesized automatic connection to emotional memory information in the AM information storage system. This hypothesis was driven by the expectation that popular music evokes emotions (e.g. Song et al., 2016) and that this emotion evocation would lead to retrieval of an emotion-congruent event. Emotion congruency is examined below in a following section, but first we examine emotionality compared to the no-music control cue. We expected also that instructing participants to evoke an emotional memory would be another means of examining emotionality in autobiographical memory. We address this question in several ways. First, we present the results of the 2 cue type (popular music vs. control cue) X 2 instruction type (recall an "emotional memory" vs.

"memory" – no emotionality mentioned) ANOVAs for measures of the evoked memory, both those subjectively rated in Phase 2 (Memory-Rating), and the LIWC measures obtained on the content of the memories themselves (Phase 1, Memory-Generation).

To examine if popular music-cued memories were especially emotional, 2 cue type X 2 instruction type between-subjects ANOVAs were conducted on the subjective rating data (Phase 2 Memory-Rating). Before analyses, raw data for each participant's 7 memory events was aggregated on all variables. The relevant data are presented in Table 22.

Table 22. Study 2: General ANOVA emotional analyses.

	Current Study Manipulation				**Comparisons**	
	Cue Type		**Instruction Type**			
	Control	Music	Memory	Emotional Memory	Zator & Katz (2017)	LIWC 2015
Phase 2 (Memory-Rating)						
Memory Intensity	4.34(0.84)	4.33(0.93)	4.16(0.96)	4.51(0.87)[1]	-	-
Memory Valence	4.75(0.86)	4.85(0.83)	4.76(0.77)	4.84(0.91)	-	-
Phase 1 (Memory-Generation)						
Affective Processes	4.56(2.31)	4.36(2.07)	**3.99(1.81)**	**4.93(2.43)***	4.77(0.34)	5.57(1.99)
Positive Emotion	2.94(1.72)	3.07(1.38)	2.76(1.42)	3.25(1.65)	4.04(0.33)	3.67(1.63)
Negative Emotion	1.58(1.12)	1.24(1.12)	1.22(0.98)	1.60(1.23)[1]	0.74(0.16)	1.84(1.09)
Anxiety	0.40(0.49)	0.24(0.48)	0.27(0.51)	0.36(0.47)	0.19(0.09)	0.31(0.32)
Anger	0.34(0.47)	0.31(0.51)	0.26(0.43)	0.39(0.54)	0.20(0.06)	0.54(0.59)
Sadness	0.48(0.60)	0.46(0.68)	0.40(0.67)	0.53(0.61)	0.25(0.09)	0.41(0.40)

Note 1. LIWC 2015 = LIWC 2015 Grand Mean.
Note 2. Means from Zator and Katz (2017) are provided for reference. Zator and Katz figures report *M*(*SE*). All other measures are *M*(*SD*).
Note 3. All significant differences bolded. *** - $p < .001$, ** - $p < .01$, * - $p < .02$, [1] – approached significance ($0.2 < p < .06$).

In contrast to our hypotheses, we did not observe any effects of cue type or interaction involving the emotional instruction type manipulation for either the subjective ratings of memory valence or intensity, or for any of the objective affective word categories in LIWC analyses. Thus, we find no evidence in these analyses that popular music-cued AMs were more emotional in nature than AMs cued in the control condition. Moreover, there was no interaction indicating that popular music automatically evokes emotional memories (whereas memories cued in the absence of music do not do so). Given Pereira et al.'s (2011) neurobiological findings indicating that high familiarity with a musical stimulus is associated with greater emotional and pleasure activation in the brain, these data (also based on highly familiar musical clips) suggest a disconnect between emotional reaction to the music and the nature of the AM produced to that music. The only reliable effect present in this analysis is the not surprising effect of instruction type manipulation: participants asked to recall an "emotional memory" produced reports with more affective words than participants asked to retrieve a "memory" (no emotionality mentioned): $F(1, 115) = 5.82$, $p = .017$, $n_p^2 = .05$. However, still relative to the LIWC 2015 grand mean, these numbers are below average, indicating that reports were described as not overly emotional as a whole.

Beyond emotionality, we also investigated if these memories differed in self-reported measures of memory saliency. These data are presented in Table 23.

Memories cued to popular music were rated as less frequently experienced: $F(1, 115) = 6.32$, $p = .013$, $n_p^2 = .05$, and less important: $F(1, 115) = 7.95$, $p = .006$, $n_p^2 = .06$, than those cued to a blank screen. In addition to memories being less salient, memories cued to popular music were more recent: $F(1, 117) = 5.80$, $p = .018$, $n_p^2 = .05$, and took longer to cue: $F(1, 119) = 50.29$, $p < .001$, $n_p^2 = .30$, than those cued to a blank screen.

Table 23. Study 2: General ANOVA additional analyses.

	Current Study Manipulation				Comparison
	Cue Type		Instruction Type		
	Control	Music	Memory	Emotional Memory	Zator & Katz (2017)
Phase 2 (Memory-Rating)					
Frequency	**3.37(0.95)**	**2.92(0.99)***	3.14(0.96)	3.14(1.02)	-
Importance	**4.55(0.97)**	**4.04(1.02)****	4.30(0.98)	4.30(1.07)	-
Vividness	5.53(0.85)	5.18(0.90)^{1}	5.33(0.94)	5.38(0.84)	-
Memory Recency	**4.03(3.11)**	**3.01(1.08)***	3.61(2.48)	3.40(2.22)	-
Phase 1 (Memory-Generation)					
Response Time (s)	**5.83(9.35)**	**17.32(8.54)*****	10.98(10.09)	12.25(11.16)	57.40(11.18)
Word Count	50.20(35.54)	39.44(23.85)^{1}	41.51(27.88)	47.91(32.83)	30.97(17.79)

Note 1. Means from Zator and Katz (2017) are provided for reference. Zator and Katz figures report *M*(*SE*). All other measures report *M*(*SD*).
Note 2. All significant differences bolded. *** - $p < .001$, ** - $p < .01$, * - $p < .02$, ^{1} – approached significance ($0.2 < p < .06$).

Thus, the answer is "no" to the question of whether music cued memories are more emotional in nature, and possibly evoked automatically. Indeed, if anything, the memories evoked in the unconstrained control-cue condition were more salient. These data suggest that popular music in this lab-setting might have induced participants to focus their memory search on less important or salient memories relative to an unconstrained cueing condition. It should be noted the data reported earlier indicate that

the memories produced overall are rated as only moderately emotional by our participants, and as such it is possible that conditions which cue more emotional memories might show the music-emotional link. However, as reported in the previous section, the data do show that the popular music did cue different types of memory content, involving reports rich in some social and leisure content, and in perceptual features. Thus, these memories may be more obscure, less salient, but richer in these features.

3.2.2.2 Examination of the popular music-cued participants' responses in depth

The results of Study 1, and the almost 100% effectiveness of music-cues in evoking autobiographical memories in this study indicate that the familiar music itself is an effective retrieval cue, even if these effects are not mediated necessarily by emotion. That is, our data does not support the conclusion that music automatically evokes an emotion. However, given the large ranges and moderate reports of emotionality and relevance of the musical cues, the data permit additional analyses that explore the music-cued memories in more depth. For instance, it is possible that emotion induction is a good retrieval cue, but only in some cases. Responses by 57 of the 62 music-cued participants (91.94%) to the question asking to what extent (if any) the listening experience affected the memory recall process is suggestive. Of this group, 54 (94.74%) endorsed that the listening experience somehow affected memory recall. Twenty-five of these participants (43.86%) endorsed an emotional response to the music as part of the listening experience that evoked the memory and 24 (42.11%) claimed the song as being present in the memory. Thus, we find that music-cued participants claim that the musical cues directly affected the recalled memories; in about half of the cases, emotion was specifically given as the reason for this effect and in about three quarters, the presence of the music itself is given as the reason.

We examine then the data on musically-cued memories in-depth as a function of a participant's emotional experience (valence and intensity) and relationship (relevance) to the musical cues, beginning with correlational analyses and then focused analyses on emotion and relevance of cue. In some cases, control-cued participants are compared as a

baseline. The purposes of these analyses are (a) to investigate the relations between participant experience of the music itself and the subsequently produced memories, and (b) to determine which effects are dependent on the musical nature of the cue (compared to the control situation). As seen below, aspects of the listening experience influence the recalled events.

3.2.2.2.1 Correlational analyses

Associations between memory measures (Phase 1 Memory-Generation and Phase 2 Memory-Rating) and music cue measures (Phase 3 Music Cue-Rating) in this population are discussed in detail below. For interest, Appendix M presents all the inter-correlations between Phase 2 (Memory-Rating) and Phase 1 (Memory-Generation) measures in the popular music-cued participants. Noted here briefly, are positive associations between leisure word use and perceptual, seeing, hearing, and positive word use (*r*s ranging from .28 to .44, all $p < .01$), suggesting that some memories may involve interacting in one's memory with the musical cue in a positive leisurely context. For instance, one of my supervisor's memories for a particular Bob Dylan song is associated with playing the board game "Monopoly" with a lady friend late at night.

3.2.2.2.1.1 Relationship between Phase 3 music cue ratings and evoked memory qualities

Table 24 presents the correlations between memory (Phase 1 Memory-Generation and Phase 2 Memory-Rating) and music cue measures (Phase 3 Music Cue-Rating). As seen, the more the music was experienced as positive, the greater was the likelihood the reported memory was associated with positive events ($r = .53$, $p < .001$), the greater was the use of positive words ($r = .17$, $p = .001$), and the lower was the use of negative ($r = -.27$, $p < .001$), anger ($r = -.24$, $p < .001$), and sadness words ($r = -.21$, $p < .001$) in the memory report. Moreover, the more the music was rated positively, the more the memory was rated as emotionally intense ($r = .19$, $p < .001$). Likewise, music cue intensity was positively associated with the participant reported memory intensity ($r = .42$, $p < .001$), though music cue intensity was not associated with the memory valence or the emotion

Table 24. Study 2: Correlations between Phase 1 and 2 memory rating measures and Phase 3 music rating variables in popular music-cued participants.

	Phase 3 Music Cue Ratings			
	Familiarity	Music Cue Intensity	Music Cue Valence	Personal Relevance
Phase 2 (Memory-Rating)				
Frequency	-.03	**.34****	.08	**.31****
Importance	**.15****	**.39****	**.21****	**.44****
Vividness	**.17****	**.36****	**.19****	**.33****
Memory Intensity	**.18****	**.42****	**.19****	**.37****
Memory Valence	.12*	.12*	**.53****	**.20****
Phase 1 (Memory-Generation)				
Memory Recency	-.07	-.11*	-.07	-.08
RT to Cue	-.05	-.08	-.05	**-.21****
LIWC Categories				
Affective Processes	.10*	.06	-.01	.12*
Positive Emotion	.05	.08	**.17****	.12*
Negative Emotion	.10	-.01	**-.27****	.03
Anxiety	.03	-.03	-.03	-.04
Anger	.07	-.04	**-.24****	-.02
Sadness	.06	.01	**-.21****	.08
Social Processes	-.09	.01	.00	.09
Family	**-.18****	-.01	-.01	.01
Friends	.03	-.01	.05	.03
Personal Concerns				
Leisure	-.07	.00	.09	.03
Cognitive Processes	.08	-.02	-.09	.02
Perceptual Processes	.06	.04	.07	.02
See	-.02	.04	-.11*	-.01
Hear	.08	.00	.01	.01

Note. ** - $p < .01$, * - $p < .05$.

words used to describe the event. Thus, we see some preliminary evidence of congruency in the individual difference in the emotional nature of the music cue and the emotional reaction to the evoked memory, both in terms of valence (music cues individuals perceive as positive, evoke positive memories) and intensity (music cues individuals perceive as intense, evoke intense memories).

3.2.2.2.1.2 Emotionality of musical cue and reported saliency

Reported music cue intensity was also positively associated with participant reports of frequency, importance, and vividness of recalled event (r = .34, .39, .36, respectively, all $p < .001$). Higher reported music cue valence (positivity) was associated with higher ratings of importance and vividness (r = .21 and .19, respectively, both $p < .001$), but not the frequency with which the event was thought of in everyday life. Thus, reported emotional experience of cue is associated with reported measures of memory saliency.

3.2.2.2.1.3 Familiarity and relevance of musical cue

Recall that in Study 1, familiarity and relevance were the strongest predictors of whether an AM was evoked. Despite this, familiarity was only weakly associated with importance, vividness, and memory intensity (r = .15, .17, and .18, respectively, all $p <$ .01). This may be attributed to high average familiarity scores with low variance. Only one relationship to word use emerged; familiarity was associated with greater use of leisure words (r = .18, $p < .001$). In contrast to familiarity, reported higher personal relevance of a song was associated with higher ratings on all saliency measures (frequency, importance, vividness), positive valence, higher memory intensity, and quicker response time (r = .31, .44, .33, .37, .20, and -.21, respectively, all $p < .001$). For this reason, relevance is examined below in more detail whereas familiarity of cue is not.

3.2.2.2.1.4 Summary

We find preliminary evidence for congruency between the emotion associated with the music cue and that of the recalled AMs. We also find that both music cue valence and intensity are associated generally with higher saliency reports and that higher relevance is more strongly associated with higher ratings of saliency, memory intensity, and positive memory valence than familiarity. Additionally, excluding a few exceptions (mainly with valence), no associations were observed between participant cue experience and memory description content.

3.2.2.2.2 What aspects of reaction to the musical cues are associated with the emotionality of the evoked memory?

The overall effects described earlier did not show that music has a privileged role in memory emotionality relative to the no-music cueing condition. Here we examine a slightly different question: are there aspects of a participant's experience of the music per se that influence the emotionality of recalled memories. We examine this with separate multiple regression analyses using, first, memory intensity and then second, memory valence scores as the outcome variables. We use the Phase 3 (Music-Rating) measures and song recency (calculated as how many years old a song was, based on the year it was popular on the Billboard charts) as predictors, with all predictors added to the equation simultaneously. This methodology mirrors that of Michels-Ratliff and Ennis's (2016) examination of nostalgic music listening experience by aspect (e.g. emotionality) of the music cue.

3.2.2.2.2.1 Memory intensity

Table 25 presents the regression analysis of the Phase 2 (Memory-Rating) memory intensity rating. The model was statistically significant (R = .47), $F(5, 415) = 22.62$, $p < .001$, R^2 = .22. The regression model equation is as follows: predicted score = 2.58 + .31(cue intensity) + .16 (cue relevance) -.10 (song recency). Participant ratings of music cue intensity (b = .31, $p < .001$) and cue relevance (b = .16, p = .004) independently predicted memory intensity ratings accounting respectively for approximately 5.4% and 1.6% of the variance in memory intensity ratings. A third statistically significant predictor, how old a song was (in years, b = -.10, p = .004), also accounted for approximately 1.6% of the variance in reported memory intensity scores. Thus, how intense a participant reported their recalled memory to be is predicted most by how intensely the music cue was experienced, and by cue relevance and song recency to lesser but significant extents.

Table 25. Study 2: Memory intensity (Phase 2) regression model using Phase 3 (Music Cue-Rating) ratings as predictor variables.

	MEM INT	CUE INT	CUE REL	SNG REC	CUE VAL	CUE FAM		*US B*	*S b*	*Sr²*
CUE INT	**.42****	-						**.31****	.30	.054
CUE REL	**.38****	**.64****	-					**.16***	.18	.016
SNG REC	**-.14***	-.03	-.03	-				**-.10***	-.13	.016
CUE VAL	**.19****	**.33****	**.37****	**-.17****	-			-.01	-.01	<.001
CUE FAM	**.18****	**.25****	**.40****	-.04	**.30****	-		.04	.03	<.001
							I	**2.58****		
M	4.34	4.67	4.14	4.59	4.86	6.27		R^2	.22	
SD	1.75	1.73	1.94	2.27	1.65	1.21		R^{2adj}	.21	
								R	.47	

Note 1. ** - $p < .001$, * - $p < .01$.
Note 2. MEM INT = memory intensity (Phase 2), CUE INT = music cue intensity, CUE REL = music cue relevance, SNG REC = song recency, CUE VAL = music cue valence, CUE FAM = music cue familiarity. I = intercept.

3.2.2.2.2.2 Memory valence

Table 26 presents the regression analysis of the Phase 2 (Memory-Rating) memory valence rating. The model was statistically significant ($R = .56$), $F(5, 413) = 37.87$, $p < .001$, $R^2 = .32$. The regression model equation is as follows: predicted score = 3.38 + .55(cue valence) - .15(song recency). Only the ratings of music cue valence and the age of the song significantly predicted memory valence ($b = .55$ and -.15, respectively, both $p < .001$), accounting for approximately 20.3% and 3.4% of the variance in ratings, respectively. Thus, how positively the recalled AM is rated, can be largely predicted by how positively the music is experienced, and to a lesser extent by how recent the song is.

Table 26. Study 2: Memory valence (Phase 2) regression model using Phase 3 (Music-Rating) ratings as predictor variables.

	MEM VAL	CUE VAL	CUE REL	CUE INT	SNG REC	CUE FAM		*US B*	*S b*	Sr^2
CUE VAL	**.53****	-						**.55****	.51	.203
CUE REL	**.20****	**.36****	-					.08	.08	.004
CUE INT	**.12***	**.33****	**.64****	-				-.09	-.09	.005
SNG REC	**-.28****	**-.18****	-.03	-.02	-			**-.15****	-.19	.034
CUE FAM	**.12***	**.30****	**.40****	**.25****	-.05	-		-.07	-.05	.002
							I	**3.38****		
M	4.84	4.85	4.14	4.46	4.59	6.27		R^2	.32	
SD	1.79	1.65	1.94	1.73	2.27	1.21		R^{2adj}	.31	
								R	.56	

Note 1. ** - $p < .001$, * - $p < .01$.
Note 2. MEM VAL = memory valence (Phase 2), CUE INT = music cue intensity, CUE REL – music cue relevance, SNG REC = song recency, CUE VAL = music cue valence, CUE FAM = music cue familiarity. I = intercept.

3.2.2.2.2.3 Additional Memory-Rating Phase (Phase 2) measures

Regression analyses for participant-rated saliency measures (frequency, importance, vividness) were also conducted (specifics in Appendix N). Music cue relevance and intensity predict higher scores on memory frequency, importance, and vividness ratings. Familiarity predicts lower frequency scores only.

3.2.2.2.3 Cue predictive factors of memory qualities summary

We see again, preliminary evidence of emotion congruency. We also see that cue relevance and intensity both predict memory intensity, frequency, importance, and vividness ratings, whereas cue valence predicts only memory valence, and familiarity only predicts lower frequency scores. Thus, we see preliminary evidence also that cue relevance and intensity may be tied to other aspects of the recalled AMs. These data supplement the Study 1 regression analyses on predictive factors for evoking a popular music-cued AM.

3.2.2.2.4 Does popular music cue emotion-congruent memories?

Recall that the emotion-congruent memory position is that an emotional stimulus leads to a felt emotion, which leads to a memory congruent with that felt emotion (i.e. the emotion felt during encoding). While our design did not permit examination of whether a mood was induced in Study 1, many participants attributed the song clips to a change in mood, with 35.74% of these responses stating that the music "made [participants] feel" an emotion. We also found here, that 43.86% of Study 2 participants attributed an emotional response to the music for why they thought the music was directly responsible for evoking a memory. The ability of popular music to evoke rather than just convey an emotion has been supported also in recent research (Song et al., 2016).

Above we presented initial correlational and regression analyses consistent with emotion-congruency; here we examine group differences. We do so in two ways. First, in line with Sheldon and Donahue (2017), examination of the same question using unfamiliar classical music as cues, we reorganized the memory rating dependent variable data for chi-square analyses. Second, we used the complete rating scale and examine the question with ANOVAs.

For both analyses, Phase 3 (Music Cue-Rating) music cue intensity scores (analogous to "arousal" in Sheldon and Donahue) were operationally categorized and reorganized into high (scores of 6 and 7) and low (1 to 5) and music cue valence scores into negative (scores of 1 to 3), positive (5 to 7), and neutral (4). These figures are found in Table 27. Memory data associated with neutral music cues were excluded from these analyses.

For chi-square analyses, we also reorganized and categorized Phase 2 participant memory ratings into high (scores of 6 or 7) and low intensity (1 to 5), and positive (1 to 3), neutral (4), and negative (5 to 7). Sheldon and Donahue (2017) reorganized 6-point Likert scales for their intensity memory rating into high (4 to 6) and low (1 to 3) intensity. We made our high intensity category more restrictive than them as our participant Phase 3 ratings enabled us to extract only the cues experienced as highest on intensity and we categorized memory ratings as such for consistency. These are presented below in Table 27 as well.

Table 27. Study 2: Number of memories reported to each category of music cue valence and music cue intensity and number of memories reported to each category of memory valence and intensity.

Music Cue Rating	Memories (% of total music-cued)	Category	Memory Rating	Memories (% of total music-cued)	Memories (% with neutral cue data excluded)
Music Cue Valence	258(62.02)	Positive (5 to 7)	**Memory Valence**	245(59.04)	219 (63.84)
	86(20.87)	Negative (1 to 3)		103(24.82)	83 (24.20)
	72(17.31)	Neutral (4)		67(16.14)	41 (11.95)
Music Cue Intensity	126(30.22)	High (6 or 7)	**Memory Intensity**	298(71.46)	236 (68.41)
	291(69.78)	Low (1 to 5)		119(28.54)	109 (31.59)

Note 1. Of the 840 total recalled memories, 417 were produced from the popular-music cued participants. For one of these memories, the cue valence was not rated, and for another, the memory valence was not rated. Thus, there are 416 memories categorized under music cue valence, and 415 memories categorized under the first memory valence column.

Note 2. As memory data associated with neutral cues were eliminated for chi-square analyses and ANOVAs, an additional column is presented for the 345 memories that remained after these eliminations. As noted above, two participants failed to report either music cue or memory data, and 343 memories are categorized under the second memory valence column.

3.2.2.2.4.1 Chi-square analyses: Memory valence and intensity

As seen in Table 28, we then looked at the frequency with which each cell was populated by memories rated as positive or negative, or as highly intense or not. In agreement with Sheldon and Donahue's (2017) results for emotional valence, as seen in Table 28, we find a significant difference in the numbers of positive and negative memories evoked to the musical cues rated as positive or negative: $X^2(2, N = 342) = 76.54$, $p < .001$. That is, high positive cues are associated with positive memories and negative cues are associated with negative memories ($p < .001$). In contrast to Sheldon and Donahue's findings, we also find a cue intensity effect: $X^2(1, N = 345) = 40.24$, $p < .001$. That is, music cues experienced as highly emotionally intense are associated with memories rated as highly intense and music cues experienced as less intense are associated with memories experienced as less intense ($p < .001$). Thus, we find evidence for congruency for both emotional valence and intensity. It also appears that these effects may be stronger for positive and less intense cues than negative and highly intense cues, respectively.

Table 28. Study 2: Chi-square analyses of emotional valence and emotional intensity music cue and memory ratings.

	Memory Valence Ratings		
Music Cue Valence	Negative	Positive	Neutral
Negative	49 (57.0%)	24 (27.9%)	13 (15.1%)
Positive	33 (12.9%)	195 (76.2%)	28 (10.9%)
	Memory Intensity Ratings		
Music Cue Intensity	Low Intensity	High Intensity	-
Low Intensity	180 (80.0%)	45 (20.0%)	-
High Intensity	56 (46.7%)	64 (53.3%)	-

Note 1. For the valence analyses, 2 participants failed to report memory valence data and 1 failed to report cue valence data.
Note 2. For valence analyses, neutral cells did not differ.

3.2.2.2.4.2 Analyses of variance

Given that our dependent variables were measured with ordinal (and not merely nominal) scales, ANOVAs were also conducted to examine exactly how these memories differed. Given the interest in differences between memories cued to two levels of both cue valence (negative and positive) and intensity (high and low), we could not aggregate

means for each participant. As a result, data were analyzed by memory instead of by participant. As with other analyses, all memories containing less than 6 words were eliminated from these LIWC analyses. This resulted in the elimination of data associated with 10 music-cued memories and 24 control-cued memories. First, 2 music cue valence (negative vs. positive, within-subjects) X 2 music cue intensity (low intensity vs. high intensity, within-subjects) X 2 instruction type (between-subjects) mixed ANOVAs were conducted to examine within-subject differences depending on cue valence and intensity. Second, to provide a proxy on the effects of music cue valence and intensity relative to memories produced in the no-music control cue condition, the following strategy was employed. Since the control group could not be separated by emotional valence and intensity of cue (due to the nature of the control cue), the responses associated with songs rated as negative, positive, high intensity, and low intensity, were compared to individual memories cued to the no-music control in separate ANOVAs. Four series of separate 2 cue type X 2 instruction type ANOVAs were conducted to compare to control-cued memories. Individual memories evoked to music experienced positively were separately compared to all control-cued data, followed by negatively-experienced music, high intensity music, and low intensity music. Significant differences are marked clearly in Table 29 for all comparisons. Only dependent variables theoretically relevant to the examination of emotion congruency are described below. No interactions were found with instruction group and thus all data presented focus only on within-subjects comparisons of music cue intensity and valence, and between-subjects comparisons of cue type (where applicable).

3.2.2.2.4.2.1 Emotional valence

Memories evoked to music experienced positively were rated as moderately positive, and more positively than AMs evoked to music experienced negatively: $F(1, 335) = 65.87, p < .001, n_p^2 = .16$, which were rated as somewhat negative. For positive and negative emotion LIWC categories, effects of music cue valence emerged such that memories cued to a song experienced positively were described with greater use of positive words: $F(1, 330) = 6.63, p = .01 , n_p^2 = .02$, and less use of negative words: $F(1, 330) = 21.00, p < .001, n_p^2 = .06$, than those cued to a song rated as negatively-

Table 29. Study 2: ANOVAs: Emotion congruency and cue emotionality effect analyses.

	Current Study: Phase 3 (Music Cue-Rating) Emotion Measures					**Comparisons**	
	Music Cue Valence			Music Cue Intensity			
Phase 1 or 2 Memory Measures	Negative (1 to 3)	Positive (5 to 7)	Control	Low (1 to 5)	High (6 to 7)	Zator & Katz (2017)	LIWC 2015
Memory Valence							
Phase 2 Memory Valence	**3.49(1.83)**	**5.45(1.56)*****	**4.74(1.94)**^{p***n***h*}	4.82(1.77)	5.21(1.94)	-	-
LIWC							
Positive Emotion	**2.24(2.69)**	**3.42(3.51)***	2.97(3.80)	2.87(3.22)	3.62(3.56)	4.04(0.33)	3.67(1.63)
Negative Emotion	**2.22(3.26)**	**0.93(2.13)*****	**1.60(2.58)**^{p**}	1.23(2.47)	1.29(2.60)	0.74(0.16)	1.84(1.09)
Anxiety	0.20(0.59)	0.25(1.23)	**0.40(1.11)**^{l*}	0.20(0.82)	0.30(1.52)	0.19(0.09)	0.31(0.32)
Anger	**0.77(1.76)**	**0.16(0.72)*****	**0.35(1.30)**	0.37(1.22)	0.20(0.84)	0.20(0.06)	0.54(0.59)
Sadness	**0.93(2.07)**	**0.34(1.30)****	**0.48(1.53)**^{n*}	0.48(1.61)	0.49(1.42)	0.25(0.09)	0.41(0.40)
Memory Intensity							
Phase 2 Memory Intensity	4.14(1.87)	4.59(1.71)	**4.34(1.66)**^{h***l*}	**4.03(1.65)**	**5.32(1.66)*****	-	-
LIWC Affective Processes	4.48(3.95)	4.40(3.93)	4.60(4.19)	4.14(3.72)	4.95(4.26)^{1}	4.77(0.34)	5.57(1.99)

Note 1. Bolded pairs are significant at $p < .02$. Corresponding *F*-values and significances reported in text.
Note 2. * - $p < .02$, ** - $p < .01$, *** - $p < .001$, ^{1} – approached significance: $0.2 < p < 0.6$.
Note 3. Significances reported either beside positive or high intensity figures indicate within-subjects valence or intensity effects, respectively.
Note 3. Significances reported beside control figures indicate between-subjects effects: ^{l} – difference between low intensity and control, ^{h} – difference between high intensity and control, ^{n} – difference between negative and control, ^{p} – difference between positive and control.

experienced. Similarly, an effect of music cue valence emerged for anger and sadness words. Descriptions of memories cued to music experienced positively contained less anger words: $F(1, 330) = 18.05, p < .001, n_p^2 = .05$, and sadness words: $F(1, 330) = 11.14, p = .001, n_p^2 = .03$ than those cued to music experienced negatively.

Therefore, evidence for emotion valence-congruent memory retrieval is seen both in the objective measures of emotional valence, the words used to describe the memories, and in the participant subjective ratings of emotional valence of cued memories.

When we compare to the no-music control condition we find that memories cued to positively-experienced songs were described with significantly less negative emotion words than were memories cued in the control cue condition: $F(1, 648) = 11.99, p = .001, n_p^2 = .02$. These songs also cued memories rated as more positively than control-cued: $F(1, 675) = 24.39, p < .001, n_p^2 = .04$. Two additional cue type effects emerged for songs experienced negatively. Memories evoked to songs experienced negatively were rated more negatively: $F(1, 504) = 29.12, p < .001, n_p^2 = .06$, than those cued in the control condition and described with significantly more sadness words: $F(1, 477) = 5.97, p = .015, n_p^2 = .01$, than controls. Overall, the findings show a congruency effect for valence as a function of the music cue, both when examined within-subject and when compared to the no-music cueing data.

3.2.2.2.4.2.2 Emotional intensity

Songs rated as being highly emotionally intense led to memories rated as more emotionally intense than AMs evoked to songs rated as less emotionally intense: $F(1, 337) = 46.36, p < .001, n_p^2 = .12$. This contrasts with Sheldon and Donahue's (2017) finding that high cue arousal led to lower memory arousal ratings, and may suggest an effect of popular music not found with classical music, specifically. Like emotional valence, evidence for congruency of emotional intensity is evident in subjective participant ratings of the memory event. However, unlike emotional valence, we fail to find evidence also in the objective LIWC emotion measures.

Control-cued participants rated their memories as intermediate relative to both memories cued to songs rated high on emotional intensity and low on emotional intensity: $F(1, 539) = 32.26$, $p < .001$, $n_p^2 = .06$ and $F(1, 644) = 5.56$, $p = .019$, $n_p^2 = .01$, respectively. As with valence, we see evidence of cue intensity effect on the subjective memory intensity ratings. However, unlike valence we fail to find objective evidence in the content of the memory reports.

3.2.2.2.4.3 Emotion congruency summary

In summary, we find evidence in both chi-square analyses and ANOVAs for emotional congruency of both cue intensity and valence relative to the subjective intensity and valence ratings of subsequently evoked memories in our highly familiar musical stimuli, and support for objective congruency in valence LIWC categories only. We also find evidence of strong cue valence and intensity effects on the subjective memory valence and intensity ratings as demonstrated by intermediate control-cued ratings, and some cue valence effects on the emotional content in the recalled memory descriptions. None of the effects were modified by instructions to provide emotional memories.

3.2.2.2.5 What role is played by cue valence and intensity on saliency of the recalled memory?

Recall that another aim of Study 2 was to determine what other effects the emotional qualities of the music cue had on evoked memories. As seen in Table 30, saliency of memory differed as a function of the reported emotional intensity of the music cue, but not the cue valence. Memories cued to stimuli rated as higher on emotional intensity were rated as more frequently experienced in day to day life: $F(1, 337) = 31.32$, $p < .001$, $n_p^2 = .09$, important: $F(1, 337) = 34.47$, $p < .001$, $n_p^2 = .09$, and vividly recalled: $F(1, 337) = 23.53$, $p < .001$, $n_p^2 = .07$, than those AMs evoked to music rated as lower on emotional intensity.

Table 30. Study 2: ANOVAs: Emotional aspects of musical cue and reported saliency and recency of evoked memory (Phase 2 Memory-Rating).

	Current Study: Phase 3 (Music Cue-Rating) Emotion Measures				
	Music Cue Valence			Music Cue Intensity	
	Negative (1 to 3)	Positive (5 to 7)	Control	Low (1 to 5)	High (6 or 7)
Memory Saliency					
Memory Frequency	3.23(1.86)	3.03(1.65)[1]	**3.37(1.64)^{p*h*l***}**	**2.71(1.57)**	**3.78(1.74)*** **
Memory Importance	3.90(1.96)	4.41(1.83)	**4.56(1.95)^{n**h*l***}**	**3.88(1.85)**	**5.03(1.68)*** **
Memory Vividness	5.00(1.67)	5.37(1.65)	**5.53(1.49)^{n**h*l***}**	**4.94(1.63)**	**5.92(1.54)*** **
Memory Recency	3.09(2.64)	3.00(2.58)	**4.04 (4.49)^{p**h**l**}**	3.15(2.70)	2.78(2.39)

Note 1. Bolded pairs are significant at $p < .02$. Corresponding *F*-values and significances reported in text.
Note 2. * - $p < .02$, ** - $p < .01$, *** - $p < .001$
Note 3. Significances reported beside either positive or high intensity figures indicate a within-subjects difference in valence or intensity, respectively.
Note 4. Significances reported beside control figures indicate a between subjects difference: [l] – difference between low intensity and control, [h] – difference between high intensity and control, [n] – difference between negative and control, [p] – difference between positive and control.

Relative to control-cued memories, AMs cued to music experienced as higher on emotional intensity were rated as more frequently experienced: $F(1, 537) = 6.05$, $p = .014$, $n_p^2 = .01$, more vividly recalled: $F(1, 539) = 5.86$, $p = .016$, $n_p^2 = .01$, more important: $F(1, 539) = 6.44$, $p = .011$, $n_p^2 = .01$, and more recent: $F(1, 524) = 8.50$, $p = .004$, $n_p^2 = .02$, and memories cued to music experienced as less emotionally intense were rated as less frequently experienced: $F(1, 642) = 24.72$, $p < .001$, $n_p^2 = .04$, less vividly recalled: $F(1, 644) = 22.44$, $p < .001$, $n_p^2 = .03$, less important: $F(1, 644) = 18.49$, $p < .001$, $n_p^2 = .03$, and more recent: $F(1, 628) = 7.24$, $p = .007$, $n_p^2 = .01$.

Despite no positive versus negative effects, relative to controls, music experienced positively evoked memories rated as less frequently experienced: $F(1, 676) = 6.71$, $p = .01$, $n_p^2 = .01$ and more recent: $F(1, 662) = 11.21$, $p = .001$, $n_p^2 = .02$, and music experienced negatively produced memories that were rated as less important: $F(1, 505) = 8.45$, $p = .004$, $n_p^2 = .02$, and less vividly recalled: $F(1, 505) = 8.55$, $p = .004$, $n_p^2 = .02$.

Thus, we find evidence that cue intensity is an effective retrieval cue for saliency of memory, a finding consistent with the conclusion made by Sheldon and Donahue (2017) that intensity is a central and more diverse emotional emotion-based factor in music-cued memory organization. Beyond cue valence affecting reported memory valence, the saliency and intensity of the memory does not differ as a function of whether the cue is reported to be positively or negatively experienced.

3.2.2.2.6 What role is played by cue valence and intensity on the content of the recalled memory?

As seen in Table 31, we find no negative versus positive, or high versus low intensity, within-subject cue effects of music cue valence, intensity, instruction type, or interaction for social, cognitive, family, friends, or leisure words. The varying emotional experience of the cue did not affect thematic content of the descriptions. This disagrees with Sheldon and Donahue's (2017) findings of greater social content reported to highly arousing and positive music cues. In contrast to our objective social content analyses, Sheldon and Donahue relied on the subjective reports of participants, which may account for this difference.

We do find effects for overall word count of the produced memory descriptions. Music experienced as highly intense evokes memories described with less overall words than AMs evoked to less intense cues: $F(1, 331) = 12.21$, $p = .001$, $n_p^2 = .04$. We also find that memories cued to less intense music are described with less words than those produced to the no-music control cue: $F(1, 613) = 21.45$, $p < .001$, $n_p^2 = .03$. Finally, we find an interesting interaction: $F(1, 331) = 5.84$, $p = .016$, $n_p^2 = .02$. The interaction is depicted below in Figure 4. Post-hoc tests revealed that AMs evoked to music cues experienced as highly intense and negative were described with more words than AMs evoked to cues experienced as less intense and negative ($p = .001$) and highly intense and positive ($p = .011$). No other reliable differences emerged. Bohanek et al. (2005) found that negative and highly emotional memories were described with more words than positive and less emotional memories, respectively. Analogously, we find instead that cues associated with high emotional intensity and negativity evoke memories described with greater words.

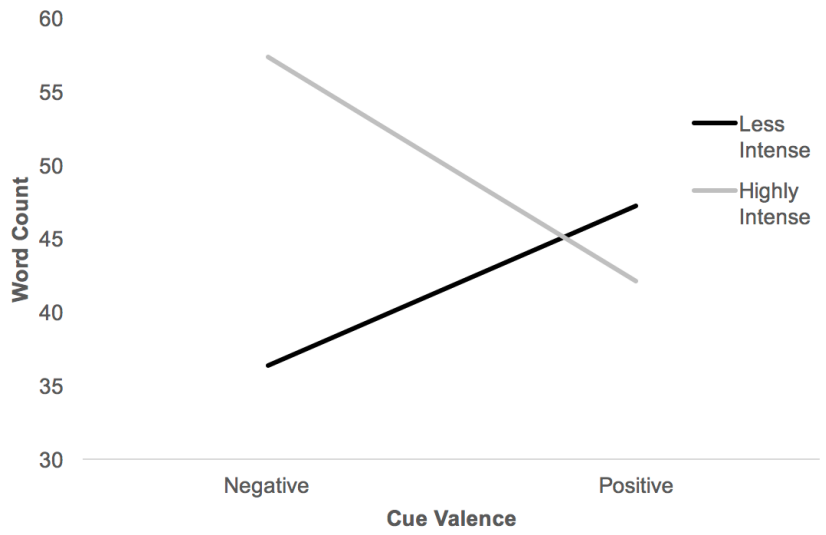

Figure 4. Memory description word count interaction. Memories evoked to a cue reported as experienced as both highly emotionally intense and negative, are described with more words than memories experienced as both less emotionally intense and negative as well as both highly intense and positive: $F(1, 331) = 5.84$, $p = .016$, $n_p^2 = .02$.

There is a striking consistency observed in the AMs evoked when one compares the effects of cue intensity (high or low) or cue valence (positive or negative) with the AMs evoked to the no-music control condition. In all cases one finds that the AMs are produced more slowly and are described with more perceptual process words, hearing-related words, and leisure-related words. The statistics follow. Compared to control-cued AMs, high intensity, low intensity, positive, and negative music cues elicited memories at more slowly: $F(1, 539) = 47.63, p < .001, n_p^2 = .08, F(1, 644) = 106.89, p < .001, n_p^2 = .14, F(1, 678) = 109.66, p < .001, n_p^2 = .14$, and $F(1, 505) = 39.45, p < .001, n_p^2 = .07$, respectively, and evoke memories described with more perceptual process: $F(1, 512) = 94.05, p < .001, n_p^2 = .16, F(1, 613) = 94.75, p < .001, n_p^2 = .13, F(1, 648) = 118.03, p < .001, n_p^2 = .15$, and $F(1, 477) = 51.08, p < .001, n_p^2 = .10$, respectively, hearing: $F(1, 512) = 125.84, p < .001, n_p^2 = .20, F(1, 613) = 161.13, p < .001, n_p^2 = .21, F(1, 648) = 179.51, p < .001, n_p^2 = .22$, and $F(1, 477) = 106.49, p < .001, n_p^2 = .18$, respectively, and leisure: $F(1, 512) = 32.63, p < .001, n_p^2 = .06, F(1, 612) = 44.41, p < .001, n_p^2 = .07, F(1, 647) = 56.25, p < .001, n_p^2 = .08$, and $F(1, 477) = 16.93, p < .001, n_p^2 = .03$, respectively, words.

Table 31. Study 2: ANOVAs: Cue emotionality effects on response time and content of memory descriptions.

	Current Study: Phase 3 (Music Cue-Rating) Emotion Measures					**Comparisons**	
	Music Cue Valence			Music Cue Intensity			
Phase 1 Measures	Negative (1 to 3)	Positive (5 to 7)	Control	Low (1 to 5)	High (6 to 7)	Zator & Katz (2017)	LIWC 2015
Response Time (s)	16.52(12.64)	17.07(13.06)	**5.86(13.86)** ^{n***p***l***h***}	17.83(14.21)	15.26(9.97)	-	-
Word Count	42.29(30.81)	46.52(34.43)	**50.84(38.97)** ^{l***}	**46.22(34.81)**	**37.76(23.32)** **	30.97(17.79)	-
LIWC							
Cognitive Processes	7.72(5.96)	6.47(5.83)	6.97(5.67)	6.76(6.08)	6.81(5.51)	12.93(0.72)	10.61(3.02)
Perceptual Processes	6.14(5.67)	7.16(6.98)	**2.63(3.63)** ^{n***p***l***h***}	6.70(6.70)	7.31(6.68)	5.24(0.45)	2.70(1.20)
Seeing	0.91(2.92)	2.10(4.79)	**0.96(2.18)** ^{p***l**h**}	1.71(4.40)	1.99(4.49)	0.73(0.33)	1.08(0.78)
Hearing	4.66(4.46)	4.56(4.22)	**0.90(2.76)** ^{n***p***l***h***}	4.61(4.50)	4.54(3.82)	4.14(0.29)	0.83(0.62)
Social Processes	10.58(7.38)	10.17(7.65)	9.22(7.44)	10.36(7.18)	10.10(8.28)	9.15(0.57)	9.74(3.38)
Family	1.47(3.69)	1.24(3.21)	1.87(3.37)	1.35(3.17)	1.20(3.61)	1.58(0.30)	0.44(0.63)
Friends	2.00(2.89)	1.82(2.87)	**1.23(2.64)** ^{p**l**}	1.93(2.89)	1.75(2.84)	1.90(0.20)	0.36(0.40)
Leisure	7.38(6.59)	8.19(6.85)	**4.14(6.60)** ^{n***p***l***h***}	7.89(6.87)	8.18(6.62)	8.69(0.45)	1.35(1.08)

Note 1. Bolded pairs are significant at $p < .02$. Corresponding *F*-values and significances of directly relevant measures are reported in text.
Note 2. * - $p < .02$, ** - $p < .01$, *** - $p < .001$
Note 3. Significant differences beside control figures indicate a between-subjects difference: ^{l} – difference between low intensity and control, ^{h} – difference between high intensity and control, ^{n} – difference between negative and control, ^{p} – difference between positive and control.

Moreover, again compared with the no-music control, when one examines cue positivity and intensity (low and high) for music cued memories one also sees memory reports with a greater proportion of seeing-related words: $F(1, 648) = 16.77, p < .001, n_p^2 = .03, F(1, 613) = 7.66, p = .006, n_p^2 = .01$, and $F(1, 512) = 11.28, p = .001, n_p^2 = .02$, respectively.

Finally, with AMs evoked to positive music cues and low intense music cues, one also finds a greater proportion of friend-related words: $F(1, 648) = 6.93, p = .009, n_p^2 = .01$ and $F(1, 613) = 7.46, p = .006, n_p^2 = .01$, respectively. In summary, while there are some differences in the memory reports found with the different music-cue emotionality characteristics, the more striking aspect is the similarity in the AM reports when cued by music compared to when cued without music.

3.2.2.2.6.1 Summary: Cue emotionality and non-emotional aspects of recalled AMs

We see that intensity associated with the cue is related to the saliency of recalled AMs, whereas valence of the cue is only associated with valence of the AM. Content-wise, as a whole, cue emotionality does not seem to significantly affect the content of the memory descriptions, except for an interaction on word count. Finally, we find that greater use of leisure and perceptual category words in music-cued memory descriptions are independent of emotionality, while use of cognitive process, social process, and family words do not differ as a function of cue emotionality or in comparison to controls.

3.2.2.2.7 What role is played by cue relevance?

The correlation and regression analyses reported above suggest that personal relevance of a popular music cue is another effective factor of importance in AM retrieval. Recall that it was expected that participants would rate at least one of the popular music cues as highly relevant, and one as less relevant. Most participants cued to popular music (n = 49 of 62, 79.03%), rated at least one song as highly relevant and one song as less relevant. This permits examination of the effect of personal relevance of music on memory evocation. To our knowledge, this is the first direct examination of personal relevance's role in retrieval in a healthy younger population, though analogues of relevance have

shown memory effects in clinical populations, and relevance has been proposed as an important factor in the popular music-AM literature (e.g. in stimuli selection, Michels-Ratliff & Ennis, 2016).

These analyses can only be conducted on participants cued by popular music. Raw data from the popular music-cued participants were categorized, re-organized, and analyzed using three separate series of ANOVAs by high (scores of 6 or 7) and low (scores of 1 to 5) participant Phase 3 music cue relevance ratings as described below. One hundred and twenty-one memories were cued to highly relevant songs, and two hundred and ninety-five memories were cued to less relevant songs. Since 49 out of 62 music-cued participants rated at least one song as highly relevant and at least one as less relevant, relevance analyses could be run within-subjects for these participants in the first series of ANOVAs: 2 instruction type (between-subjects) X 2 music cue relevance (high vs. low, within-subjects) ANOVAs. For each participant separately, data for memories cued to songs ranked as highly relevant were aggregated by participant, followed by data for memories cued to songs ranked as less relevant. For the 49 participants with memories cued to both songs rated as highly and less relevant, 2 means were calculated. For LIWC analyses, one of these participants was eliminated from both high and low relevance mean data and two additional participants were eliminated from low relevance data for low memory description average word count. Thus, for the LIWC within-subjects comparisons, 46 music-cued participants remained. For the remaining 13 participants (who rated all song cues as either highly or less relevant), only one mean was aggregated. These participants were only included in the second and third series of ANOVAs described in detail below, comparing memories cued to highly relevant songs to controls (participants cued to a blank screen) and cued to less relevant songs to controls. Three control-cued participants were eliminated from LIWC analyses for low average memory description word count.

3.2.2.2.7.1 Within-subjects: High (6 or 7) vs. low (1 to 5) relevance

For the first group of 49 participants, 2 instruction type (“emotional memory”, n = 25, vs. no emotionality mentioned, n = 24, between-subjects) X 2 music cue relevance (high vs.

low, within-subjects) mixed ANOVAs examined the difference between memories cued to songs rated as highly relevant compared to those rated lower on relevance. The remaining 13 participants were excluded from these analyses. The specifics of these effects can be found in Table 32, and for expositional purposes the relevant findings are presented separately. Recall that only 46 participants were included in these LIWC analyses.

3.2.2.2.7.1.1 Objective measures of generated memory descriptions: LIWC analyses of content (Phase 1)

Songs rated as highly relevant evoked memories that were described with more positive words: $F(1, 44) = 6.34, p = .016, n_p^2 = .13$, more social words: $F(1, 44) = 6.17, p = .017, n_p^2 = .12$, and fewer anger words than those rated as less relevant: $F(1, 44) = 6.30, p = .016, n_p^2 = .13$. No other effects reached significance.

3.2.2.2.7.1.2 Subjective participant ratings of evoked memories (Phase 2: Memory-Rating Phase)

Recall that in the general 2 cue type X 2 instruction type ANOVAs, memories cued to music were reported as less salient than those cued to a blank screen, leading to the conclusion that these may be less salient or more obscure memories. In contrast to these findings, as seen in Table 32, highly relevant music evoked memories rated as more frequently experienced in day to day life: $F(1, 47) = 32.34, p < .001, n_p^2 = .41$, more important: $F(1, 47) = 35.09, p < .001, n_p^2 = .43$, more vividly recalled: $F(1, 47) = 13.82, p = .001, n_p^2 = .23$, more emotionally intense: $F(1, 47) = 26.59, p < .001, n_p^2 = .36$, more positive: $F(1, 47) = 14.40, p < .001, n_p^2 = .23$, and quicker to cue: $F(1, 47) = 7.16, p = .01, n_p^2 = .13$, than memories evoked by music that was rated as less relevant. No effects of memory recency were found.

Participants asked to recall an “emotional memory” rated evoked memories as more vividly recalled ($M = 4.98, SE = 0.19$) than those cued to recall a “memory” without emotional instruction ($M = 4.29, SD = 0.19$): $F(1, 47) = 6.63, p = .013, n_p^2 = .12$. The cue type X instruction type effects did not reach significance on any of the variables.

Table 32. Study 2: Comparison of memory qualities (subjective and objective) cued to high (6 or 7) or low (1 to 5) relevance music cues (n=49).

	Current Study		**Comparisons**	
Phase 2 (Memory-Rating)	Highly Relevant Music Cues	Less Relevant Music Cues	Zator & Katz (2017)	LIWC 2015
Frequency	**3.70(1.41)**	**2.61(1.11)*** **	-	-
Importance	**5.08(1.30)**	**3.65(1.16)*** **	-	-
Vividness	**5.76(1.12)**	**4.93(1.38)** **	-	-
Memory Intensity	**5.22(1.39)**	**4.06(1.39)*** **	-	-
Memory Valence	**5.51(1.43)**	**4.60(0.91)*** **	-	-
Memory Recency	3.06(1.65)	3.13(1.64)	-	-
Phase 1 (Memory-Generation)				
RT to Cue	**14.74(8.70)**	**18.50(10.21)***	57.40 (11.18)	-
Word Count	45.06(26.00)	40.37(19.57)[1]	30.97(17.79)	-
LIWC Categories (n=46)				
Affective Processes	4.92(3.36)	4.27(2.23)	4.77(0.34)	5.57(1.99)
Positive Emotion	**3.79(2.58)**	**2.80(1.52)***	4.04(0.33)	3.67(1.63)
Negative Emotion	1.12(1.61)	1.40(1.34)	0.74(0.16)	1.84(1.09)
Anxiety	0.25(1.17)	0.27(0.58)	0.19(0.09)	0.31(0.32)
Anger	**0.11(0.42)**	**0.35(0.53)***	0.20(0.06)	0.54(0.59)
Sadness	0.47(0.81)	0.48(0.95)	0.25(0.09)	0.41(0.40)
Social Processes	**11.65(5.97)**	**9.31(3.55)***	9.15(0.57)	9.74(3.38)
Family	1.63(3.04)	0.84(1.10)	1.58(0.30)	0.44(0.63)
Friend	2.03(2.29)	1.64(1.36)	1.90(0.20)	0.36(0.40)
Personal Concerns				
Leisure	8.41(4.70)	8.12(3.97)	8.69(0.45)	1.35(1.08)
Cognitive Processes	6.78(4.79)	6.92(3.64)	12.93(0.72)	10.61(3.02)
Perceptual Processes	6.91(3.96)	7.01(3.15)	5.24(0.45)	2.70(1.20)
Seeing	1.52(2.29)	1.53(1.86)	0.73(0.33)	1.08(0.78)
Hearing	4.76(2.81)	4.88(2.62)	4.14(0.29)	0.83(0.62)

Note 1. * - $p < .02$, ** - $p < .01$, *** - $p < .001$, [1] – approaching significance ($0.2 < p < .06$).
Note 2. All values report *M*(*SD*) except Zator and Katz (2017) who report *M*(*SE*).
Note 3. One participant was excluded from the memory recency data for missing data. For LIWC analyses, three music-cued participants were eliminated due to low memory description word count.

3.2.2.2.7.2 Between-subjects: High (6 or 7) vs. control, Low (1 to 5) vs. control

The previous analyses could only be conducted on participants cued by music. As with the emotional analyses above, to provide a proxy on the effects of music cue relevance relative to memories produced in the non-music control cue condition, the following strategy was employed. Since the control group cues could not be separated by high and low relevance (due to the nature of the control cue), the aggregated means for responses associated with songs rated as highly relevant (6 or 7) and those for responses to songs rated as less relevant (1 to 5) were compared to all aggregated means of the control group in two separate series of 2 instruction type X 2 cue type (control vs. music cues; the first vs. high relevance music, the second vs. low relevance music) ANOVAs. These analyses permitted use of all participants cued to popular music. The means for these data are presented in Table 33 (Phase 1 Memory-Generation objective measures) and Table 34 (Phase 2 Memory-Rating subjective measures). Due to the different number of music-cued participants in these analyses compared to our previous within-subject analyses, the means for high and low relevance music-cued memories are presented again in comparison to controls as these differed slightly from our within-subjects comparison means.

3.2.2.2.7.2.1 High relevance popular music cues compared to controls

The effects of high relevance are presented in the left-hand column and the neutral cue effects (control group) are presented in the center column in Tables 33 and 34. Songs rated as highly relevant tended to cue memories rated as more important: $F(1, 107) = 6.41$, $p = .013$, $n_p^2 = .06$, more emotionally intense: $F(1, 107) = 17.31$, $p < .001$, $n_p^2 = .14$, more positive: $F(1, 107) = 10.43$, $p = .002$, $n_p^2 = .09$, and took longer to cue: $F(1, 107) = 25.63$, $p < .001$, $n_p^2 = .19$, than those cued to the no-music control cue. No cue type effects or interactions emerged for frequency or vividness.

Four LIWC effects emerged such that popular music rated as highly relevant cued memories described with more social: $F(1, 101) = 7.34$, $p = .008$, $n_p^2 = .07$, leisure: $F(1, 101) = 24.46$, $p < .001$, $n_p^2 = .20$, perceptual: $F(1, 101) = 53.41$, $p < .001$, $n_p^2 = .35$, and

hearing: $F(1, 101) = 77.88$, $p < .001$, $n_p^2 = .44$, words than those cued to the no-music control cue. No effects of instruction type or interactions emerged.

Thus, in contrast to the overall general 2 cue type X 2 instruction type ANOVA described above where relevance was not considered, we see that highly relevant popular music cues are tied to more salient and positive memories. Thus, we find evidence here for the hypothesis that memories cued to popular music are somewhat dependent on the relevance of the music.

Table 33. Comparisons of Phase 2 subjective participant ratings of memories cued to high and low relevance music cues to control cued-memories.

	Current Study		
Phase 2 (Memory Rating)	High Relevance Music Cues	Control Group	Low Relevance Music Cues
Frequency	3.70(1.40)	3.36(0.94)	**2.55(1.04)**[b***]
Importance	**5.10(1.30)**[a*]	4.55(0.97)	**3.58(1.11)**[b***]
Vividness	5.77(1.37)	5.53(0.85)	**4.89(1.04)**[b***]
Memory Intensity	**5.23(1.38)**[a***]	4.34(0.84)	3.97(1.77)[1]
Memory Valence	**5.47(1.44)**[a**]	4.75(0.86)	4.60(0.91)
Memory Recency	3.07(1.48)[1]	4.03(3.10)	3.05(1.63)[1]

Note 1. [a] - difference between high relevant songs and control group, [b] – difference between low relevant songs and control group.
Note 2. * - $p < .02$, ** - $p < .01$, *** - $p < .001$. [1] – effect approached significance ($0.2 < p < .06$).
Note 3. All values report *M*(*SD*).

3.2.2.2.7.2.2 Low relevance popular music cues

Low relevance data are presented in the right-hand column in Tables 33 and 34, compared again to the control cue data in the center column. Songs rated as lower on relevance tended to evoke memories rated as less frequently experienced in day to day life: $F(1, 118) = 20.03$, $p < .001$, $n_p^2 = .15$, less important: $F(1, 118) = 26.61$, $p < .001$, $n_p^2 = .18$, less vivid: $F(1, 118) = 13.74$, $p < .001$, $n_p^2 = .10$, and also took longer to cue a memory: $F(1, 118) = 57.07$, $p < .001$, $n_p^2 = .33$, than those cued to a blank screen. No cue type effects emerged for memory intensity or valence and thus, AMs cued to music cues rated lower on relevance did not differ emotionally from the control-cued AMs. No effect of instruction type or interaction emerged for any Phase 2 memory ratings. Five

Table 34. Study 2: Comparisons of Phase 1 (Memory-Generation Phase) objective measures of memories evoked to high and low relevance music cues to control cued-memories.

	Current Study			Comparisons	
Phase 1 (Memory-Generation)	High Relevance Music Cues	Control Group	Low Relevance Music Cues	Zator & Katz (2017)	LIWC 2015
RT to Cue	**14.57(8.70)**[a***]	5.83(9.35)	**18.50(14.10)**[b***]	57.40(11.18)	-
Word Count	45.42(25.83)	50.20(35.54)	38.26(23.24)[b1]	30.97(17.79)	-
Affective Processes	5.03(3.40)	4.56(2.31)	4.09(2.12)	4.77(0.34)	5.57(1.99)
Positive Emotion	3.81(2.56)[a1]	2.94(1.72)	2.73(1.46)	4.04(0.33)	3.67(1.63)
Negative Emotion	1.21(1.69)	1.58(1.12)	1.29(1.31)	0.74(0.16)	1.84(1.09)
Anxiety	0.25(1.15)	0.40(0.49)	0.25(0.53)	0.19(0.09)	0.31(0.32)
Anger	0.16(0.56)	0.34(0.47)	0.34(0.51)	0.20(0.06)	0.54(0.59)
Sadness	0.49(0.82)	0.48(0.60)	0.44(0.88)	0.25(0.09)	0.41(0.40)
Social Processes	**11.71(5.92)**[a**]	9.21(3.36)	9.76(3.57)	9.15(0.57)	9.74(3.38)
Family	1.62(3.01)	1.86(1.58)	**1.04(1.28)**[b**]	1.58(0.30)	0.44(0.63)
Friend	2.01(2.27)	1.24(1.14)	1.83(1.60)	1.90(0.20)	0.36(0.40)
Personal Concerns					
Leisure	**8.36(4.66)**[a***]	4.23(3.80)	**8.09(4.15)**[b***]	8.69(0.45)	1.35(1.08)
Cognitive Processes	6.87(4.78)	6.89(3.83)	6.63(4.09)	12.93(0.72)	10.61(3.02)
Perceptual Processes	**6.87(3.93)**[a***]	2.66(1.73)	**6.72(3.34)**[b***]	5.24(0.45)	2.70(1.20)
Seeing	1.50(2.27)	0.94(0.89)	**1.58(1.79)**[b**]	0.73(0.33)	1.08(0.78)
Hearing	**4.75(2.78)**[a***]	0.96(1.54)	**4.63(2.81)**[b***]	4.14(0.29)	0.83(0.62)

Note 1. LIWC 2015 = LIWC 2015 Grand Mean.

Note 2. [a] – difference between high relevance music cues and control group, [b] – difference between low relevance music cues and control group.

Note 3. * - $p < .02$, ** - $p < .01$, *** - $p < .001$. [1] – effect approached significance ($0.2 < p < .06$).

Note 4. All values report *M*(*SD*) except Zator and Katz (2017) who report *M*(*SE*).

Note 5. For LIWC analyses, 3 control-cued participants were eliminated due to low description word count. For music-cued participants, 3 participants were eliminated from low relevance data, and one participant from high relevance data due to low description word count.

effects for LIWC variables emerged: greater use of leisure: $F(1, 114) = 27.22$, $p < .001$, $n_p^2 = .19$, perceptual: $F(1, 114) = 67.29$, $p < .001$, $n_p^2 = .37$, seeing: $F(1, 114) = 5.94$, $p = .016$, $n_p^2 = .05$, and hearing: $F(1, 114) = 75.86$, $p < .001$, $n_p^2 = .40$, words, and fewer family words: $F(1, 114) = 9.36$, $p = .003$, $n_p^2 = .08$, were seen in AMs cued to less relevant music in comparison to those memory descriptions evoked to the no-music control cue. As with music cue valence and intensity, the presence of this increased thematic leisure and perceptual content is unique to musically-cued memories overall, and is not dependent on the relevance of the cue relative to control-cued memories.

3.2.2.2.7.3 Summary: Relevance

To our knowledge this is the first study to directly examine the personal relevance of a popular music song cue to characteristics of the AM evoked by that music in a healthy young adult population. Highly relevant popular music evokes positive AMs that are frequently thought of, important, vividly remembered, and emotionally intense, compared to less relevant music, which is tied to more obscure memories. Interestingly, we see two effects of emotion word use: a small difference in proportion of anger words and positive words used, with high relevance memory reports employing less anger-related terms and more positive emotion words. Only one additional difference in the content of the reported memories as a function of the relevance of the music cue emerged: greater use of social words to highly relevant cues. That is music, regardless of reported relevance level tends to evoke memories (as reported in their descriptions) similar in content. We see in both AMs evoked to high and low relevance cues, memory descriptions which contain a larger proportion of leisure, perceptual, and hearing words than in the content for memories elicited in the no-music control condition. Recall that these latter effects basically replicate the findings in the main 2 cue type X 2 instruction type ANOVA described above. Interestingly, when compared to our no-music control condition, memories cued to highly relevant music were rated as more important, emotionally intense, and positive, and less relevant music as less vivid and frequently experienced in day to day life.

3.2.3 Results summary

We review our complex Study 2 results here in light of our main aims.

In summary, we find that memories cued to popular music are described with more leisure and perceptual terms relative to memories evoked without music, and these features are independent of cue emotionality or relevance. This indicates that popular music tends to retrieve memories with these characteristics and may suggest that these AMs involve perceptual interaction with the cue itself.

We fail to find evidence that as a whole, popular music evokes especially emotional memories, though it is noted that this may be due to moderate memory intensity and only slightly positive memory reports on average. However, we find effects of both cue emotionality (valence and intensity) and cue relevance. Specifically, that is, while we find overall that the memories are not especially emotional in comparison to our control condition, we find that this effect is moderated by cue properties. That is, we find evidence of both valence and intensity congruency in subjective ratings and of valence in the memory descriptions. Moreover, we find evidence that greater strength of the emotional connection to the cue (emotional "intensity" sometimes labeled as "arousal" in the literature) tends to be associated with greater recalled memory saliency and intensity. These effects obtain when compared to both low intensity music-cued AMs and control-cued AMs. In contrast, music cue valence tends to only be associated with memory valence though relative to control-cued AMs, positive cues evoke memories rated as more positive, and negative cues evoke memories rated as more negative. We also find that music rated as highly relevant evokes AMs with evidence of higher importance, emotional intensity, and that these memories tend to be more positive than both memories evoked to songs rated as less relevant and to control-cued memories. Additionally, highly relevant music evokes AMs rated as more vivid and frequently experienced in everyday life than those rated as less relevant. Thus, it appears that cue valence impacts memory valence only, whereas cue intensity and cue relevance impact memory emotionality as well as a broad spectrum of non-emotional qualities of the recalled AMs.

Chapter 4

4 General Discussion

In Study 1, to rectify a limitation in stimuli selection, we examined healthy young adults' experience and knowledge of popular music clips spanning 20 years. We find here that popular music is generally enjoyed, familiar, positive, and moderately relevant to participants. The resulting database displays a variety of measures that should be of interest to AM researchers in choosing focused stimuli.

There are intriguing aspects of these normative data that deserve continued study. For instance, we find that young adults are familiar with a breadth of popular music from across the 20 years sampled (1996-2015) as reported both in their familiarity ratings and in their ability to recall knowledge of the musical clip (i.e. artist, title, year it was released and popular). Recall that we saw that over half of titles and artists were recalled completely correctly (across all 20 years), and that on average, participants who provided a year response guessed the year a song was popular (released) within about two and a half years. These data are consistent with findings of retention of this type of information across the lifespan and that knowledge of title and artist information and accuracy of the year the song was popular is associated with higher familiarity of the musical cue (Bartlett & Snelus, 1980; Schulkind, Hennis, & Rubin, 1999).

Another intriguing and novel aspect of the normative data is the wide range of sources and musical tastes reported by our sample. Although radio is still a salient source for music, most participants also indicated use of one or another internet-dependent resource (about half report accessing a streaming service). Perhaps not surprisingly, more obscure genres were reported, but were only endorsed by small percentages of participants; top 40 music was still the preferred music choice. Instead of demonstrating decreased exposure to more specialized musical forms, which we might expect with the increased use of private listening devices and ease of access to various types of music, these data suggest that the introduction of these devices and increased prevalence of individualized music listening in day to day life may actually be <u>increasing</u> exposure to Top 40 music, tying this music even more closely to the events in an individual's life.

In Study 2, using our stimulus set chosen based on the strongest predictors of evoking an AM (familiarity and relevance) from the Study 1 database, we addressed several questions regarding the effects of music cues on the evocation and nature of AMs. In contrast to past literature that either uses one measure or the other, we employ both common subjective measures of memory experience (Phase 2 Memory-Rating) and objective measures of recalled memories (content analyses of memory descriptions provided by participants in Phase 1). Finally, we had participants rate their experience of the music cues in a phase following the cueing task (vs. using an emotion-normed stimulus set) and then compared their cue ratings to both objective and subjective measures of the AMs recalled to them.

A summary and implications of the findings of Study 2 are presented below.

First, in general, we find that AMs overall are described with more social words and are experienced as somewhat important, highly vivid, not frequently-experienced in everyday life, somewhat emotionally intense and more positive than negative. The latter two effects are consistent with prior research, which shows that recall favours more positive memories (e.g. Schulkind & Woldorf, 2005; Walker, Skowronski, & Thomspon, 2003) and tend to be only moderately intense emotionally (Conway & Pleydell-Pearce, 2000). The moderate intensity ratings may reflect that over time, our emotional assessments of past events become less intense (e.g. Walker, Vogl, & Thompson, 1997). These overall emotionality findings are consistent with the working self model of retrieval (Conway & Pleydell-Pearce, 2000).

We also find specifically that memories cued to music are described with more leisure, and perceptual terms, suggesting that music tends to retrieve memories of these qualities, findings that are supported in our Study 2 open-ended response about the role the music played in the recalled memory event. These descriptions occur regardless of personal experience (emotionality) or association (relevance) with the music cue.

Second, we addressed whether popular music automatically evokes an especially emotionally-rich AM. Here, we employed a second manipulation: asking participants to either recall an “emotional memory” or simply recall a “memory” (with no reference to

emotionality). We find little support that, overall, popular music evokes especially emotional memories. However, recall that in recognition of the recent interest in cue-stimulus relationships (e.g. Sheldon & Donahue, 2017), our third aim was to examine which (if any) and how properties of the music cue itself inform the popular music-evoked memories. Here we found that an especially emotional popular music-cued effect is, moderated, however, when one considers the level of personal relevance and emotionality of the music itself. We modify the conception that memories elicited by popular music cues are especially emotional to the notion that this effect is limited to music that is personally relevant, highly emotionally intense, and rated as positive or negative. Music that is highly relevant to individuals evokes memories rated higher in salience (importance), memory intensity, and also tend to be more positive than both memories cued to songs rated low on relevance and to non-music control-cued memories. Additionally, highly relevant music evokes memories rated as more frequently experienced and vivid relative to less relevant music. Likewise, music rated as highly emotionally intense by individuals evokes memories rated higher on memory saliency (vividness, importance, frequency) and intensity than both AMs evoked to music cues rated lower on intensity and to control cues. Additionally, relative to control-cued AMs, highly intense music evokes memories experienced more positively. While cue valence does not affect memory intensity nor non-emotional memory qualities, it does affect memory valence, with control cues falling intermediate to more positively rated memories to positive cues, and more negatively rated memories to negative cues.

In terms of predictive factors of the cue properties on memory qualities, we also find that the degree of the emotional intensity of an AM is independently predicted by music cue intensity, by cue relevance, and more recent popular music. Analogously, the degree to which an AM is rated as being positive is predicted by cue positivity and more recent music, but not by relevance or cue intensity. High cue relevance and high cue intensity also predict higher reported memory saliency while cue familiarity is largely unrelated to recalled AMs (partially attributable to consistently high familiarity ratings across responses). With highly familiar songs, we still see large variance in the qualities of the reported AMs.

Fourth, we examined whether emotion-congruent AM retrieval (e.g. Bower, 1981) emerges with popular music cues, a recent finding obtained using novel classical music (Sheldon & Donahue, 2017).

We expected that AMs produced to popular music would be congruent in both emotionality measures: intensity (commonly referred to as "arousal" in the literature) and valence. That is, congruence would obtain if cues rated as more intense produced AMs rated as more intense and cues rated as less intense produced AMs rated as less intense. Similarly, congruence could be said to occur if cues rated as positive also produced AMs rated as positive and cues rated as negative produced AMs rated as negative. We also expected these effects to appear in the content of the memory reports. Although we find overall that popular music-cued memories are not especially emotional in comparison to control-cued AMs, we do find nonetheless evidence for emotional congruence. Valence congruency effects were observed in both objective and subjective measures. Intensity congruence was observed as well, but only with subjective measures. These findings broadly support those of prior literature on emotion-normed classical music-cued AMs and with past literature finding valence effects. They extend the literature from classical music to popular music and also by demonstrating congruency effects for arousal (intensity). Though not a test of an AM theory *per se,* these data are consistent with emotion-congruent AM retrieval (e.g. Bower, 1981), and to some extent consistent with the more nuanced retrieval model (Conway & Pleydell-Pearce, 2000). Specifically, both theories predict congruency, and that was observed here. There is a suggestion in the data that the congruency effects might be more pronounced for positive cues than negative cues, an inference that can be drawn from the Conway and Pleydell-Pearce (2000) model but not necessarily from the Bower (1981) model. Moreover, also consistent with the Conway and Pleydell-Pearce (2000) model, the level of emotionality was at best, moderate.

Some additional observations follow.

4.1 Music versus non-music cueing effects

Recall that in addition to AMs cued by popular music we also had a condition where AMs were cued by a blank screen (a no-music control). We find that memories cued to popular music were on average, rated as moderately important, highly vivid, and not frequently experienced in everyday life. Relative to the control cue condition, these music-cued AMs were rated as less important, less frequently experienced in everyday life, and as equally high on vividness. Belfi et al. (2016) found more perceptual details, which they associated with vividness of re-experiencing, in popular music-cued memories though in their case, the comparison was AMs cued to faces. We too find greater use of perceptual words in our participants' descriptions of AMs when cued by music (relative to our no-music control condition) though do not see differences on subjective vividness ratings. Thus, we produce some, albeit limit, that memories cued to popular music are especially vivid.

Unexpectedly, we found that AMs cued to music are rated both as less frequently experienced and as less important and thus may be more obscure. One possibility is that the no-music control we employed was less constraining than when retrieval was cued by music, and when not constrained, participants tended to access more salient memories. Put another way, the music might have served to force participants to limit search, in much the same way as asking participants to recall AMs from a specific part of their life. Such directed search might evoke more mundane or obscure memories, relative to the less constrained control condition.

Another point we wish to emphasize is the content analysis of the AMs produced when cued by music or a blank screen. We find greater use of leisure and perceptual words in memory descriptions (overall in Study 1 and relative to the no-music control in Study 2). In Study 2, this effect was independent of reported cue emotionality (valence or intensity) and cue relevance to participant. Janata et al. (2007) similarly found high use of social and leisure in their music-cued memories, using an earlier version of the LIWC though no cue type comparison was made. Additionally, when questioned in Study 2 about the role music played in the memory itself, about three quarters of the participants stated that the music cue played a role in their memory and nearly all of these respondents (91.11%)

gave examples of specific instances or locations where the music had been played. The second largest response was reference to some social event, endorsed by over half of these respondents. This supports Juslin and Laukka's (2004) findings that popular music is commonly encountered in everyday life, specifically in leisurely and social activities such as exercise, bathing, relaxing, eating, and socializing. The novel implication for the findings here is that the contextual background of experiencing the music is reflected in AM organization or retrieval.

4.2 The role of emotionality

The findings with respect to emotionality are complex. We find that memories cued to popular music in both Study 1 and 2 are objectively described with about three times as many positive emotion than negative emotion words, a finding consistent with Zator and Katz (2017) and with the non-music AM literature suggesting a bias towards recalling positive memories (e.g. Walker et al., 2003). However, although we find greater positivity than negativity in these memories, we find no difference in either intensity or valence ratings or in any of the LIWC affective process word categories between popular music-cued AMs and those evoked by the no-music control cue. In addition to no cue type effects, we find no interaction evidence that music cues emotional AMs automatically inasmuch as (a) we fail to find evidence that music cues evoked similarly emotional AMs (subjectively or objectively) regardless of instruction to retrieve an "emotional memory" or retrieve a "memory" with no emotionality mentioned, and (b) fail to find that control cues evoke primarily emotional AMs only when instructed to do so. A possibility that may account for this might be the AMs evoked were not highly emotional even when we instructed people to produce emotional memories. It may be that even with instruction to produce emotional AMs, participants are inclined to retrieve only moderately emotional AMs and that highly emotional memories may be more tightly guarded. This last possibility is somewhat suggested by Brown and Schopflocher (1998) describing two different types of autobiographical memories: the first more easily accessed and mundane (e.g. memory of a meal), the second more tightly guarded but significant (which may include elements of high emotion, e.g. personal loss).

Our findings are consistent with the AM literature. In fact, individuals favour recalling mildly positive AMs (as we see here), rather than those that are either highly emotional or negative (Conway & Pleydell-Pearce, 2000; Walker et al., 2003). Another, and not necessarily incompatible finding is that over time, memories, even if initially highly emotional, become less emotionally when recalled (e.g. Walker et al., 1997). Conway and Pleydell-Pearce (2000) argue that both effects may result from the working self's desire to avoid re-experiencing intense or negative emotions in the reconstruction of retrieved AMs.

In our study, we examined two aspects of emotion: valence (how positive or negative) and intensity (how strong or arousing). Based on the notion of emotion-congruent AM retrieval (e.g. Bower, 1981), we expected that the participant's emotional experience (both with respect to intensity and valence) of the music cue (the stimulus) would lead to a felt emotion, which would in turn evoke an AM congruent with this felt emotion. In this study, our design does not permit a direct test of whether the music directly evoked an emotion, and that this emotion was felt by the participant during the recall exercise. However, we can rely on past literature (Juslin et al., 2008; Juslin & Laukka, 2004; Song et al., 2016) and the open-ended responses in both Study 1 and 2 to suggest that this did indeed happen. Recall that in Study 1, about half of respondents to the emotion open-ended question endorsed an emotional response to the music, most which were positive responses. We see this reflected in both Study 1 and 2 cue valence ratings, with a tendency towards positive valence in the emotional experience of the popular music cues. We also found in the Study 2 open-ended responses, that a large proportion of participants specifically noted that the emotional reaction to the music was responsible for recall. Thus, we think it likely that emotion may have been induced by the music in many of the Study 2 music cueing trials, a prerequisite assumed by emotion-congruent AM retrieval.

As noted above, in Study 2, we find evidence of emotion-congruent AM retrieval. Specifically, we find evidence of emotional valence congruency between participant experience of the popular musical cues with both their subjective experience of the subsequently recalled memories and objective measures – the words used to describe the

memory events (with several emotion LIWC categories). We also find evidence of emotional intensity congruency between participant experience of the popular musical cues (Phase 3 music cue intensity ratings) and their subjective memory intensity ratings. Recall that we argued above that these findings are consistent with both the predictions of Bower's (1981) and Conway and Pleydell-Pearce's (2000) models on how the emotionality associated with a popular music cue may influence retrieval and the nature of the AMs retrieved.

Interestingly, for the subjective emotion ratings, the control-cued memories fall intermediate to these congruency effects. That is, positive music cues evoked memories reported as more positive than those evoked by no-music controls cues, and similarly, negative music cues evoked memories reported as more negative than those evoked in the control cue condition. While the effects with the objective LIWC are not as widespread, when they do exist, they show the same pattern; the memory reports to positive cues contain less negative words and the memory reports to negative cues contain more sadness words relative to the controls.

Analogous findings obtain for the intensity subjective ratings. That is, highly intense music cues evoked memories rated as more intense than control cues and less intense music cues evoked memories rated as less intense than control cues. However, these effects do not emerge for the objective LIWC measure, although they are in the direction we would expect given the pattern in subjective ratings.

To our knowledge this is the first empirical support for AM emotion congruency effects using both participant reported ratings and objective analyses in popular music cueing. The findings reported here align partially with Sheldon and Donahue's (2017) and Schulkind and Woldorf's (2005) examination of arousal (what we call "intensity" here) and valence congruency with normed novel classical music. Both studies, which used novel classical music, found an effect of valence congruency, but not for arousal. Thus, it appears that the valence congruency effect is a robust effect of AMs evoked with music (i.e. both novel classical and familiar popular). In contrast to these studies, we find also a congruency effect of intensity (arousal). Further work is needed to replicate the novel

intensity effects observed here. Assuming replication, intensity congruency may reveal a feature of popular music-cued AMs not found with classical music. Future work is suggested to replicate the intensity congruency effect and to examine whether any such effect is due to the nature of the cues (i.e. familiarity, relevance, or lyrical material present with popular music cues).

Though we find strong results for valence congruency in both subjective and objective measures, and for intensity congruency in subjective participant memory intensity ratings, we fail to find an effect of congruency with objective intensity measures (i.e. LIWC affective processes words). While unexpected, several possibilities come to mind. First, it may be that, as with other studies (e.g. Sheldon & Donahue, 2017), arousal congruency does not emerge. There may be no emotional intensity effect. However, given that we found intensity congruency with subjective measures, it is more probable that this failure is due to a methodological issue in this study. That is, while the LIWC categories used to assess valence-congruency are clearly reflective of a valenced emotional response (i.e. a positive memory will be responded to with many positive words), the affective processes LIWC category (used as an objective analogue to emotional intensity) is composed of all words found in the affective subcategories (Pennebaker, Boyd, et al., 2015). Thus, this category only tabulates the total amount of emotion words, effectively reflecting only the amount of emotion in the memory. There is a careful distinction here. The amount of emotional description does not necessarily reflect the strength of these emotions (which is what emotional intensity reflects) and does not possess the nuance of different qualities of emotions. While the affective process category was deemed to be the most analogous word category to our subjective emotional intensity rating (as more emotional information overall may indicate a more intense emotional response), it may be that both the strength and quality of the emotional response are not adequately captured by simply the number of affective process words.

4.3 The effect of the emotional aspects of a cue on non-emotional AM characteristics

In the previous section, we examined the effects of the emotionality of a cue on the

emotionality of the AM produced to that cue (congruency). We also examined effects of music cue emotionality on non-emotional aspects of the recalled memories (e.g. saliency and non-emotional content). First, our multiple regression models (Appendix N) reveal that higher music cue intensity predicts all saliency factors: higher frequency, vividness, and importance ratings of recalled AMs. In contrast, valence does not predict any saliency ratings. Second, our ANOVAs showed that higher reported music cue intensity leads to greater memory intensity and memory saliency ratings (vividness, importance, frequency) compared to AMs evoked to popular music cues rated as lower on intensity and to control cues. These findings contrast those reported in Sheldon and Donahue's (2017), who found lower saliency was associated with higher arousal (intensity) cues. This discrepancy may be partially attributed to the unique aspects of our study design: instead of normed novel musical cues, we used popular music and we used participant ratings of the music cues as the predictor variables in the multiple regression and independent variables in the ANOVAs. These differences might explain the discrepancy. The range of emotional responses we find to the various cues suggest the importance of individual differences. The same song may induce different levels of emotion or different emotions entirely depending on the participant's history with the cue. Indeed, we find the importance of individual differences with both the relevance of the cue and the intensity of the cue.

Taken together, these data lead to a speculative conclusion: how intense an individual finds the music they are listening to impacts multiple qualities of the memories that come to mind, whereas how positive or negative they perceive the music to be, only influences the valence of the recalled AM. Thus, valence cue factors appear to follow emotion-congruent AM retrieval, whereas intensity also appears to affect more diverse emotional and non-emotional memory qualities in retrieval.[7]

[7] These cue property regression models may prove to be useful in informing future researchers on item selection from the Study 1 database.

4.4 Personal relevance

To our knowledge, Study 2 presents the first direct examination of possible effects of personal relevance of popular music on recalled AMs in a healthy young adult population. Given the promising findings in Alzheimer's Disease (e.g. El Haj et al., 2015; El Haj, Fasotti, & Allain, 2012; El Haj, Postal, & Allain, 2012) and the literature suggesting that the emotion regulation functions of popular music in young adulthood may be tied to personally relevant music (e.g. Lippman & Greenwood, 2012), we wanted to see if relevance was also a retrieval factor in healthy young adults and also, what aspects of the recalled memories relevance may influence.

In Study 1, we observed that the more relevant a song is to an individual, the more likely they will recall a specific autobiographical memory. In Study 2, we find diverse support for personal relevance's effect on these recalled AMs. First, in our regression analyses, we found that reported higher music cue relevance predicts higher ratings on all three saliency factors (frequency, importance, vividness) and also on memory intensity, though not memory valence (again, this is predicted uniquely by music cue valence). Second, we found that the songs rated highly on relevance led to memories rated as more salient (rated as more frequently experienced in everyday life, more important, more vivid), positive, and more emotionally intense compared to memories cued to songs rated as less relevant. Additionally, these highly relevant songs cued AMs rated as more important, intense, and positive than memories evoked by the no-music control cues. In contrast, relative to the controls, less relevant songs evoked AMs rated as less frequently-experienced, less important, and less vividly recalled.

Thus, we conclude that high personal relevance is a highly effective factor in retrieving memories reported as both more distinct and more positive. Interestingly though, whether a song was rated as highly or less relevant had little effect on the content of the produced memory descriptions. Additionally, similar to our cue emotionality analyses, we fail to find increased perceptual detail (used as an objective measure of vividness in Belfi et al., 2016) in the memories evoked to highly relevant songs compared to the AMs evoked to less relevant songs. Why only the participant's perception of the memory differs drastically, and not the content of the memories is an area for future research.

4.5 Access to specific event AMs

Though not a direct aim of the current thesis, our data enable comparison of access to AMs to other studies employing music. As noted by Haque and Conway (2001), specific AMs are typically evoked on average, in between 5 and 7 seconds. We find this for the non-music control-cued AMs in Study 2.

In contrast, popular music-cued memories (regardless of reported cue emotionality) were evoked on average, in more than three times the amount of time taken to cue as the no-music controls, and more than twice as long as the typical retrieval time. Similarly, slow response rates are observed in classical music studies (Schulkind & Woldorf, 2005; Sheldon & Donahue, 2017). In popular music-cueing literature, Zator and Katz (2017) found even slower response times with popular music cues that were quicker than with their word-cued memories, though they acknowledge study-specific task demands that may have led to slower response times overall. They attributed these relatively shorter music cue response times to quicker access directly to specific event memory information in the autobiographical memory knowledge base (AKB; Conway & Pleydell-Pearce, 2000) than when presented with the tailored word cues for recall. However, here we see slower response times than the average AM recall rate for popular music cueing than control-cued retrieval, which may actually indicate a slower access to this specific event information in the AKB. This may suggest a more complex interplay between music cue and the retrieval process, leading to a longer retrieval path.

Recall that Schulkind and Woldorf (2005) and Sheldon and Donahue (2017) found that novel classical music cues normed as either highly arousing or positive, evoked memories more quickly than less arousing or negative cues, arguably speeding up direct access to AMs. We fail to find response time differences as a function of cue emotionality in Study 2. However, we do find that music cues rated as highly relevant tend to evoke memories more quickly than those rated as less relevant. One could argue that this indicates that highly relevant musical stimuli can access specific events relatively fast, or at least relative to other musical cues. Nonetheless, musical cues, both here and in earlier studies, evoke AM much slower than typically found with other cues including the no-musical cue employed here (e.g. Haque and Conway, 2001). Our

findings more specifically suggest that in contrast to novel classical music, both how positively or negatively an individual experiences a music cue (and how emotionally intense) does not affect access to AMs differently, at least in popular music. On the other hand, how relevant a musical cue is to an individual does affect access to AMs differently.

4.6 Replication of Zator and Katz (2017)

The study most closely related to Study 2 reported here, is the study by Zator and Katz (2017). Given the similarity and the argument that their findings reflected embodiment in the evoked AMs, it is worthwhile to directly compare our results to those earlier results even though the studies differed in important ways.

While the no-music control employed in Study 2 is not analogous to two different types of word cues used in Zator and Katz (2017), we nonetheless consider the current findings relative to those they reported. In the current study, as reported, we find no cue type effects for relativity, personal pronouns, or past tense words that have been found in the earlier study. However, we do see similar proportions of words in all categories (popular music-cued and control-cued) as found in Zator and Katz (2017). This suggests that the effects in the earlier study are driven by word-cued retrieval and not music cueing per se. The differences between this study and the earlier one also suggest that effects attributed to music cueing in Zator and Katz (2017) may be in fact effects of AM retrieval in general and not specific to music cueing. Specifically, Zator and Katz noted greater use of relativity-related words in descriptions of music-evoked AMs relative to AMs evoked to word cues directly referencing a specific time period (“five years old”), an effect not seen with the word cues indirectly referencing a time period (e.g. “Harry Potter and the Philosopher’s Stone movie is released”). Our results suggest that when given a word cue directing to a time period of interest, retrieval may bypass some typical embodied response.

4.7 Limitations, future directions, and a speculation

Though adding knowledge and a database to the literature, as with such a large study, we must acknowledge potential limitations. Similarly, we suggest future directions based on questions arising from the study done here, and speculate on the role played by music in AM.

4.7.1 Event cueing

Event cueing obtains in cueing experiments when an evoked memory event is then used as cue for a subsequent memory (Brown & Schopflocher, 1998). Studying the relations between the original and cued events, Brown and Schopflocher (1998) determined that events exist in "event clusters", which may present pairs of events similar in age and time period, emotional content, importance, and vividness (see additionally Wright & Nunn, 2000).

We cannot discount the possibility that event cueing occurred during the Memory-Generation Phase (Phase 1), especially in the no-music control cue condition. Given that the control cue was simply a blank screen and that all events were recalled in relatively close succession, it is possible that the lack of distinct sensory cue may have resulted in previously-recalled event(s) influencing the subsequently evoked memories. It is possible of course that this could occur in any AM cueing experiment where many memories are recalled in close succession. However, our popular music cueing involved 7 distinct sensory cues (rather than 7 identical blank screens with no clear sensory cue differentiating separate trials), making event cueing less likely than in the non-music control cue condition. This may suggest that control-cued memories may take on characteristics of event clusters: memories from a similar age, with similar emotional content, similar importance, and similar vividness (Brown & Schopflocher, 1998; Wright & Nunn, 2000). The potential issue here, is that we may not have achieved the large range of possible memories with our controls cues that were evoked to popular music. Instead, control-cued participants may have evoked one memory and then a chain of similar memories in subsequent recall trials. These memories produced in the no-music

control condition are available and can be used in subsequent analyses to see if event cueing occurred frequently in this condition.

4.7.2 Instruction manipulation

We recognize that our manipulation to encourage emotional memories did not produce highly emotional memories. It is possible with only highly emotional memories that one will find evidence that they were evoked automatically to popular music. Either AMs do not deviate from a moderate emotionality on average regardless of how a participant is instructed to retrieve one, or the manipulation was unsuccessful. As noted above, moderate AM emotionality is the norm when memories are evoked in the laboratory and may, in fact, be a characteristic of the memory system. Nonetheless, one cannot discount the role of emotionality, and even the possibility that evidence for automatic music-cued emotional AM evocation if more emotional memories were present. A task for future research is in determining how to produce such memories in lab conditions.

4.7.3 Objective measure of emotional memory intensity

Related to our instructional manipulation, we discuss here a possible limitation to why we failed to find the anticipated congruence effect on the objective measure for memory emotional intensity. As noted above, the use of the LIWC affective category may not be the most reflective of the strength of the emotional experience and thus, may not be the best objective analogue to the subjective ratings of memory intensity or music cue intensity ratings. We only observed an effect approaching significance in the direction we expected. This may reflect that instead of strength, the LIWC simply measured the amount of emotion. A better or complementary method may be to first take emotion words normed on extremity of experience (e.g. annoyed vs. furious; happy vs. ecstatic) and analyze the frequency of different levels of these words. This would present a method that retains this strength aspect that might not be captured in the LIWC.

4.7.4 Attribution of effect directionality (What came first? The chicken or the egg)

We asked people to rate their memories in one phase of the study (Phase 2 Memory-Rating) and at a later phase (Phase 3 Music Cue-Rating) we asked people to rate their

reaction to the music per se. The advantage of this is that we accounted for individual differences in cue experience, but the disadvantage is that the memory and music cue ratings could somehow be confounded. Some of the results show that the nature of the cue (e.g. cue valence) is related to the nature of the memory (e.g. memory valence). Data of this sort is one of the basis for the claim made here that congruence occurs. We stand by that claim but recognize that the direction of the association is unclear: it may be that, for instance, music one feels is pleasant leads to pleasant memories. It is also possible however, that a given song might evoke a pleasant memory, and this sense of pleasantness tinges the music cue ratings. We carefully designed our procedure recognizing this issue. We placed the Memory-Generation Phase first (Phase 1), where participants would have listened to the music for the first time. We specifically placed the Music Cue-Rating Phase last (Phase 3, with the memory rating task in between) to put as much distance as possible between the cueing task and the cue rating task. The purpose of this placement was to minimize the possibility that the music would be tied highly to the event description. In the Music Cue-Rating Phase (Phase 3), we also had both participants who were cued by music and those in the no-music condition give ratings to the 7 songs used in the Memory-Generation Phase (Phase 1) plus three additional songs. If the cue ratings in Phase 3 were in part based on the memories evoked earlier, one might expect the music-cued and control-cued participants would differ on how they rated the items used for one group initially but not on the new items. However, the two groups did not systematically differ on how they rated the old music cues, nor did they differ on the three new cues. Thus, we might conclude tentatively, that the music affected the memory and not the other way around. Moreover, here we also looked at the content of the AM report using the LIWC, a fairly unobtrusive measure of memory content, and even here we find effects relating cue and AM, at least for valence. These findings, when taken in conjunction with other research showing a disconnect between cue rating and memory produced, suggests the two ratings (characteristics of the cue, and characteristics of one's memory) are relatively independent. Nonetheless an ideal solution would be to somehow experimentally manipulate the cue and memory.

4.7.5 Nostalgia and mixed emotional responses

Although we did not explicitly examine effects of nostalgia here, we speculate on its importance. Oxford Dictionaries defines the complex emotional experience known as nostalgia quite nicely as, “a sentimental longing or wistful affection for a period in the past” (Nostalgia, n.d.). This complex emotion has been examined in both general popular music literature and popular music cueing literature and is often thought of as a mixture of positive and negative emotions (Barrett et al., 2010). In their naturalistic study of popular music in everyday life, Juslin et al. (2008) found that participants reported happiness and nostalgia emotions most often when listening to music. Related to our work, Janata et al. (2007) administered a survey of participant emotional reaction to each cueing song in their seminal study of popular music-cued AMs. Similar to Juslin et al. (2008), the top three reported emotions were happiness, “youthful”, and nostalgia. In Study 1, we found also found that 1 in 10 respondents reported mixed emotions, and about 1 in 17 reported nostalgia specifically in the open-ended emotional response questions. We even surveyed what was associated with a nostalgic response to a popular music cue in Study 1, finding that these were often associated with past events (childhood in particular), positive emotion, and both friends and family. These findings suggest that nostalgia is a feature of at least some AMs associated with popular music. Thus, music listening may be more complex than just a valence measure from positive to negative.

Regrettably, due to the nature of our investigations (to compare cue and memory emotional qualities) and to maintain relative design simplicity, no measure of nostalgia or option for measurement of mixed emotion were surveyed in Study 2. It is possible given the literature, that nostalgia or mixed emotions may be factors in popular music-cued AMs and that cue properties may be associated with these AMs (as hinted by the data in Michels-Ratliff & Ennis, 2016), necessitating further research.

The database presented in Study 1 provides a resource for studying the effect of nostalgia in more detail.

4.7.6 Aspects of the popular music cue not accounted for: Thematic and lyrical content

Although not also studied in the current thesis, it is difficult to ignore the multiple sensory and meaningful aspects of a popular music cue we did not account for in Study 2: thematic and lyrical content. In contrast to a classical music cue (which only contains musical and emotional content), presumably a participant may interact with popular music in any way due to the music itself, the emotion it conveys, or to the verbal information (i.e. the lyrics, thematic content) presented. This may affect their emotional reaction and why they find the song relevant or not, among other responses.

Relevant AM retrieval theory may support this. Recall that in Study 2, we found cueing response times for popular-music cued AMs two to three times the average response times for AM recall, which we see for the no-music control-cued AMs (5 to 7 seconds; Haque & Conway, 2001). Zator and Katz (2017) report even longer cueing times, though they attribute this to possible task demands. Compared to other memory processes, average AM retrieval times are long and fluctuate considerably (Conway, 1996). This may be due to the complex reconstructive process of AM retrieval (Conway, 1996). If we are to accept this theory, it would make sense that compared to typical AM retrieval, a longer response time would indicate a more complex search. Thus, longer retrieval times we found for popular music-cued AMs (even when acknowledging quicker response time for high relevance songs) may reflect that the retrieval process (e.g. working self, Conway & Pleydell-Pearce, 2000) not only considers the emotional and relevance-related content of the cue, but other aspects (i.e. why the cue is relevant, the lyrical content, etc.).

The study of classical music, a somewhat analogue of how an individual may respond to a popular music cue, rectifies this issue by simplifying possible factors outside of music and emotion that might affect AMs. However, it does so by eliminating use of the music that participants are most likely to encounter and associate with memories. We chose not to include lyrical examination in our research to avoid complicating an already complex design. This being said, when asked to elaborate on what about the musical cues directly evoked recalled memories, we did find that only a small percentage of participants in Study 2 responded saying that lyrics specifically led to their recalled memories. In

contrast, a far larger proportion responded that emotion induction was a strong factor. This might be a fair representation, or this could be simply that participants were repeatedly asked about their emotional experience of the cue and of their recalled memories, and no mention of lyrics were made throughout the experiment. Thus, future research should consider lyrical and thematic content in studying AMs related to popular music.

4.7.7 Broader age range

Related to above, differential effects of emotion in AM study may be attributed to the difference in age groups. For instance, Janata et al. (2007), Cady et al. (2008), Zator and Katz (2017), and the current study use the convenient sample of undergraduate young adults while Belfi et al. (2016) used a range of adult participants. Recall that the "reminiscence bump" refers to the phenomenon in general AM literature where older individuals tend to recall a larger proportion of memories from the second and third decades of their lives when asked to recall a memory, hinting towards the importance of this time (Rubin, Wetzler, & Nebes, 1986). Given the notion that popular music-cued memories follow this effect when the AM of older adults are surveyed experimentally (Platz et al., 2015), it is possible that our sample (around 18 years old) was too young to unveil broader overall effects of more salient and emotional memories to popular music (instead limiting them to cue emotionality and relevance-specific effects). Additionally, it is possible that our methodology asked for too many emotional memories and that given their age, the participants simply did not have as many highly emotional memories to survey from, leading to not overly emotional memories on average as reported in our data. It is possible that given the length of time passed in an older sample compared to our younger sample, if we cued older individuals with popular music from this salient adolescent time period, music would cue less obscure memories relative to other cueing methods given simply the larger number of memories across the lifespan and some support for the tendency to recall more salient ones from this reminiscence bump time period (Bernsten & Rubin, 2002; Rubin & Schulkind, 1997; Rubin et al., 1986). Belfi et al. (2016) employed popular music from this reminiscence period in their older adult sample. However, they found a low recall rate (about 30%) and this may be due to

random sampling from the Billboard charts. One can envision cross-sectional developmental AM studies using the Study 1 database for people 10 or 15 years and even more remote in the future from when the music was popular to test ageing effects on song-induced memories.

4.7.8 A concluding speculation

Finally, we speculate as follows.[8]

Highly relevant songs and songs experienced as highly emotionally intense may be especially tied to more defining moments in a participant's past. The reasoning for highly relevant songs leading to these important memories is logical, whereas the reasoning for highly intense songs is less clear. Thus, we speculate on relevance here. Self-defining memories have been described as highly important events associated with an individual's self-concept and important positive and negative "concerns and conflicts" that we experience over our lifetime (e.g. losses, achievements, Blagov & Singer, 2004, p. 484; Conway, et al., 2004). Such events may be associated with important goals or components central to an individual's self-concept (Conway & Pleydell-Pearce, 2000; Thorne, McLean, & Lawrence, 2004).

Specifically, one can speculate that the relevance of the cue specifically is tied to a foundational event in the individual's past. These self-defining memories have been reported as used as mood regulatory tools, effectively using positive memories to reverse negative mood (Conway et al., 2004). Recall that in our young adults, emotion regulation functions of popular music are especially tied to high personal relevance of the music. It might be that the music is tied to these events, and this is why they are used for a regulatory function. While there is a literature on the relevance of a cue with respect to regulatory functions in a young adult population, similar to those studied here, we suspect that highly intense music also serves a regulatory function. Related to this, given that our

[8] I am letting my imagination go wild.

cues evoke valence-congruent AMs, if self-defining memories are used to regulate mood, this could indicate that music cues an emotion, which cues the memory, which reinforces the mood.

Self-defining memories are reported with high vividness, high emotional intensity, high importance, and frequent rehearsal, and are often associated to a network of memories related to an important theme (Conway et al., 2004; McLean & Thorne, 2003; Singer & Blagov, 2004). These are characteristics similar to those found here with memories cued to highly relevant music and those AMs cued to highly emotionally intense music, at least comparatively to other AMs evoked in this study. Though there may be a tendency to recover negative self-defining memories when prompted (e.g. Blagov & Singer, 2004), we did not specifically prompt self-defining memories, but cued participants with a potentially affect-inducing stimulus.

In the case of relevance, this cue was also rated as somehow highly important to the individual. Given we see valence congruency effects, that our highly relevant songs are associated with positive affect, and that our cues are subjectively important to the individual for a particular reason, it is possible that highly relevant songs are tied to positive self-defining memories. This is supported subjectively, by the higher ratings of importance, emotional intensity, and positivity associated with AMs cued to highly relevant music relative to AMs evoked both to the control cue and to less relevant music, and higher ratings of frequency (analogous to rehearsal) and vividness relative to AMs evoked to less relevant music. This may also be partially supported objectively by our supplementary LIWC analyses. The only LIWC category with a relevance effect was personal pronouns. Highly relevant music evoked AMs described with greater use of these words relative to less relevant music. Use of personal pronouns in event descriptions has been used in AM literature to assess self-reflection (Walker, Yancu, & Skowronski, 2014), and thus we may see more self-reference in these memories cued to highly relevant songs, which may then indicate a greater self-defining importance of these events.

Chapter 5

5 Conclusion

Overall this thesis has addressed two main literature gaps in popular music cueing. First, we addressed a limitation in stimuli selection, offering a large database of popular music cues surveyed for important measures of interest to popular music-AM researchers. In Study 1 we also learned that despite expectations, radio or Top 40 music is still preferred amongst the current young adult population. Thus, this music is a reasonable genre of music from which to build stimulus sets for AM cueing study. From both studies, we found that young adults find popular music generally positive, enjoyable, moderately relevant, moderately intense in emotional experience, and familiar.

Second, we addressed the question of whether popular music evokes especially emotional AMs, and also addressed how popular music-evoked autobiographical memories are related to both an individual's emotional experience of the music and how personally relevant they find a given song. We also provide comparison to a no-music control cue. In general, we find that popular music tends to cue memories described with greater use of leisure and perceptual details than our non-music control cue, an effect that is independent of emotionality or relevance of cue. This may indicate specific effects of popular music-cued AMs. We also find that music evokes memories more slowly than the average AM retrieval, and than the no-music control, which may suggest that popular music retrieves via a longer, more complex route than the majority of AMs. We find evidence for this in that we also find that aspects of the cue (emotionality and relevance) affect the evoked AMs in broad and varied ways. Specifically, music commonly cues memories that are congruent in emotional valence and intensity with how the individual emotionally perceives the music, providing evidence of emotion-congruent AM retrieval (e.g. Bower, 1981). While we find that cue valence only affects memory valence, we find that cue intensity affects broader qualities (emotional and non-emotional) of the recalled memory. That is, relative to music experienced as less emotionally intense and to controls, music experienced as highly emotionally intense evoked memories experienced as more salient (frequent, important, vivid) and more emotionally intense. Additionally,

relative to control-cued AMs, music experienced as highly emotionally intense evoked memories experienced more positively. In agreement with past literature, this suggests that intensity (or arousal) may be the stronger emotional AM organization factor. Beyond cue emotionality, we find that music rated as highly relevant evoked memories experienced as more salient, positive, and emotionally intense than those cued to less relevant music. Highly relevant music also cued AMs faster than less relevant music. Highly relevant music also evoked memories experienced as more important, positive, and emotionally intense than control cues. These findings may suggest that highly relevant music and music rated as highly intense evoke more salient, and possibly even self-defining memories. Our findings may reflect the complex nature of popular music, and suggests examination of other factors of a popular music cue (e.g. lyrical and thematic content, nostalgia), self-defining memories, and a sample of larger age range.

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Appendices

Appendix A: Study 1 Demographic Questions

1. How old are you? (Text box)
2. Gender (1 – male, 2 – female, 3 – other)
3. What is your first language? (Text box)
4. Where did you spend the majority of your childhood and youth years? (Text box)
5. Are you a musician? If yes, please describe your training (e.g. Years, type, accomplishments) and musical proficiencies (e.g. Instruments) briefly.[9]
6. How do you normally listen to or find new music? List in order of preference beginning with the method you use most and describe briefly (one or two sentences, e.g. Radio) (Text box).
7. What is/are your favourite genre(s) of music? (Text box)

[9] Not reported on here as not of immediate relevance to study aims.

Appendix B: Study 1 Stimuli List by Year

1996 (7 tracks):

- "Macarena" – Los del Rio
- "One Sweet Day" – Mariah Carey and Boyz II Men
- "Because You Loved Me" – Celine Dion
- "California Love" – 2Pac feat. Dr. Dre
- "Ironic" – Alanis Morrisette
- "It's All Coming Back to Me Now" – Celine Dion
- "Always Be My Baby" – Mariah Carey

1997 (7 tracks):

- "Something About the Way You Look Tonight" – Elton John
- "I'll Be Missing You" – Puff Daddy feat. Faith Evans and 112
- "Un-break My Heart" – Toni Braxton
- "I Believe I Can Fly" – R. Kelly
- "Wannabe" – Spice Girls
- "Quit Playing Games (With My Heart) – Backstreet Boys
- "MMMBop" – Hanson

1998 (7 tracks):

- "Too Close" – Next
- "You're Still the One" – Shania Twain
- "Truly Madly Deeply" – Savage Garden
- "All My Life" – K-Ci and JoJo
- "My Heart Will Go On" – Celine Dion
- "Everybody (Backstreet's Back)" – Backstreet Boys
- "Tubthumping" – Chumbawamba

1999 (7 tracks):

- "No Scrubs" – TLC
- "…Baby One More Time" – Britney Spears
- "Genie in a Bottle" – Christina Aguilera
- "Every Morning" – Sugar Ray
- "Livin' la Vida Loca" – Ricky Martin
- "I Want It That Way" – Backstreet Boys
- "All Star" – Smash Mouth

2000 (8 tracks):

- "Say My Name" – Destiny's Child
- "Kryptonite" – 3 Doors Down
- "I Wanna Know" – Joe
- "I Knew I Loved You" – Savage Garden
- "Breathe" – Faith Hill
- "Bye Bye Bye" – 'NSync
- "That's the Way It Is" – Celine Dion
- "All The Small Things" – Blink 182

2001 (8 tracks):

- "Hanging By a Moment" – Lifehouse
- "Fallin'" – Alicia Keys
- "Drops of Jupiter" – Train
- "I'm Real" – Jennifer Lopez feat. Ja Rule
- "Let Me Blow Ya Mind" – Eve feat. Gwen Stefani
- "Thank You" – Dido
- "Independent Women" – Destiny's Child
- "Love Don't Cost a Thing" – Jennifer Lopez

2002 (8 tracks):

- "How You Remind Me" – Nickelback
- "Hot in Herre" – Nelly
- "Wherever You Will Go" – The Calling
- "In The End" – Linkin Park
- "Complicated" – Avril Lavigne
- "The Middle" – Jimmy Eat World
- "Hero" – Enrique Iglesias
- "Don't Let Me Get Me" – Pink

2003 (6 tracks):

- "In da Club" – 50 Cent
- "Crazy in Love" – Beyoncé feat. Jay-Z
- "Bring Me To Life" – Evanescence feat. Paul McCoy
- "Beautiful" – Christina Aguilera
- "Where is the Love?" – The Black Eyed Peas
- "Lose Yourself" – Eminem

2004 (8 tracks):

- "Yeah!" – Usher feat. Lil Jon and Ludacris
- "If I Ain't Got You" – Alicia Keys
- "This Love" – Maroon Five
- "The Reason" – Hoobastank
- "Hey Ya!" – Outkast
- "Here Without You" – 3 Doors Down
- "My Immortal" – Evanescence
- "Numb" Linkin Park

2005 (7 tracks):

- "American Idiot" – Green Day
- "Since U Been Gone" – Kelly Clarkson
- "Gold Digger" – Kanye West feat. Jamie Foxx
- "Don't Phunk with My Heart" – The Black Eyed Peas
- "Photograph" – Nickelback
- "Boulevard of Broken Dreams" – Green Day
- "Behind These Hazel Eyes" – Kelly Clarkson

2006 (8 tracks):

- "Bad Day" – Daniel Powter
- "You're Beautiful" – James Blunt
- "Hips Don't Lie" – Shakira feat. Wyclef Jean
- "Crazy" – Gnarls Barkley
- "Chasing Cars" – Snow Patrol
- "SexyBack" – Justin Timberlake feat. Timabland
- "SOS" – Rihanna
- "Breaking Free" – High School Musical

2007 (8 tracks):

- "Irreplaceable" – Beyoncé
- "Umbrella" – Rihanna feat. Jay-Z
- "Before He Cheats" – Carrie Underwood
- "Hey There Delilah" – Plain White T's
- "Say it Right" – Nelly Furtado
- "How to Save a Life" – The Fray
- "Everyday" – High School Musical 2

2008 (7 tracks):

- "Low" – Flo Rida feat. T-Pain
- "Bleeding Love" – Leona Lewis
- "Apologize" – Timbaland feat. One Republic
- "No Air" – Jordin Sparks and Chris Brown
- "Love in This Club" – Usher feat. Young Jeezy
- "I Kissed a Girl" – Katy Perry
- "I'm Yours" – Jason Mraz
- "With You" – Chris Brown

2009 (8 tracks):

- "Poker Face" – Lady Gaga
- "I Gotta Feeling" – The Black Eyed Peas
- "Right Round" – Flo Rida
- "Single Ladies (Put a Ring on It)" – Beyoncé
- "Heartless" – Kanye West
- "You Belong with Me" – Taylor Swift
- "I Know You Want Me (Calle Ocho)" – PitBull
- "The Climb" – Miley Cyrus

2010 (7 tracks):

- "Love the Way You Lie" – Eminem feat. Rihanna
- "California Gurls" – Katy Perry feat. Snoop Doff
- "Airplanes" – B.o.B. feat. Hayley Williams
- "Bad Romance" – Lady Gaga
- "Dynamite" – Taio Cruz
- "I Like It" – Enrique Iglesias feat. Pitbull
- "Mine" – Taylor Swift

2011 (6 tracks):

- "Party Rock Anthem" – LMFAO Feat. Lauren Bennett and GoonRock
- "Firework" – Katy Perry
- "Give Me Everything" – Pitbull feat. Ne-Yo, Afrojack, and Nayer
- "Grenade" – Bruno Mars
- "Moves Like Jagger" – Maroon 5 feat. Christina Aguilera
- "Someone Like You" – Adele

2012 (8 tracks):

- "Call Me Maybe" – Cary Rae Jepsen
- "Lights" – Ellie Goulding
- "We Found Love" – Rihanna feat. Calvin Harris
- "What Makes You Beautiful" – One Direction
- "Some Nights" – Fun.
- "Wild Ones" – Flo Rida feat. Sia
- "We Are Never Getting Back Together" – Taylor Swift
- "As Long as You Love Me" – Justin Bieber feat. Big Sean

2013 (7 tracks):

- "Thrift Shop" – Macklemore and Ryan Lewis feat. Wanz
- "Blurred Lines" – Robin Thicke feat. T.I. and Pharrell Williams
- "Can't Hold Us" – Macklemore and Ryan Lewis feat. Ray Dalton
- "Ho Hey" – The Lumineers
- "I Knew You Were Trouble" – Taylor Swift
- "Wrecking Ball" – Miley Cyrus
- "Wake Me Up" – Avicii

2014 (8 tracks):

- "Happy" – Pharrell Williams
- "Let it Go" – Idina Menzel
- "All of Me" – John Legend
- "Fancy" – Iggy Azalea feat. Charlie XCX
- "Talk Dirty" – Jason Derulo feat. 2 Chainz
- "All About That Bass" – Meghan Trainor
- "Turn Down for What" – DJ Snake and Lil Jon
- "Story of My Life" – One Direction

2015 (8 tracks):

- "Uptown Funk" – Mark Ronson feat. Bruno Mars
- "Thinking Out Loud" – Ed Sheeran
- "See You Again" – Wiz Khalifa feat. Charlie Puth
- "Sugar" – Maroon 5
- "Shut Up and Dance" – Walk The Moon
- "Blank Space" – Taylor Swift
- "Earned It" – The Weeknd
- "Take Me to Church" – Hozier

Appendix C: Study 1 Song Lists

Song List 1

- **1996:** Ironic – Alanis Morrisette
- **1997:** I'll Be Missing You – Puff Daddy feat. Faith Evans and 112
- **1998:** Everybody (Backstreet's Back) – Backstreet Boys
- **1999:** All Star – Smashmouth
- **1999:** No Scrubs - TLC
- **2000:** Breathe – Faith Hill
- **2001:** I'm Real – Jennifer Lopez and Ja Rule
- **2002:** Don't Let Me Get Me – Pink
- **2002:** In The End – Linkin Park
- **2003:** Crazy in Love – Beyoncé feat. Jay-Z
- **2004:** Hey Ya! - Outkast
- **2004:** My Immortal – Evanescence
- **2005:** Since U Been Gone – Kelly Clarkson
- **2006:** Chasing Cars – Snow Patrol
- **2007:** Everyday – High School Musical 2
- **2008:** Low – Flo Rida feat. T-Pain
- **2009:** Poker Face – Lady Gaga
- **2010:** Love the Way You Lie – Eminem feat. Rihanna
- **2011:** California Gurls – Katy Perry feat. Snoop Dogg
- **2011:** Party Rock Anthem – LMFAO feat. Lauren Bennett and GoonRock
- **2012:** As Long As You Love Me – Justin Bieber feat. Big Sean
- **2013:** Wake Me Up - Avicii
- **2013:** Wrecking Ball – Miley Cyrus
- **2014:** Turn Down For What – DJ Snake and Lil Jon
- **2015:** See You Again – Wiz Khalifa feat. Charlie Puth

Song List 2

- **1996:** Because You Loved Me – Celine Dion
- **1997:** MMMbop – Hanson
- **1998:** All My Life – K-Ci and JoJo
- **1999:** Livin' la Vida Loca – Ricky Martin
- **2000:** I Knew I Loved You – Savage Garden
- **2001:** Drops of Jupiter – Train
- **2001:** Fallin' – Alicia Keys
- **2002:** Hero – Enrique Iglesias
- **2003:** Lose Yourself – Eminem
- **2004:** The Reason – Hoobastank
- **2005:** Behind These Hazel Eyes – Kelly Clarkson
- **2005:** Gold Digger – Kanye West feat. Jaimie Foxx
- **2006:** SOS – Rihanna
- **2007:** Before He Cheats – Carrie Underwood

- **2007:** Hey There Delilah – Plain White T's
- **2008:** No Air – Jordin Sparks and Chris Brown
- **2009:** I Gotta Feeling – The Black Eyed Peas
- **2009:** I Know You Want Me (Calle Ocho) – PitBull
- **2010:** Mine – Taylor Swift
- **2011:** Someone Like You – Adele
- **2012:** Lights – Ellie Goulding
- **2013:** Can't Hold Us – Macklemore and Ryan Lewis feat. Ray Dalton
- **2014:** All About That Bass – Meghan Trainor
- **2014:** Story of My Life – One Direction
- **2015:** Thinking Out Loud – Ed Sheeran

Song List 3

- **1996:** It's All Coming Back to Me Now – Celine Dion
- **1996:** Macarena – Los del Rio
- **1997:** Something About the Way You Look Tonight – Elton John
- **1998:** Truly Madly Deeply – Savage Garden
- **1998:** Tubthumping – Chumbawamba
- **1999:** Genie in a Bottle – Christina Aguilera
- **2000:** Say My Name – Destiny's Child
- **2000:** Kryptonite – 3 Doors Down
- **2001:** Thank You – Dido
- **2002:** Wherever You Will Go – The Calling
- **2003:** In da Club – 50 Cent
- **2003:** Bring Me to Life – Evanescence feat. Paul McCoy
- **2004:** If I Ain't Got You – Alicia Keys
- **2005:** Boulevard of Broken Dreams – Green Day
- **2006:** Hips Don't Lie – Shakira feat. Wyclef Jean
- **2007:** Apologize – Timbaland feat. One Republic
- **2008:** I'm Yours – Jason Mraz
- **2010:** Bad Romance – Lady Gaga
- **2011:** Firework – Katy Perry
- **2012:** Call My Maybe – Carly Rae Jepsen
- **2013:** Thrift Shop – Macklemore
- **2014:** Let It Go – Idina Menzel
- **2014:** Talk Dirty to Me – Jason Derulo
- **2015:** Shut Up and Dance – Walk The Moon

Song List 4

- **1996:** California Love – 2 Pac feat. Dr. Dre
- **1997:** Wannabe – Spice Girls
- **1998:** My Heart Will Go On – Celine Dion
- **1999: …**Baby One More Time – Britney Spears
- **2000:** Bye Bye Bye – 'Nsync

- **2001:** Independent Women– Destiny's Child
- **2001:** Hanging By a Moment – Lifehouse
- **2002:** How You Remind Me – Nickelback
- **2002:** Hot in Herre – Nelly
- **2003:** Hey Ya! - Outkast
- **2004:** Yeah! – Usher feat. Lil John and Ludacris
- **2005:** American Idiot – Green Day
- **2006:** Breaking Free – High School Musical
- **2006:** Crazy – Gnarls Barkley
- **2007:** How to Save A Life – The Fray
- **2008:** With You – Chris Brown
- **2009:** Heartless – Kanye West
- **2009:** You Belong With Me – Taylor Swift
- **2010:** Airplanes – BoB and Hayley Williams
- **2011:** Grenade – Bruno Mars
- **2012:** Some Nights – Fun.
- **2013:** Ho Hey – The Lumineers
- **2014:** All of Me – John Legend
- **2015:** Sugar – Maroon5
- **2015:** Take Me to Church – Hozier

Song List 5

- **1996:** One Sweet Day – Boyz II Men and Mariah Carey
- **1997:** Quit Playing Games (With My Heart) – Backstreet Boys
- **1997:** Un-break My Heart – Toni Braxton
- **1998:** You're Still The One – Shania Twain
- **1999:** Every Morning – Sugar Ray
- **2000:** I Wanna Know – Joe
- **2000:** That's the Way It Is – Celine Dion
- **2001:** Love Don't Cost a Thing – Jennifer Lopez
- **2002:** The Middle – Jimmy Eat World
- **2003:** Beautiful – Christina Aguilera
- **2004:** This Love – Maroon 5
- **2005:** Photograph – Nickelback
- **2006:** SexyBack – Justin Timberlake feat. Timbaland
- **2006:** You're Beautiful – James Blunt
- **2007:** Umbrella – Rihanna feat. Jay-Z
- **2008: I** Kissed a Girl – Katy Perry
- **2009:** The Climb – Miley Cyrus
- **2010:** Dynamite – Taio Cruz
- **2011:** Give Me Everything – Pitbull feat. Ne-Yo, Afrojack, and Nayer
- **2012:** We Are Never Getting Back Together – Taylor Swift
- **2012:** Wild Ones – Flo Rida feat. Sia
- **2013:** Blurred Lines – Robin Thicke feat. T.I. and Pharrell Williams

- **2014:** Happy – Pharrell Williams
- **2015:** Blank Space – Taylor Swift
- **2015:** Earned It – The Weeknd

Song List 6

- **1996:** Always Be My Baby – Mariah Carey
- **1997:** I Believe I Can Fly – R Kelly
- **1998:** Too Close – Next
- **1999:** I Want It That Way – Backstreet Boys
- **1999:** Believe – Cher
- **2000:** All The Small Things – Blink 182
- **2001:** Let Me Blow Ya Mind – Eve feat. Gwen Stefani
- **2002:** Complicated – Avril Lavigne
- **2003:** Where is The Love? – The Black Eyed Peas
- **2003:** Here Without You – 3 Doors Down
- **2004:** Numb – Linkin Park
- **2005:** Don't Phunk With My Heart – The Black Eyed Peas
- **2006:** Bad Day – Daniel Powter
- **2007:** Apologize – Timbaland feat. One Republic
- **2007:** Irreplaceable – Beyoncé
- **2007:** Say It Right – Nelly Furtado
- **2008:** Bleeding Love – Leona Lewis
- **2008:** Love In This Club – Usher
- **2009:** Right Round – FloRida
- **2009:** Single Ladies (Put a Ring on It) – Beyoncé
- **2010:** I Like It – Enrique Iglesias feat. Pitbull
- **2011:** Moves Like Jagger – Maroon 5 feat. Christina Aguilera
- **2012:** What Makes You Beautiful – One Direciton
- **2012:** We Found Love – Rihanna feat. Calvin Harris
- **2013:** I Knew You Were Trouble – Taylor Swift
- **2014:** Fancy – Iggy Azalea feat. Charli XCX
- **2015:** Uptown Funk – Mark Ronson feat. Bruno Mars

Table 35. Study 1: Inter-correlations between music cue experience ratings, knowledge, if an AM was evoked, if an emotional elaboration was given, and emotional elaboration qualities (Part 1 of 2).

	EMO VAL	FAM	EMO INT	AM EVO	NEG EMO	POS EMO	REL	ENJ	SNG REC	TIT ACC	ART ACC	YRS AW
EMO VAL	-	**.48****	**.30****	**.28****	**-.28****	**.72****	**.57****	**.73****	.15**	**.30****	**.30****	-.10**
FAM		-	**.26****	**.38****	-.05**	**.51****	**.66****	**.59****	**.48****	**.59****	**.58****	**-.29****
EMO INT			-	.17**	.05**	**.31****	**.36****	**.29****	.16**	.16**	.17**	-.07**
AM EVO				-	-.02	**.28****	**.37****	**.29****	.17**	**.28****	**.25****	-.10**
NEG EMO					-	**-.28****	-.04**	**-.25****	.03**	-.03**	-.03**	.00
POS EMO						-	**.57****	**.76****	.16**	**.31****	**.31****	-.09**
REL							-	**.63****	**.28****	**.42****	**.42****	-.16**
ENJ								-	**.21****	**.37****	**.35****	-13**
SNG REC									-	**.41****	**.40****	**-.44****
TIT ACC										-	**.53****	**-.26****
ART ACC											-	**-.29****
YRS AW												-

Note 1. Due to space constraints, the correlation matrix is presented in two parts.
Note 2. * - $p < .05$, ** - $p < .01$. Due to the large number of comparisons, only r values of .20 or larger were highlighted.
Note 3. EMO VAL = emotional valence (1-9), FAM = familiarity (1-9), EMO INT = emotional intensity (1-9), NEG EMO = negative emotion (1-9), POS EMO = positive emotion (1-9), REL = relevance (1-9), ENJ = enjoyment (1-9), SNG REC = song recency, TIT ACC = title accuracy (0-2), ART ACC = artist accuracy (0-2), YRS AW = year accuracy; absolute value of number of years away from year released.

Table 36. Study 1: Inter-correlations between music cue experience ratings, knowledge, if an AM was evoked, if an emotional elaboration was given, and emotional elaboration qualities (Part 2 of 2).

	NOS	ER EL	ER POS	ER NEG	ER NEU	ER MIX
EMO VAL	**.20****	.14**	**.45****	**-.38****	**-.22****	.11**
FAM	**.20****	.12**	**.26****	-.13**	**-30****	.13**
EMO INT	.10**	.10**	.12**	-.02	**-.17****	.11**
AM EVO	**.20****	**.20****	**.18****	-.08**	**-.20****	.10**
NEG EMO	-.05**	.11	**-.40****	**.56****	-.08**	.01
POS EMO	**.20****	**.16****	**.52****	**-.46****	**-.22****	.11**
REL	**.22****	**.17****	**.29****	-.13**	**-.28****	.13**
ENJ	**.21****	.13**	**.48****	**-.38****	**-.27****	.13**
SNG REC	.00	.03*	.08**	.01	-.14**	.00
TIT ACC	.14**	.08**	.15**	-.07**	**-.17****	.05*
ART ACC	.14**	.07**	**.20****	-.09**	**-.22****	.05*
YRS AW	-.04*	.02	-.06*	-.02	.09**	-.02
NOS	-	.19**	-.13**	-.11**	-.13**	**.64****
ER EL		-	.03	.01	.01	.01
ER POS			-	**-.56****	**-.39****	-.09**
ER NEG				-	**-20****	.04
ER NEU					-	-.09**
ER MIX						-

Note 1. * - $p < .05$, ** - $p < .01$. Due to the large number of comparisons, only *r* values of .20 or larger were highlighted.

Note 2. EMO VAL = emotional valence (1-9), FAM = familiarity (1-9), EMO INT = emotional intensity (1-9), NEG EMO = negative emotion (1-9), POS EMO = positive emotion (1-9), REL = relevance (1-9), ENJ = enjoyment (1-9), SNG REC = year the song was released, TIT ACC = title accuracy (0-2), ART ACC = artist accuracy (0-2), YRS AW = year item accuracy; absolute value of number of years away from year released, NOS = nostalgia, ER ELAB = emotional response elaboration provided (1-yes, 0-no), ER POS = emotional response positive (1-yes, 0-no), ER NEG = emotional response negative (1-yes, 0-no), ER NEU = emotional response neutral (1-yes, 0-no), ER MIX= emotional response mixed (1-yes, 0-no).

Appendix E: Study 1 The Database

The database is presented separately by year (two parts per year). Both tables for each year present the song title, song artist, year of popularity, number of participants who rated the given song, and the number and percentage of participants (out of those rating a given song) that responded that the song evoked a specific event autobiographical memory. Table 1 for each year also presents the mean ratings of all participants rating a given song for the emotion measures (emotional valence, emotional intensity, negative emotion, positive emotion), enjoyment, and relevance. Table 2 for each year also presents the means for the knowledge (title, artist, year accuracy) and familiarity measures. Each pair of tables is presented chronologically below beginning with songs sampled from 1996.

Recall that the following variables were measured on 9-point Likert scales: emotional valence, emotional intensity, negative emotion, positive emotion, enjoyment, relevance, and familiarity. Except emotional valence, which was measured from 1 (*very negative*) to 9 (*very positive*), all Likert measures were rated from 1 (*low*) to 9 (*high*). Title and artist accuracy knowledge responses were coded as 0 (*incorrect*), 1 (*partially correct*), and 2 (*entirely correct*). Year accuracy was calculated as an absolute measure of years away from the year of popularity (song year). For example, for a song popular in 2013, if one participant responded with “2011” and another participant responded with “2015”, both received a score of 2 on this “years away” accuracy measure.

Table 37. Study 1 Database: 1996 (Part 1 of 2: Emotion measures, enjoyment, and relevance).

Song Information				AM	Emotional Measures				Other	
SNG TIT	SNG ART	SNG YR	N	AM EVO	EMO VAL	EMO INT	NEG EMO	POS EMO	ENJ	REL
California Love	2Pac feat Dr. Dre	1996	45	9(20.00%)	4.93(1.96)	3.16(2.34)	2.49(1.94)	4.16(2.74)	4.44(2.41)	2.89(2.30)
Always Be My Baby	Mariah Carey	1996	39	8(20.51%)	5.08(1.99)	3.37(2.38)	1.71(1.23)	4.32(2.57)	5.00(2.61)	2.82(2.44)
Because You Loved Me	Celine Dion	1996	41	6(14.63%)	4.63(2.19)	3.43(2.42)	2.85(2.28)	4.13(2.51)	4.30(2.40)	2.78(2.52)
Ironic	Alanis Morrisette	1996	39	12(30.77%)	4.74(2.21)	3.34(2.06)	2.47(1.87)	4.84(2.43)	4.84(2.30)	3.45(2.31)
It's All Coming Back	Celine Dion	1996	41	6(14.63%)	5.02(2.10)	3.54(2.45)	2.49(2.08)	4.55(2.33)	4.56(2.38)	2.27(1.94)
Macarena	Los del Rio	1996	41	32(78.05%)	6.70(2.05)	3.75(2.23)	1.49(1.43)	6.63(2.27)	6.37(2.38)	5.28(2.32)
One Sweet Day	Mariah Carey and Boyz II Men	1996	41	5(12.20%)	4.46(2.03)	3.44(2.26)	2.34(1.82)	4.17(2.24)	4.17(2.18)	2.17(2.01)

Note 1. SNG TIT = song title, SNG ART = song artist, SNG YR = year of popularity, N = number of participants rating the song, AM EVO = specific AM evoked, EMO VAL = emotional valence, EMO INT = emotional intensity, NEG EMO = negative emotion, POS EMO = positive emotion, ENJ = enjoyment, REL = personal relevance.
Note 2. M(SD) provided.

Table 38. Study 1 Database: 1996 (Part 2 of 2: Familiarity and knowledge measures).

Song Information				AM	Knowledge Measures			
SNG TIT	SNG ART	SNG YR	N	AM EVO	FAM	TIT ACC	ART ACC	YR ACC
California Love	2Pac feat Dr. Dre	1996	45	9(20.00%)	4.11(2.93)	1.18(0.81)	0.84(1.00)	4.84(4.67)
Always Be My Baby	Mariah Carey	1996	39	8(20.51%)	3.90(2.72)	0.79(0.83)	0.82(1.00)	7.04(3.14)
Because You Loved Me	Celine Dion	1996	41	6(14.63%)	3.68(2.80)	1.07(0.96)	0.68(0.96)	4.93(3.29)
Ironic	Alanis Morrisette	1996	39	12(30.77%)	4.92(3.07)	0.36(0.71)	0.31(0.73)	8.38(4.11)
It's All Coming Back	Celine Dion	1996	41	6(14.63%)	2.45(2.24)	0.12(0.46)	0.63(0.94)	5.25(3.02)
Macarena	Los del Rio	1996	41	32(78.05%)	7.80(1.51)	1.85(0.48)	0.20(0.60)	5.31(5.02)
One Sweet Day	Mariah Carey and Boyz II Men	1996	41	5(12.20%)	2.30(2.00)	0.05(0.31)	0.54(0.90)	6.18(3.02)

Note 1. SNG TIT = song title, SNG ART = song artist, SNG YR = year of popularity, N = number of participants rating the song, AM EVO = specific AM evoked, FAM = familiarity, TIT ACC = title accuracy, ART ACC = artist accuracy, YR ACC = year accuracy (years away from song year, absolute value)
Note 2. M(SD) provided.

Table 39. Study 1 Database: 1997 (Part 1 of 2: Emotion measures, enjoyment, and relevance).

Song Information				AM	Emotional Measures					Other
SNG TIT	SNG ART	SNG YR	N	AM EVO	EMO VAL	EMO INT	NEG EMO	POS EMO	ENJ	REL
I'll Be Missing You	Puff Daddy feat. Faith Evans and 112	1997	40	12(30.00%)	5.67(1.96)	4.29(2.34)	2.16(1.62)	5.55(2.04)	5.92(2.17)	4.18(2.47)
MMMBop	Hanson	1997	41	5(12.20%)	5.05(2.54)	3.10(2.31)	2.10(1.92)	4.95(2.67)	4.88(2.85)	2.02(1.98)
Quit Playing Games (With My Heart)	Backstreet Boys	1997	41	10(24.39%)	4.53(1.99)	3.25(2.02)	2.63(2.11)	3.98(2.54)	4.39(2.21)	3.29(2.49)
I Believe I Can Fly	R. Kelly	1997	39	19(48.72%)	5.46(1.45)	3.85(2.35)	2.03(1.60)	5.36(2.11)	5.90(1.73)	4.62(1.90)
Something About the Way You Look Tonight	Elton John	1997	41	5(12.20%)	4.79(1.78)	2.61(2.31)	1.97(1.68)	4.20(2.39)	4.40(2.23)	2.23(1.92)
Un-break My Heart	Toni Braxton	1997	41	3(7.32%)	4.32(1.94)	3.29(2.47)	2.78(2.02)	3.27(2.11)	3.83(2.16)	2.20(1.89)
Wannabe	Spice Girls	1997	45	25(55.56%)	6.27(2.09)	4.59(2.47)	1.95(1.76)	6.34(2.47)	6.41(2.55)	5.16(2.97)

Note 1. SNG TIT = song title, SNG ART = song artist, SNG YR = year of popularity, N = number of participants rating the song, AM EVO = specific AM evoked, EMO VAL = emotional valence, EMO INT = emotional intensity, NEG EMO = negative emotion, POS EMO = positive emotion, ENJ = enjoyment, REL = personal relevance.
Note 2. M(SD) provided.

Table 40. Study 1 Database: 1997 (Part 2 of 2: Familiarity and knowledge measures).

Song Information				AM		Knowledge Measures		
SNG TIT	SNG ART	SNG YR	N	AM EVO	FAM	TIT ACC	ART ACC	YR ACC
I'll Be Missing You	Puff Daddy feat. Faith Evans and 112	1997	40	12(30.00%)	5.49(2.67)	0.63(0.87)	0.10(0.44)	5.62(3.63)
MMMBop	Hanson	1997	41	5(12.20%)	2.68(2.61)	0.15(0.53)	0.07(0.35)	4.75(3.57)
Quit Playing Games (With My Heart)	Backstreet Boys	1997	41	10(24.39%)	4.63(2.66)	1.07(0.69)	0.83(0.97)	4.76(3.42)
I Believe I Can Fly	R. Kelly	1997	39	19(48.72%)	6.92(1.66)	1.67(0.66)	0.46(0.85)	3.83(2.83)
Something About the Way You Look Tonight	Elton John	1997	41	5(12.20%)	2.25(1.98)	0.46(0.67)	0.24(0.66)	5.39(6.85)
Un-break My Heart	Toni Braxton	1997	41	3(7.32%)	3.32(2.03)	0.34(0.76)	0.02(0.16)	3.92(3.35)
Wannabe	Spice Girls	1997	45	25(55.56%)	7.18(2.07)	0.71(0.76)	1.51(0.87)	4.00(3.42)

Note 1. SNG TIT = song title, SNG ART = song artist, SNG YR = year of popularity, N = number of participants rating the song, AM EVO = specific AM evoked, FAM = familiarity, TIT ACC = title accuracy, ART ACC = artist accuracy, YR ACC = year accuracy (years away from song year, absolute value)
Note 2. M(SD) provided.

Table 41. Study 1 Database: 1998 (Part 1 of 2: Emotion measures, enjoyment, and relevance).

Song Information				AM	Emotional Measures				Other	
SNG TIT	SNG ART	SNG YR	N	AM EVO	EMO VAL	EMO INT	NEG EMO	POS EMO	ENJ	REL
All My Life	K-Ci and JoJo	1998	41	1(2.44%)	4.21(1.70)	2.85(2.21)	3.00(2.15)	3.53(2.03)	3.55(1.96)	2.15(1.98)
Everybody (Backstreet's Back)	Backstreet Boys	1998	40	20(50.00%)	6.53(2.11)	4.25(4.23)	1.67(1.28)	6.65(2.30)	6.80(2.19)	4.70(2.88)
My Heart Will Go On	Celine Dion	1998	45	15(33.33%)	5.95(1.98)	5.40(2.65)	2.89(2.17)	5.45(2.64)	5.95(2.22)	4.77(2.73)
Too Close	Next	1998	39	3(7.69%)	4.36(1.81)	2.54(1.69)	1.75(1.30)	4.44(2.14)	4.17(2.05)	2.08(1.84)
Truly Madly Deeply	Savage Garden	1998	41	3(7.32%)	4.46(1.89)	2.70(2.15)	1.78(1.19)	4.55(2.63)	4.83(2.24)	2.78(2.36)
Tubthumping	Chumbawamba	1998	41	6(14.63%)	5.60(2.26)	3.44(2.12)	1.54(1.14)	5.95(2.24)	5.76(2.54)	3.25(2.38)
You're Still the One	Shania Twain	1998	41	18(43.90%)	5.70(1.99)	4.95(2.44)	2.08(1.73)	5.63(2.59)	5.88(2.42)	4.90(2.68)

Note 1. SNG TIT = song title, SNG ART = song artist, SNG YR = year of popularity, N = number of participants rating the song, AM EVO = specific AM evoked, EMO VAL = emotional valence, EMO INT = emotional intensity, NEG EMO = negative emotion, POS EMO = positive emotion, ENJ = enjoyment, REL = personal relevance.
Note 2. M(SD) provided.

Table 42. Study 1 Database: 1998 (Part 2 of 2: Familiarity and knowledge measures).

Song Information				AM	Knowledge Measures			
SNG TIT	SNG ART	SNG YR	N	AM EVO	FAM	TIT ACC	ART ACC	YR ACC
All My Life	K-Ci and JoJo	1998	41	1(2.44%)	2.08(1.91)	0.63(0.94)	0.15(0.53)	3.35(3.17)
Everybody (Backstreet's Back)	Backstreet Boys	1998	40	20(50.00%)	6.75(2.59)	0.83(0.98)	1.60(0.81)	4.11(2.92)
My Heart Will Go On	Celine Dion	1998	45	15(33.33%)	6.71(2.27)	1.13(0.89)	1.27(0.96)	3.84(6.45)
Too Close	Next	1998	39	3(7.69%)	2.18(2.04)	0.28(0.69)	0.15(0.54)	3.90(4.09)
Truly Madly Deeply	Savage Garden	1998	41	3(7.32%)	3.30(2.65)	0.10(0.44)	0.10(0.44)	4.38(3.45)
Tubthumping	Chumbawamba	1998	41	6(14.63%)	4.65(2.60)	0.05(0.31)	0.15(0.53)	4.75(4.06)
You're Still the One	Shania Twain	1998	41	18(43.90%)	5.60(2.85)	0.78(0.61)	1.22(0.99)	4.66(2.59)

Note 1. SNG TIT = song title, SNG ART = song artist, SNG YR = year of popularity, N = number of participants rating the song, AM EVO = specific AM evoked, FAM = familiarity, TIT ACC = title accuracy, ART ACC = artist accuracy, YR ACC = year accuracy (years away from song year, absolute value)
Note 2. M(SD) provided.

Table 43. Study 1 Database: 1999 (Part 1 of 2: Emotion measures, enjoyment, and relevance).

Song Information				AM	Emotional Measures				Other	
SNG TIT	SNG ART	SNG YR	N	AM EVO	EMO VAL	EMO INT	NEG EMO	POS EMO	ENJ	REL
All Star	Smash Mouth	1999	40	24(60.00%)	7.03(1.91)	5.69(2.50)	1.64(1.42)	6.79(2.28)	7.00(2.12)	6.11(2.67)
…Baby One More Time	Britney Spears	1999	45	20(44.44%)	5.98(1.97)	3.71(2.23)	2.02(1.49)	5.53(2.48)	6.24(1.92)	4.68(2.49)
I Want It That Way	Backstreet Boys	1999	39	22(56.41%)	6.51(2.16)	4.85(2.74)	1.92(1.69)	6.72(2.21)	7.18(2.16)	5.23(2.73)
Believe	Cher	1999	39	8(20.51%)	5.67(2.57)	3.59(2.21)	1.64(1.33)	5.51(2.59)	6.03(2.75)	3.34(2.46)
Every Morning	Sugar Ray	1999	41	6(14.63%)	4.56(1.84)	2.39(1.69)	2.24(1.87)	4.17(2.42)	4.51(2.18)	2.34(1.81)
Genie in a Bottle	Christina Aguilera	1999	41	7(17.07%)	5.40(1.85)	3.05(2.45)	1.78(1.53)	5.39(2.19)	5.12(2.37)	2.85(2.05)
Livin' la Vida Loca	Ricky Martin	1999	40	13(32.50%)	5.25(1.97)	3.40(1.86)	2.08(1.44)	5.48(2.34)	5.70(1.95)	3.43(2.16)
No Scrubs	TLC	1999	39	9(23.08%)	5.56(1.97)	3.70(2.22)	1.84(1.07)	5.47(2.51)	5.69(2.54)	3.97(2.92)

Note 1. SNG TIT = song title, SNG ART = song artist, SNG YR = year of popularity, N = number of participants rating the song, AM EVO = specific AM evoked, EMO VAL = emotional valence, EMO INT = emotional intensity, NEG EMO = negative emotion, POS EMO = positive emotion, ENJ = enjoyment, REL = personal relevance.
Note 2. M(SD) provided.

Table 44. Study 1 Database: 1999 (Part 2 of 2: Familiarity and knowledge measures).

Song Information				AM	Knowledge Measures			
SNG TIT	SNG ART	SNG YR	N	AM EVO	FAM	TIT ACC	ART ACC	YR ACC
All Star	Smash Mouth	1999	40	24(60.00%)	7.75(1.88)	1.25 (0.93)	0.88 (0.99)	5.39 (3.14)
…Baby One More Time	Britney Spears	1999	45	20(44.44%)	7.27(1.76)	1.62 (0.68)	1.64 (0.77)	3.72 (2.33)
I Want It That Way	Backstreet Boys	1999	39	22(56.41%)	7.38(1.90)	1.51 (0.85)	1.59 (0.79)	2.46 (2.15)
Believe	Cher	1999	39	8(20.51%)	6.15(2.59)	0.85 (0.88)	0.87 1.01)	4.76 (5.11)
Every Morning	Sugar Ray	1999	41	6(14.63%)	3.24(2.08)	0.20 (0.60)	0.10 (0.44)	3.96 (4.31)
Genie in a Bottle	Christina Aguilera	1999	41	7(17.07%)	4.55(2.98)	1.37 (0.94)	0.63 (0.94)	4.00 (2.70)
Livin' la Vida Loca	Ricky Martin	1999	40	13(32.50%)	5.46(2.48)	1.15 (0.74)	0.45 (0.82)	3.87 (4.14)
No Scrubs	TLC	1999	39	9(23.08%)	5.23(2.31)	0.67 (0.81)	0.54 (0.88)	3.18 (3.24)

Note 1. SNG TIT = song title, SNG ART = song artist, SNG YR = year of popularity, N = number of participants rating the song, AM EVO = specific AM evoked, FAM = familiarity, TIT ACC = title accuracy, ART ACC = artist accuracy, YR ACC = year accuracy (years away from song year, absolute value)
Note 2. M(SD) provided.

Table 45. Study 1 Database: 2000 (Part 1 of 2: Emotion measures, enjoyment, and relevance).

Song Information				AM	Emotional Measures				Other	
SNG TIT	SNG ART	SNG YR	N	AM EVO	EMO VAL	EMO INT	NEG EMO	POS EMO	ENJ	REL
All The Small Things	Blink 182	2000	39	9(23.08%)	5.62(2.42)	3.36(2.53)	1.51(1.14)	4.97(2.70)	5.77(2.51)	3.92(2.82)
Breathe	Faith Hill	2000	40	7(17.50%)	4.53(2.31)	3.15(2.20)	1.95(1.68)	4.20(2.68)	4.60(2.65)	2.41(1.86)
Say My Name	Destiny's Child	2000	40	11(27.50%)	6.55(1.89)	3.92(2.81)	1.58(1.13)	6.46(2.29)	6.68(2.20)	4.70(2.75)
I Knew I Loved You	Savage Garden	2000	41	3(7.32%)	4.32(2.11)	2.90(2.47)	2.41(2.09)	3.80(2.27)	3.60(1.97)	2.10(1.53)
I Wanna Know	Joe	2000	39	0(0%)	4.21(1.94)	2.03(1.55)	2.03(1.87)	3.28(2.21)	3.41(2.16)	1.95(1.70)
Kryptonite	3 Doors Down	2000	41	6(14.63%)	4.40(2.02)	2.23(1.87)	2.28(1.71)	4.63(2.27)	4.39(2.23)	2.12(1.85)
Bye Bye Bye	'NSync	2000	45	23(51.11%)	6.07(1.97)	4.44(2.26)	1.76(1.51)	5.96(2.26)	6.18(2.21)	5.07(2.40)
That's The Way It Is	Celine Dion	2000	40	10(25.00%)	5.43(2.01)	3.90(2.44)	2.03(1.69)	5.35(2.39)	5.35(2.50)	3.20(2.50)

Note 1. SNG TIT = song title, SNG ART = song artist, SNG YR = year of popularity, N = number of participants rating the song, AM EVO = specific AM evoked, EMO VAL = emotional valence, EMO INT = emotional intensity, NEG EMO = negative emotion, POS EMO = positive emotion, ENJ = enjoyment, REL = personal relevance.
Note 2. M(SD) provided.

Table 46. Study 1 Database: 2000 (Part 2 of 2: Familiarity and knowledge measures).

Song Information				AM	Knowledge Measures			
SNG TIT	SNG ART	SNG YR	N	AM EVO	FAM	TIT ACC	ART ACC	YR ACC
All The Small Things	Blink 182	2000	39	9(23.08%)	5.13(2.94)	0.31(0.73)	0.62(0.94)	3.45(3.11)
Breathe	Faith Hill	2000	40	7(17.50%)	2.79(2.54)	0.13(0.46)	0.10(0.44)	5.80(3.18)
Say My Name	Destiny's Child	2000	40	11(27.50%)	6.82(2.36)	2.00(0.00)	1.25(0.90)	3.67(3.10)
I Knew I Loved You	Savage Garden	2000	41	3(7.32%)	2.68(2.06)	0.59(0.81)	0.12(0.46)	4.44(6.05)
I Wanna Know	Joe	2000	39	0(0%)	1.95(1.72)	0.64(0.90)	0.05(0.32)	3.68(4.34)
Kryptonite	3 Doors Down	2000	41	6(14.63%)	3.29(2.59)	0.71(0.96)	0.29(0.72)	4.25(2.23)
Bye Bye Bye	'NSync	2000	45	23(51.11%)	6.58(2.57)	1.49(0.76)	1.16(0.98)	4.12(8.50)
That's The Way It Is	Celine Dion	2000	40	10(25.00%)	4.38(2.80)	0.85(0.92)	0.80(0.99)	5.04(3.86)

Note 1. SNG TIT = song title, SNG ART = song artist, SNG YR = year of popularity, N = number of participants rating the song, AM EVO = specific AM evoked, FAM = familiarity, TIT ACC = title accuracy, ART ACC = artist accuracy, YR ACC = year accuracy (years away from song year, absolute value)
Note 2. M(SD) provided.

Table 47. Study 1 Database: 2001 (Part 1 of 2: Emotion measures, enjoyment, and relevance).

Song Information				AM	Emotional Measures				Other	
SNG TIT	SNG ART	SNG YR	N	AM EVO	EMO VAL	EMO INT	NEG EMO	POS EMO	ENJ	REL
Independent Women	Destiny's Child	2001	45	6(13.33%)	5.07(2.17)	3.13(2.42)	2.09(1.81)	4.33(2.63)	4.64(2.32)	3.00(2.38)
Drops of Jupiter	Train	2001	41	19(46.34%)	6.20(2.19)	4.78(2.62)	2.00(1.67)	6.33(2.41)	6.80(2.20)	5.10(1.52)
Fallin'	Alicia Keys	2001	41	4(9.76%)	4.85(1.77)	3.29(2.00)	2.32(1.97)	4.29(2.36)	5.44(1.87)	3.05(2.26)
Hanging by a Moment	Lifehouse	2001	45	4(8.89%)	5.32(1.89)	3.81(2.83)	1.89(1.53)	4.16(2.79)	5.16(2.45)	3.16(2.66)
I'm Real	Jennifer Lopz feat. Ja Rule	2001	40	4(10.00%)	4.74(1.84)	2.77(1.84)	2.03(1.50)	4.05(2.12)	4.26(2.32)	2.24(1.99)
Love Don't Cost a Thing	Jennifer Lopez	2001	41	7(17.07%)	5.32(2.16)	2.98(2.13)	1.76(1.56)	4.71(2.93)	5.12(2.54)	3.07(2.55)
Let Me Blow Ya Mind	Eve feat. Gwen Stefani	2001	39	3(7.69%)	4.38(2.06)	2.46(1.98)	1.78(1.36)	4.08(2.43)	4.30(2.21)	2.19(1.76)
Thank You	Dido	2001	41	6(14.63%)	5.15(1.88)	3.00(2.04)	1.71(1.19)	5.27(2.40)	5.17(2.30)	2.66(1.73)

Note 1. SNG TIT = song title, SNG ART = song artist, SNG YR = year of popularity, N = number of participants rating the song, AM EVO = specific AM evoked, EMO VAL = emotional valence, EMO INT = emotional intensity, NEG EMO = negative emotion, POS EMO = positive emotion, ENJ = enjoyment, REL = personal relevance.
Note 2. M(SD) provided.

Table 48. Study 1 Database: 2001 (Part 2 of 2: Familiarity and knowledge measures).

Song Information				AM	Knowledge Measures			
SNG TIT	SNG ART	SNG YR	N	AM EVO	FAM	TIT ACC	ART ACC	YR ACC
Independent Women	Destiny's Child	2001	45	6(13.33%)	3.89(2.75)	0.51(0.82)	0.89(0.98)	4.00(3.12)
Drops of Jupiter	Train	2001	41	19(46.34%)	6.56(2.49)	0.90(1.00)	0.83(0.99)	5.27(3.51)
Fallin'	Alicia Keys	2001	41	4(9.76%)	4.41(2.63)	0.54(0.81)	0.54(0.90)	4.85(3.12)
Hanging by a Moment	Lifehouse	2001	45	4(8.89%)	3.77(2.84)	0.40(0.75)	0.33(0.74)	3.97(3.21)
I'm Real	Jennifer Lopz feat. Ja Rule	2001	40	4(10.00%)	2.48(2.50)	0.50(0.88)	0.18(0.55)	2.68(2.34)
Love Don't Cost a Thing	Jennifer Lopez	2001	41	7(17.07%)	4.29(2.86)	0.78(0.88)	0.29(0.68)	3.30(2.67)
Let Me Blow Ya Mind	Eve feat. Gwen Stefani	2001	39	3(7.69%)	2.79(2.39)	0.28(0.65)	0.21(0.62)	3.29(2.58)
Thank You	Dido	2001	41	6(14.63%)	3.95(2.43)	0.15(0.53)	0.15(0.53)	3.44(2.50)

Note 1. SNG TIT = song title, SNG ART = song artist, SNG YR = year of popularity, N = number of participants rating the song, AM EVO = specific AM evoked, FAM = familiarity, TIT ACC = title accuracy, ART ACC = artist accuracy, YR ACC = year accuracy (years away from song year, absolute value)
Note 2. M(SD) provided.

Table 49. Study 1 Database: 2002 (Part 1 of 2: Emotion measures, enjoyment, and relevance).

Song Information				AM	Emotional Measures				Other	
SNG TIT	SNG ART	SNG YR	N	AM EVO	EMO VAL	EMO INT	NEG EMO	POS EMO	ENJ	REL
Complicated	Avril Lavigne	2002	39	18(46.15%)	6.62(2.18)	5.36(2.53)	2.18(1.76)	6.49(2.20)	7.10(2.09)	5.59(2.82)
Don't Let Me Get Me	Pink	2002	40	6(15.00%)	4.65(1.78)	3.00(1.89)	2.23(1.66)	4.63(2.12)	4.08(2.23)	2.58(2.14)
Hero	Enrique Iglesias	2002	41	13(31.71%)	6.07(1.88)	4.49(2.31)	2.41(1.77)	5.44(2.29)	6.15(2.09)	3.76(2.23)
How You Remind Me	Nickelback	2002	45	15(33.33%)	5.67(1.76)	4.13(2.46)	2.31(1.78)	5.09(2.53)	5.80(2.32)	4.53(2.63)
In the End	Linkin Park	2002	40	15(37.50%)	5.28(2.58)	4.25(2.56)	2.78(2.19)	4.46(2.87)	4.87(2.95)	3.85(3.11)
The Middle	Jimmy Eat World	2002	41	18(43.90%)	6.29(1.69)	4.17(2.13)	1.73(1.12)	6.05(2.47)	6.37(2.34)	4.66(2.42)
Hot in Herre	Nelly	2002	45	16(35.56%)	6.36(1.77)	3.71(2.49)	1.91(1.55)	5.9(2.44)	6.51(2.12)	4.73(2.51)
Wherever You Will Go	The Calling	2002	41	8(19.51%)	4.39(1.77)	3.10(2.28)	2.58(2.14)	4.00(2.04)	4.39(2.23)	2.56(2.03)

Note 1. SNG TIT = song title, SNG ART = song artist, SNG YR = year of popularity, N = number of participants rating the song, AM EVO = specific AM evoked, EMO VAL = emotional valence, EMO INT = emotional intensity, NEG EMO = negative emotion, POS EMO = positive emotion, ENJ = enjoyment, REL = personal relevance.
Note 2. M(SD) provided.

Table 50. Study 1 Database: 2002 (Part 2 of 2: Familiarity and knowledge measures).

Song Information				AM	Knowledge Measures			
SNG TIT	SNG ART	SNG YR	N	AM EVO	FAM	TIT ACC	ART ACC	YR ACC
Complicated	Avril Lavigne	2002	39	18(46.15%)	7.33(2.13)	1.54(0.85)	1.38(0.94)	2.89(2.08)
Don't Let Me Get Me	Pink	2002	40	6(15.00%)	3.25(2.94)	0.15(0.53)	0.75(0.98)	3.88(3.70)
Hero	Enrique Iglesias	2002	41	13(31.71%)	6.05(2.50)	1.44(0.84)	0.93(1.01)	4.25(3.41)
How You Remind Me	Nickelback	2002	45	15(33.33%)	6.34(2.31)	0.78(0.85)	1.38(0.94)	2.59(2.21)
In The End	Linkin Park	2002	40	15(37.50%)	4.85(3.23)	0.63(0.93)	1.00(1.01)	4.71(3.32)
The Middle	Jimmy Eat World	2002	41	18(43.90%)	6.05(2.38)	0.41(0.81)	0.44(0.84)	2.87(2.05)
Hot in Herre	Nelly	2002	45	16(35.56%)	6.91(2.12)	1.22(0.80)	0.80(0.99)	2.59(2.24)
Wherever You Will Go	The Calling	2002	41	8(19.51%)	3.34(2.51)	0.41(0.67)	0.10(0.44)	3.87(3.02)

Note 1. SNG TIT = song title, SNG ART = song artist, SNG YR = year of popularity, N = number of participants rating the song, AM EVO = specific AM evoked, FAM = familiarity, TIT ACC = title accuracy, ART ACC = artist accuracy, YR ACC = year accuracy (years away from song year, absolute value)
Note 2. M(SD) provided.

Table 51. Study 1 Database: 2003 (Part 1 of 2: Emotion measures, enjoyment, and relevance).

Song Information				AM		Emotional Measures			Other	
SNG TIT	SNG ART	SNG YR	N	AM EVO	EMO VAL	EMO INT	NEG EMO	POS EMO	ENJ	REL
In da Club	50 Cent	2003	41	18(46.15%)	6.23(2.43)	4.00(2.54)	2.27(1.95)	6.00(2.35)	6.37(2.29)	4.22(2.78)
Beautiful	Christina Aguilera	2003	41	6(15.00%)	5.88(1.99)	5.35(2.14)	2.30(1.91)	5.93(2.32)	6.48(1.75)	5.05(2.37)
Crazy in Love	Beyoncé feat. Jay-Z	2003	40	13(31.71%)	6.66(2.17)	4.74(2.73)	1.42(0.83)	6.90(2.25)	6.76(2.56)	5.23(2.61)
Lose Yourself	Eminem	2003	41	15(33.33%)	6.39(1.67)	5.37(2.43)	2.41(1.76)	6.41(2.01)	7.20(1.66)	5.41(2.59)
Where is the Love?	The Black Eyed Peas	2003	39	15(37.50%)	6.56(1.79)	4.90(2.41)	2.56(1.96)	6.00(2.22)	7.05(1.89)	5.54(2.57)
Bring Me to Life	Evanescence feat. Paul McCoy	2003	41	18(43.90%)	4.88(1.95)	3.75(2.27)	3.05(2.19)	4.68(1.27)	5.00(2.53)	3.51(2.57)

Note 1. SNG TIT = song title, SNG ART = song artist, SNG YR = year of popularity, N = number of participants rating the song, AM EVO = specific AM evoked, EMO VAL = emotional valence, EMO INT = emotional intensity, NEG EMO = negative emotion, POS EMO = positive emotion, ENJ = enjoyment, REL = personal relevance.
Note 2. M(SD) provided.
Note 3. Due to an error in list construction, only 6 songs from 2003 were surveyed.

Table 52. Study 1 Database: 2003 (Part 2 of 2: Familiarity and knowledge measures).

Song Information				AM	Knowledge Measures			
SNG TIT	SNG ART	SNG YR	N	AM EVO	FAM	TIT ACC	ART ACC	YR ACC
In da Club	50 Cent	2003	41	9(23.08%)	6.07(2.81)	0.90(0.97)	0.98(1.01)	2.81(2.67)
Beautiful	Christina Aguilera	2003	41	7(17.50%)	6.80(2.19)	1.41(0.74)	0.88(1.01)	3.09(2.67)
Crazy in Love	Beyoncé feat. Jay-Z	2003	40	11(27.50%)	7.36(2.24)	1.43(0.90)	1.43(0.90)	3.47(2.96)
Lose Yourself	Eminem	2003	41	3(7.32%)	7.20(2.00)	1.24(0.97)	1.88(0.46)	3.23(2.70)
Where is the Love?	The Black Eyed Peas	2003	39	0(0%)	6.97(2.22)	1.64(0.78)	1.21(0.98)	3.31(2.38)
Bring Me to Life	Evanescence feat. Paul McCoy	2003	41	6(14.63%)	5.29(2.60)	0.24(0.66)	0.59(0.92)	2.79(1.96)

Note 1. SNG TIT = song title, SNG ART = song artist, SNG YR = year of popularity, N = number of participants rating the song, AM EVO = specific AM evoked, FAM = familiarity, TIT ACC = title accuracy, ART ACC = artist accuracy, YR ACC = year accuracy (years away from song year, absolute value)
Note 2. M(SD) provided.
Note 3. Due to an error in list construction, only 6 songs from 2003 were surveyed.

Table 53. Study 1 Database: 2004 (Part 1 of 2: Emotion measures, enjoyment, and relevance).

Song Information				AM	Emotional Measures				Other	
SNG TIT	SNG ART	SNG YR	N	AM EVO	EMO VAL	EMO INT	NEG EMO	POS EMO	ENJ	REL
Hey Ya!	Outkast	2004	85	42(49.41%)	6.58(2.16)	4.55(2.54)	1.66(1.22)	6.35(2.41)	6.71(2.39)	4.99(2.74)
Here Without You	3 Doors Down	2004	38	5(13.16%)	5.05(2.31)	4.53(2.58)	2.95(2.38)	4.43(2.77)	5.51(2.46)	4.11(2.63)
If I Ain't Got You	Alicia Keys	2004	41	7(17.07%)	6.08(2.00)	4.39(2.78)	2.03(1.90)	5.75(2.45)	6.17(2.14)	4.00(2.75)
My Immortal	Evanescence	2004	40	7(17.50%)	5.00(2.09)	4.97(2.58)	3.33(2.26)	4.41(2.69)	4.82(2.67)	3.85(2.92)
The Reason	Hoobastank	2004	41	6(14.63%)	5.22(1.97)	4.44(2.36)	2.95(2.31)	4.59(2.61)	5.35(2.34)	3.95(2.55)
This Love	Maroon 5	2004	41	12(29.27%)	6.12(2.06)	4.68(2.38)	2.07(1.95)	6.22(2.10)	6.98(1.81)	5.32(2.62)
Numb	Linkin Park	2004	39	11(28.21%)	5.23(2.37)	4.72(2.51)	2.87(2.07)	5.23(2.54)	5.97(2.70)	3.90(2.35)
Yeah!	Usher feat. Lil John and Ludacris	2004	45	21(46.67%)	6.33(1.82)	4.27(2.26)	2.09(1.69)	6.18(2.15)	6.58(1.85)	5.33(2.68)

Note 1. SNG TIT = song title, SNG ART = song artist, SNG YR = year of popularity, N = number of participants rating the song, AM EVO = specific AM evoked, EMO VAL = emotional valence, EMO INT = emotional intensity, NEG EMO = negative emotion, POS EMO = positive emotion, ENJ = enjoyment, REL = personal relevance.
Note 2. M(SD) provided.

Table 54. Study 1 Database: 2004 (Part 2 of 2: Familiarity and knowledge measures).

Song Information				AM		Knowledge Measures		
SNG TIT	SNG ART	SNG YR	N	AM EVO	FAM	TIT ACC	ART ACC	YR ACC
Hey Ya!	Outkast	2004	85	42(49.41%)	6.91(2.58)	1.35(0.91)	0.78(0.97)	3.36(3.71)
Here Without You	3 Doors Down	2004	38	5(13.16%)	5.13(2.76)	0.82(0.96)	0.47(0.86)	2.96(2.05)
If I Ain't Got You	Alicia Keys	2004	41	7(17.07%)	5.08(2.87)	0.90(0.97)	0.93(1.01)	3.32(2.81)
My Immortal	Evanescence	2004	40	7(17.50%)	4.10(3.07)	0.30(0.69)	0.70(0.97)	2.76(2.18)
The Reason	Hoobastank	2004	41	6(14.63%)	5.12(2.47)	0.63(0.80)	0.24(0.62)	2.97(1.93)
This Love	Maroon 5	2004	41	12(29.27%)	7.33(2.00)	0.93(1.01)	1.61(0.80)	3.44(2.80)
Numb	Linkin Park	2004	39	11(28.21%)	6.00(2.86)	1.08(0.98)	1.08(1.01)	2.16(1.77)
Yeah!	Usher feat. Lil John and Ludacris	2004	45	21(46.67%)	7.27(2.15)	1.56(0.84)	1.16(1.00)	2.87(1.93)

Note 1. SNG TIT = song title, SNG ART = song artist, SNG YR = year of popularity, N = number of participants rating the song, AM EVO = specific AM evoked, FAM = familiarity, TIT ACC = title accuracy, ART ACC = artist accuracy, YR ACC = year accuracy (years away from song year, absolute value)
Note 2. M(SD) provided.

Table 55. Study 1 Database: 2005 (Part 1 of 2: Emotion measures, enjoyment, and relevance).

Song Information				AM	Emotional Measures				Other	
SNG TIT	SNG ART	SNG YR	N	AM EVO	EMO VAL	EMO INT	NEG EMO	POS EMO	ENJ	REL
American Idiot	Green Day	2005	45	18(40.00%)	6.22(1.89)	4.24(2.52)	2.09(1.99)	5.80(2.56)	5.98(2.56)	5.00(2.92)
Behind These Hazel Eyes	Kelly Clarkson	2005	41	8(19.51%)	4.88(2.01)	3.51(2.21)	2.95(2.22)	4.51(2.27)	5.41(2.18)	3.46(2.09)
Don't Phunk With My Heart	The Black Eyed Peas	2005	39	6(15.38%)	4.92(2.13)	3.26(2.26)	1.53(1.06)	5.00(2.35)	5.10(2.23)	3.03(2.29)
Boulevard of Broken Dreams	Green Day	2005	39	14(35.90%)	5.74(1.90)	4.18(2.74)	2.33(1.75)	5.82(2.02)	6.41(2.02)	4.59(2.72)
Gold Digger	Kanye West feat. Jaimie Foxx	2005	41	20(48.78%)	6.22(2.23)	4.24(2.30)	1.85(1.31)	6.66(2.22)	7.10(2.13)	5.00(2.67)
Since U Been Gone	Kelly Clarkson	2005	39	19(48.72%)	6.21(2.13)	5.13(2.16)	2.34(1.91)	6.15(2.15)	6.53(2.14)	5.71(2.57)
Photograph	Nickelback	2005	41	15(36.59%)	5.46(2.03)	4.76(2.50)	2.59(1.91)	5.29(2.42)	6.07(2.04)	4.88(2.60)

Note 1. SNG TIT = song title, SNG ART = song artist, SNG YR = year of popularity, N = number of participants rating the song, AM EVO = specific AM evoked, EMO VAL = emotional valence, EMO INT = emotional intensity, NEG EMO = negative emotion, POS EMO = positive emotion, ENJ = enjoyment, REL = personal relevance.
Note 2. M(SD) provided.

Table 56. Study 1 Database: 2005 (Part 2 of 2: Familiarity and accuracy measures).

Song Information				AM		Knowledge Measures		
SNG TIT	SNG ART	SNG YR	N	AM EVO	FAM	TIT ACC	ART ACC	YR ACC
American Idiot	Green Day	2005	45	18(40.00%)	6.11(3.00)	1.11(0.96)	1.20(1.00)	1.67(1.59)
Behind These Hazel Eyes	Kelly Clarkson	2005	41	8(19.51%)	5.37(2.40)	0.41(0.77)	0.93(1.01)	2.44(1.92)
Don't Phunk With My Heart	The Black Eyed Peas	2005	39	6(15.38%)	4.64(2.83)	0.56(0.91)	1.08(1.01)	2.58(1.77)
Boulevard of Broken Dreams	Green Day	2005	39	14(35.90%)	6.97(2.06)	0.56(0.91)	1.74(0.68)	1.54(1.68)
Gold Digger	Kanye West feat. Jaimie Foxx	2005	41	20(48.78%)	7.61(1.82)	1.88(0.46)	1.46(0.90)	2.40(2.32)
Since U Been Gone	Kelly Clarkson	2005	39	19(48.72%)	7.55(2.08)	1.79(0.62)	1.36(0.93)	1.87(1.71)
Photograph	Nickelback	2005	41	15(36.59%)	6.80(2.54)	0.83(1.00)	1.37(0.94)	2.48(2.28)

Note 1. SNG TIT = song title, SNG ART = song artist, SNG YR = year of popularity, N = number of participants rating the song, AM EVO = specific AM evoked, FAM = familiarity, TIT ACC = title accuracy, ART ACC = artist accuracy, YR ACC = year accuracy (years away from song year, absolute value)
Note 2. M(SD) provided.

Table 57. Study 1 Database: 2006 (Part 1 of 2: Emotion measures, enjoyment, and relevance).

Song Information				AM	Emotional Measures				Other	
SNG TIT	SNG ART	SNG YR	N	AM EVO	EMO VAL	EMO INT	NEG EMO	POS EMO	ENJ	REL
Bad Day	Daniel Powter	2006	39	12(30.77%)	6.03(2.01)	5.13(2.13)	2.33(1.58)	5.77(2.24)	6.44(2.11)	5.62(2.37)
Breaking Free	High School Musical	2006	44	25(56.82%)	6.58(2.34)	4.98(2.83)	1.60(1.14)	6.40(2.70)	6.49(2.64)	5.91(2.76)
Crazy	Gnarls Barkley	2006	45	6(13.33%)	5.40(1.85)	3.38(2.37)	2.16(1.61)	4.82(2.45)	5.73(2.14)	3.71(2.17)
Hips Don't Lie	Shakira feat. Wyclef Jean	2006	41	24(58.54%)	6.83(2.12)	4.44(2.57)	1.55(1.32)	7.27(1.84)	7.32(1.69)	5.27(2.63)
SexyBack	Justin Timberlake feat. Timbaland	2006	41	17(41.46%)	5.88(2.34)	4.15(2.55)	1.93(1.42)	5.80(2.74)	6.32(2.73)	5.34(2.67)
Chasing Cars	Snow Patrol	2006	39	16(41.03%)	5.97(1.80)	5.33(2.57)	2.76(2.01)	5.51(2.14)	6.67(2.03)	5.69(2.66)
SOS	Rihanna	2006	41	20(48.78%)	5.65(2.02)	3.95(2.26)	2.12(1.63)	5.78(2.23)	6.17(2.10)	4.34(2.27)
You're Beautiful	James Blunt	2006	41	11(26.83%)	5.71(1.90)	4.61(2.13)	2.20(1.69)	5.61(2.23)	6.02(2.08)	4.73(2.46)

Note 1. SNG TIT = song title, SNG ART = song artist, SNG YR = year of popularity, N = number of participants rating the song, AM EVO = specific AM evoked, EMO VAL = emotional valence, EMO INT = emotional intensity, NEG EMO = negative emotion, POS EMO = positive emotion, ENJ = enjoyment, REL = personal relevance.
Note 2. M(SD) provided.

Table 58. Study 1 Database: 2006 (Part 2 of 2: Familiarity and accuracy measures).

Song Information				AM		Knowledge Measures		
SNG TIT	SNG ART	SNG YR	N	AM EVO	FAM	TIT ACC	ART ACC	YR ACC
Bad Day	Daniel Powter	2006	39	12(30.77%)	7.08(1.95)	1.54(0.72)	0.62(0.91)	2.06(1.60)
Breaking Free	High School Musical	2006	44	25(56.82%)	7.51(2.35)	1.5(0.85)	1.73(0.69)	1.40(1.43)
Crazy	Gnarls Barkley	2006	45	6(13.33%)	5.96(2.50)	1.64(0.71)	0.69(0.85)	3.54(2.97)
Hips Don't Lie	Shakira feat. Wyclef Jean	2006	41	24(58.54%)	7.90(1.35)	1.80(0.60)	1.95(0.31)	2.33(1.72)
SexyBack	Justin Timberlake feat. Timbaland	2006	41	17(41.46%)	7.71(2.28)	1.59(0.71)	1.59(0.81)	2.35(1.95)
Chasing Cars	Snow Patrol	2006	39	16(41.03%)	6.70(2.68)	1.03(1.01)	0.87(1.01)	2.90(1.96)
SOS	Rihanna	2006	41	20(48.78%)	6.80(1.71)	1.76(0.66)	1.66(0.76)	2.83(4.42)
You're Beautiful	James Blunt	2006	41	11(26.83%)	6.93(2.46)	1.49(0.75)	0.88(1.01)	3.56(5.97)

Note 1. SNG TIT = song title, SNG ART = song artist, SNG YR = year of popularity, N = number of participants rating the song, AM EVO = specific AM evoked, FAM = familiarity, TIT ACC = title accuracy, ART ACC = artist accuracy, YR ACC = year accuracy (years away from song year, absolute value)
Note 2. M(SD) provided.

Table 59. Study 1 Database: 2007 (Part 1 of 2: Emotion measures, enjoyment, and relevance).

Song Information				AM	Emotional Measures				Other	
SNG TIT	SNG ART	SNG YR	N	AM EVO	EMO VAL	EMO INT	NEG EMO	POS EMO	ENJ	REL
Before He Cheats	Carrie Underwood	2007	41	12(29.27%)	5.61(2.18)	4.63(2.55)	2.76(2.17)	5.27(2.48)	6.17(2.18)	4.50(2.47)
Hey There Delilah	Plain White T's	2007	41	19(46.34%)	5.73(1.84)	4.95(2.01)	3.15(2.29)	5.75(2.00)	6.48(1.85)	5.55(1.93)
How to Save a Life	The Fray	2007	45	16(35.56%)	6.49(2.20)	5.66(2.55)	2.51(2.32)	6.13(2.43)	6.93(2.25)	6.09(2.56)
Everyday	High School Musical 2	2007	40	14(35.00%)	5.67(2.50)	4.30(2.77)	1.82(1.30)	5.47(2.78)	5.41(2.84)	4.23(3.07)
Irreplaceable	Beyoncé	2007	39	7(17.95%)	6.05(2.36)	4.33(2.29)	2.56(2.05)	5.79(2.04)	6.38(2.09)	4.64(2.51)
Say It Right	Nelly Furtado	2007	39	10(25.64%)	5.38(1.95)	3.85(2.08)	2.36(1.91)	5.10(2.35)	5.44(2.33)	3.97(2.39)
Umbrella	Rihanna feat. Jay-Z	2007	41	23(56.10%)	6.20(1.90)	4.34(2.01)	1.93(1.69)	6.25(2.24)	6.85(1.88)	5.61(2.25)

Note 1. SNG TIT = song title, SNG ART = song artist, SNG YR = year of popularity, N = number of participants rating the song, AM EVO = specific AM evoked, EMO VAL = emotional valence, EMO INT = emotional intensity, NEG EMO = negative emotion, POS EMO = positive emotion, ENJ = enjoyment, REL = personal relevance.
Note 2. M(SD) provided.

Table 60. Study 1 Database: 2007 (Part 2 of 2: Familiarity and accuracy measures).

Song Information				AM		Knowledge Measures		
SNG TIT	SNG ART	SNG YR	N	AM EVO	FAM	TIT ACC	ART ACC	YR ACC
Before He Cheats	Carrie Underwood	2007	41	12(29.27%)	7.10(2.33)	1.34(0.91)	1.29(0.96)	2.28(1.82)
Hey There Delilah	Plain White T's	2007	41	19(46.34%)	7.63(1.26)	1.78(0.57)	0.81(0.98)	2.83(2.27)
How to Save a Life	The Fray	2007	45	16(35.56%)	7.31(2.24)	1.62(0.72)	0.96(0.98)	2.03(1.91)
Everyday	High School Musical 2	2007	40	14(35.00%)	4.95(3.22)	0.50(0.88)	1.40(0.93)	1.79(1.35)
Irreplaceable	Beyoncé	2007	39	7(17.95%)	6.87(2.14)	1.31(0.95)	1.69(0.73)	1.78(1.84)
Say It Right	Nelly Furtado	2007	39	10(25.64%)	6.16(2.57)	0.26(0.68)	1.36(0.93)	2.75(2.34)
Umbrella	Rihanna feat. Jay-Z	2007	41	23(56.10%)	8.37(1.22)	1.93(0.35)	1.83(0.54)	1.32(1.04)

Note 1. SNG TIT = song title, SNG ART = song artist, SNG YR = year of popularity, N = number of participants rating the song, AM EVO = specific AM evoked, FAM = familiarity, TIT ACC = title accuracy, ART ACC = artist accuracy, YR ACC = year accuracy (years away from song year, absolute value)
Note 2. M(SD) provided.

Table 61. Study 1 Database: 2008 (Part 1 of 2: Emotion measures, enjoyment, and relevance).

Song Information				AM	Emotional Measures				Other	
SNG TIT	SNG ART	SNG YR	N	AM EVO	EMO VAL	EMO INT	NEG EMO	POS EMO	ENJ	REL
Bleeding Love	Leona Lewis	2008	39	14(25.90%)	6.13(2.30)	4.74(2.36)	2.54(2.05)	5.72(2.36)	6.49(2.29)	5.13(2.56)
I'm Yours	Jason Mraz	2008	41	19(46.34%)	6.76(1.84)	4.77(2.44)	1.53(0.96)	7.05(2.00)	7.22(1.78)	6.10(2.25)
I Kissed a Girl	Katy Perry	2008	40	22(55.00%)	6.23(2.05)	4.50(2.18)	2.03(1.53)	6.28(2.33)	6.60(2.00)	4.40(2.49)
Love in This Club	Usher feat. Young Jeezy	2008	39	6(15.38%)	5.42(2.05)	3.76(2.42)	2.26(1.55)	5.34(2.42)	5.45(2.10)	3.53(2.51)
Low	Flo Rida feat. T-Pain	2008	40	27(67.50%)	6.68(1.80)	4.98(2.31)	1.51(0.79)	6.63(2.17)	7.13(2.03)	6.10(2.26)
No Air	Jordin Sparks and Chris Brown	2008	41	2(4.88%)	5.76(1.93)	4.15(2.40)	2.78(2.15)	5.22(2.49)	6.05(2.04)	3.63(2.48)
With You	Chris Brown	2008	45	14(31.11%)	6.41(1.72)	4.25(2.87)	1.98(1.53)	5.86(2.24)	6.53(1.93)	5.11(2.75)
Apologize	Timbaland feat. One Republic	2008	80	27 (33.75%)	5.71 (1.90)	4.91 (2.03)	2.95 (2.31)	5.48 (2.16)	6.46 (1.99)	5.51 (2.47)

Note 1. SNG TIT = song title, SNG ART = song artist, SNG YR = year of popularity, N = number of participants rating the song, AM EVO = specific AM evoked, EMO VAL = emotional valence, EMO INT = emotional intensity, NEG EMO = negative emotion, POS EMO = positive emotion, ENJ = enjoyment, REL = personal relevance.
Note 2. M(SD) provided.

Table 62. Study 1 Database: 2008 (Part 2 of 2: Familiarity and accuracy measures).

Song Information				AM		Knowledge Measures		
SNG TIT	SNG ART	SNG YR	N	AM EVO	FAM	TIT ACC	ART ACC	YR ACC
Bleeding Love	Leona Lewis	2008	39	14(25.90%)	7.28(1.93)	1.38(0.82)	1.05(1.00)	1.53(1.58)
I'm Yours	Jason Mraz	2008	41	19(46.34%)	7.50(1.80)	1.65(0.77)	1.65(0.77)	1.67(1.45)
I Kissed a Girl	Katy Perry	2008	40	22(55.00%)	8.61(0.68)	1.95(0.32)	2.00(0.00)	1.69(1.66)
Love in This Club	Usher feat. Young Jeezy	2008	39	6(15.38%)	5.03(3.07)	1.08(0.77)	0.92(1.01)	2.31(1.69)
Low	Flo Rida feat. T-Pain	2008	40	27(67.50%)	8.05(1.86)	1.55(0.82)	1.45(0.90)	1.60(1.77)
No Air	Jordin Sparks and Chris Brown	2008	41	2(4.88%)	5.73(2.83)	1.20(0.98)	0.81(0.98)	2.69(2.70)
With You	Chris Brown	2008	45	14(31.11%)	6.20(2.86)	1.67(0.74)	1.38(0.94)	1.88(1.64)
Apologize	Timbaland feat. One Republic	2008	80	27 (33.75%)	7.66 (1.77)	1.79 (0.52)	1.05 (0.99)	1.91 (1.76)

Note 1. SNG TIT = song title, SNG ART = song artist, SNG YR = year of popularity, N = number of participants rating the song, AM EVO = specific AM evoked, FAM = familiarity, TIT ACC = title accuracy, ART ACC = artist accuracy, YR ACC = year accuracy (years away from song year, absolute value)
Note 2. M(SD) provided.

Table 63. Study 1 Database: 2009 (Part 1 of 2: Emotion measures, enjoyment, and relevance).

Song Information				AM	Emotional Measures				Other	
SNG TIT	SNG ART	SNG YR	N	AM EVO	EMO VAL	EMO INT	NEG EMO	POS EMO	ENJ	REL
Heartless	Kanye West	2009	45	18(40.00%)	6.24(1.75)	4.40(2.50)	2.31(1.74)	5.73(2.22)	6.51(2.18)	5.16(2.78)
I Gotta Feeling	The Black Eyed Peas	2009	41	27(65.85%)	6.54(1.63)	4.76(2.13)	1.93(1.63)	6.85(1.81)	7.08(1.80)	6.07(2.15)
I Know You Want Me (Calle Ocho)	Pitbull	2009	41	16(39.02%)	4.78(2.04)	3.07(2.02)	2.49(1.89)	4.83(2.52)	5.27(2.20)	3.88(2.32)
Poker Face	Lady Gaga	2009	38	20(52.63%)	5.95(2.12)	4.58(2.05)	2.21(1.80)	6.13(2.18)	6.50(2.23)	5.11(2.45)
Right Round	Flo Rida	2009	39	21(53.85%)	6.41(2.09)	4.67(2.50)	1.90(1.29)	6.41(2.04)	6.72(2.00)	4.82(2.73)
Single Ladies (Put a Ring on It)	Beyoncé	2009	39	14(35.90%)	6.08(2.02)	4.26(2.25)	2.13(1.59)	6.45(2.29)	6.74(2.15)	5.10(2.70)
You Belong with Me	Taylor Swift	2009	45	16(35.56%)	6.41(2.06)	4.71(2.43)	1.73(1.40)	5.89(2.68)	6.75(2.28)	5.95(2.60)
The Climb	Miley Cyrus	2009	41	23(56.10%)	6.80(1.62)	5.45(2.32)	2.39(2.01)	6.32(1.99)	6.61(2.14)	6.15(2.33)

Note 1. SNG TIT = song title, SNG ART = song artist, SNG YR = year of popularity, N = number of participants rating the song, AM EVO = specific AM evoked, EMO VAL = emotional valence, EMO INT = emotional intensity, NEG EMO = negative emotion, POS EMO = positive emotion, ENJ = enjoyment, REL = personal relevance.
Note 2. M(SD) provided.

Table 64. Study 1 Database: 2009 (Part 2 of 2: Familiarity and accuracy measures).

Song Information				AM		Knowledge Measures		
SNG TIT	SNG ART	SNG YR	N	AM EVO	FAM	TIT ACC	ART ACC	YR ACC
Heartless	Kanye West	2009	45	18(40.00%)	7.14(2.50)	1.84(0.52)	1.51(0.87)	2.07(2.73)
I Gotta Feeling	The Black Eyed Peas	2009	41	27(65.85%)	8.12(1.00)	1.32(0.91)	1.81(0.60)	1.95(1.67)
I Know You Want Me (Calle Ocho)	Pitbull	2009	41	16(39.02%)	6.61(1.74)	1.27(0.90)	1.59(0.81)	2.03(2.04)
Poker Face	Lady Gaga	2009	38	20(52.63%)	8.50(1.22)	1.87(0.48)	2.00(0.00)	1.23(1.65)
Right Round	Flo Rida	2009	39	21(53.85%)	8.18(1.21)	1.72(0.56)	1.74(0.68)	1.51(1.28)
Single Ladies (Put a Ring on It)	Beyoncé	2009	39	14(35.90%)	8.21(1.19)	1.85(0.43)	1.90(0.45)	2.03(1.62)
You Belong with Me	Taylor Swift	2009	45	16(35.56%)	8.17(1.51)	1.84(0.52)	1.96(0.30)	1.48(1.37)
The Climb	Miley Cyrus	2009	41	23(56.10%)	8.02(1.97)	1.71(0.68)	1.95(0.31)	1.24(1.14)

Note 1. SNG TIT = song title, SNG ART = song artist, SNG YR = year of popularity, N = number of participants rating the song, AM EVO = specific AM evoked, FAM = familiarity, TIT ACC = title accuracy, ART ACC = artist accuracy, YR ACC = year accuracy (years away from song year, absolute value)
Note 2. M(SD) provided.

Table 65. Study 1 Database: 2010 (Part 1 of 2: Emotion measures, enjoyment, and relevance).

Song Information				AM	Emotional Measures				Other	
SNG TIT	SNG ART	SNG YR	N	AM EVO	EMO VAL	EMO INT	NEG EMO	POS EMO	ENJ	REL
Airplanes	B.o.B feat. Hayley Williams	2010	45	23(51.11%)	6.14(2.08)	4.73(2.56)	2.43(1.82)	6.00(2.27)	6.48(1.95)	5.60(2.42)
Dynamite	Taio Cruz	2010	41	30(73.17%)	6.41(1.94)	4.59(1.88)	1.76(1.39)	6.34(2.30)	6.63(2.09)	6.00(2.37)
Love the Way You Lie	Eminem feat. Rihanna	2010	40	16(40.00%)	6.50(2.01)	5.43(2.40)	2.33(1.62)	6.23(2.38)	7.25(1.75)	6.13(2.29)
I Like It	Enrique Iglesias feat. Pitbull	2010	38	12(31.58%)	5.32(1.82)	4.42(2.14)	2.53(2.14)	5.34(2.30)	5.63(2.11)	4.68(2.46)
California Gurls	Katy Perry feat. Snoop Dogg	2010	40	24(60.00%)	7.05(1.58)	4.54(2.14)	1.50(1.22)	7.10(1.71)	6.92(2.18)	5.68(2.58)
Bad Romance	Lady Gaga	2010	41	20(48.78%)	5.56(1.57)	4.00(2.53)	2.05(1.71)	6.08(1.90)	6.22(2.08)	4.71(2.59)
Mine	Taylor Swift	2010	41	17(41.46%)	5.98(2.25)	4.98(2.66)	2.41(1.99)	5.85(2.74)	6.53(2.16)	4.95(2.90)

Note 1. SNG TIT = song title, SNG ART = song artist, SNG YR = year of popularity, N = number of participants rating the song, AM EVO = specific AM evoked, EMO VAL = emotional valence, EMO INT = emotional intensity, NEG EMO = negative emotion, POS EMO = positive emotion, ENJ = enjoyment, REL = personal relevance.
Note 2. M(SD) provided.

Table 66. Study 1 Database: 2010 (Part 2 of 2: Familiarity and accuracy measures).

Song Information				AM		Knowledge Measures		
SNG TIT	SNG ART	SNG YR	N	AM EVO	FAM	TIT ACC	ART ACC	YR ACC
Airplanes	B.o.B feat. Hayley Williams	2010	45	23(51.11%)	7.78(1.31)	1.87(0.51)	1.42(0.92)	1.29(0.94)
Dynamite	Taio Cruz	2010	41	30(73.17%)	8.20(1.29)	1.85(0.53)	1.22(0.96)	1.21(1.04)
Love the Way You Lie	Eminem feat. Rihanna	2010	40	16(40.00%)	8.40(1.15)	1.95(0.32)	1.90(0.44)	1.28(1.16)
I Like It	Enrique Iglesias feat. Pitbull	2010	38	12(31.58%)	6.95(2.13)	1.47(0.73)	1.37(0.91)	2.06(2.03)
California Gurls	Katy Perry feat. Snoop Dogg	2010	40	24(60.00%)	8.46(1.39)	1.85(0.53)	1.83(0.55)	1.38(1.93)
Bad Romance	Lady Gaga	2010	41	20(48.78%)	8.30(1.04)	2.00(0.00)	2.00(0.00)	1.37(1.65)
Mine	Taylor Swift	2010	41	17(41.46%)	7.24(1.80)	1.09(0.97)	1.29(0.93)	1.83(2.20)

Note 1. SNG TIT = song title, SNG ART = song artist, SNG YR = year of popularity, N = number of participants rating the song, AM EVO = specific AM evoked, FAM = familiarity, TIT ACC = title accuracy, ART ACC = artist accuracy, YR ACC = year accuracy (years away from song year, absolute value)
Note 2. M(SD) provided.

Table 67. Study 1 Database: 2011 (Part 1 of 2: Emotion measures, enjoyment, and relevance).

Song Information				AM	Emotional Measures				Other	
SNG TIT	SNG ART	SNG YR	N	AM EVO	EMO VAL	EMO INT	NEG EMO	POS EMO	ENJ	REL
Give Me Everything	Pitbull feat. Ne-Yo, Afrojack, and Nayer	2011	41	20(48.78%)	6.22 (2.13)	4.27(2.47)	1.59(0.97)	6.10(2.54)	6.63(2.02)	5.24(2.52)
Grenade	Bruno Mars	2011	45	19(42.22%)	5.67 (1.86)	4.22(2.33)	2.80(2.12)	5.44(2.16)	5.80(2.32)	5.00(2.41)
Firework	Katy Perry	2011	39	20(51.28%)	6.50 (1.54)	4.59(2.61)	1.74(1.45)	6.92(1.60)	6.85(1.44)	5.54(2.04)
Party Rock Anthem	LMFAO feat. Lauren Bennett and GoonRock	2011	40	21(52.50%)	6.33 (1.80)	4.53(2.32)	2.15(1.78)	6.15(1.94)	6.40(1.72)	5.63(1.93)
Moves Like Jagger	Maroon 5 feat. Christina Aguilera	2011	39	17(43.59%)	6.31 (1.81)	4.10(2.15)	1.74(1.09)	5.87(2.26)	6.59(1.85)	5.05(2.41)
Someone Like You	Adele	2011	41	15(36.59%)	5.56 (2.15)	5.39(2.18)	3.44(2.20)	5.63(2.21)	6.53(2.17)	5.73(2.21)

Note 1. SNG TIT = song title, SNG ART = song artist, SNG YR = year of popularity, N = number of participants rating the song, AM EVO = specific AM evoked, EMO VAL = emotional valence, EMO INT = emotional intensity, NEG EMO = negative emotion, POS EMO = positive emotion, ENJ = enjoyment, REL = personal relevance.
Note 2. M(SD) provided.
Note 3. Due to list construction error, only 6 songs were surveyed for 2011.

Table 68. Study 1 Database: 2011 (Part 2 of 2: Familiarity and accuracy measures).

Song Information				AM		Knowledge Measures		
SNG TIT	SNG ART	SNG YR	N	AM EVO	FAM	TIT ACC	ART ACC	YR ACC
Give Me Everything	Pitbull feat. Ne-Yo, Afrojack, and Nayer	2011	41	20(48.78%)	7.58(1.68)	0.95(1.00)	1.39(0.86)	1.68(1.96)
Grenade	Bruno Mars	2011	45	19(42.22%)	8.11(0.98)	1.91(0.36)	1.91(0.42)	1.45(1.11)
Firework	Katy Perry	2011	39	20(51.28%)	8.59(0.72)	1.97(0.16)	2.00(0.00)	1.38(0.88)
Party Rock Anthem	LMFAO feat. Lauren Bennett and GoonRock	2011	40	21(52.50%)	8.36(1.01)	1.48(0.68)	1.70(0.72)	1.19(1.13)
Moves Like Jagger	Maroon 5 feat. Christina Aguilera	2011	39	17(43.59%)	8.32(1.09)	1.85(0.49)	1.69(0.66)	1.42(1.08)
Someone Like You	Adele	2011	41	15(36.59%)	8.05(1.54)	1.63(0.77)	1.85(0.53)	1.29(1.13)

Note 1. SNG TIT = song title, SNG ART = song artist, SNG YR = year of popularity, N = number of participants rating the song, AM EVO = specific AM evoked, FAM = familiarity, TIT ACC = title accuracy, ART ACC = artist accuracy, YR ACC = year accuracy (years away from song year, absolute value)
Note 2. M(SD) provided.

Table 69. Study 1 Database: 2012 (Part 1 of 2: Emotion measures, enjoyment, and relevance).

Song Information				AM	Emotional Measures				Other	
SNG TIT	SNG ART	SNG YR	N	AM EVO	EMO VAL	EMO INT	NEG EMO	POS EMO	ENJ	REL
As Long as You Love Me	Justin Bieber feat. Big Sean	2012	40	19(47.50%)	6.18(2.11)	4.59(2.42)	2.18(2.01)	5.85(2.56)	5.95(2.61)	5.56(2.85)
Call Me Maybe	Carly Rae Jepsen	2012	40	17(42.50%)	6.25(1.85)	4.08(2.56)	2.05(1.57)	6.40(2.06)	6.38(1.82)	4.93(2.52)
Lights	Ellie Goulding	2012	41	8(19.51%)	5.12(1.79)	3.71(2.09)	2.17(1.75)	5.49(2.26)	6.00(1.76)	3.78(2.15)
What Makes You Beautiful	One Direction	2012	39	24(61.54%)	6.18(2.06)	5.00(2.43)	1.92(1.44)	5.92(2.74)	6.21(2.39)	5.21(2.52)
Some Nights	Fun.	2012	45	18(40.00%)	6.23(2.00)	4.39(2.70)	2.43(2.15)	5.93(2.68)	6.37(2.21)	5.86(2.24)
We Are Never Getting Back Together	Taylor Swift	2012	40	20(50.00%)	6.20(1.80)	4.50(2.35)	2.40(1.89)	5.70(2.31)	6.55(1.96)	5.38(2.42)
We Found Love	Rihanna feat. Calvin Harris	2012	39	17(43.59%)	6.6 (2.06)	4.39(2.46)	2.05(1.71)	6.34(2.04)	7.29(1.80)	5.37(2.59)
Wild Ones	Flo Rida feat. Sia	2012	40	18(45.00%)	6.30(1.74)	4.40(1.98)	1.87(1.38)	6.35(2.17)	6.78(1.80)	5.00(2.06)

Note 1. SNG TIT = song title, SNG ART = song artist, SNG YR = year of popularity, N = number of participants rating the song, AM EVO = specific AM evoked, EMO VAL = emotional valence, EMO INT = emotional intensity, NEG EMO = negative emotion, POS EMO = positive emotion, ENJ = enjoyment, REL = personal relevance.
Note 2. M(SD) provided.

Table 70. Study 1 Database: 2012 (Part 2 of 2: Familiarity and accuracy measures).

Song Information				AM		Knowledge Measures		
SNG TIT	SNG ART	SNG YR	N	AM EVO	FAM	TIT ACC	ART ACC	YR ACC
As Long as You Love Me	Justin Bieber feat. Big Sean	2012	40	19(47.50%)	7.85(2.08)	1.88(0.46)	1.85(0.53)	1.42(1.23)
Call Me Maybe	Carly Rae Jepsen	2012	40	17(42.50%)	8.58(1.00)	1.95(0.32)	1.90(0.38)	1.05(0.92)
Lights	Ellie Goulding	2012	41	8(19.51%)	7.02(1.90)	1.20(0.98)	1.17(1.00)	1.47(1.16)
What Makes You Beautiful	One Direction	2012	39	24(61.54%)	8.26(1.02)	1.08(0.96)	1.95(0.32)	0.69(0.73)
Some Nights	Fun.	2012	45	18(40.00%)	7.35(1.80)	1.76(0.65)	1.29(0.97)	1.31(1.45)
We Are Never Getting Back Together	Taylor Swift	2012	40	20(50.00%)	8.54(0.97)	1.60(0.63)	1.95(0.32)	1.75(1.71)
We Found Love	Rihanna feat. Calvin Harris	2012	39	17(43.59%)	7.97(1.64)	1.67(0.66)	1.74(0.68)	1.22(1.45)
Wild Ones	Flo Rida feat. Sia	2012	40	18(45.00%)	7.93(1.38)	1.88(0.46)	1.35(0.89)	1.26(1.35)

Note 1. SNG TIT = song title, SNG ART = song artist, SNG YR = year of popularity, N = number of participants rating the song, AM EVO = specific AM evoked, FAM = familiarity, TIT ACC = title accuracy, ART ACC = artist accuracy, YR ACC = year accuracy (years away from song year, absolute value)
Note 2. M(SD) provided.

Table 71. Study 1 Database: 2013 (Part 1 of 2: Emotion measures, enjoyment, and relevance).

Song Information				AM	Emotional Measures					Other
SNG TIT	SNG ART	SNG YR	N	AM EVO	EMO VAL	EMO INT	NEG EMO	POS EMO	ENJ	REL
Blurred Lines	Robin Thicke feat. T.I. and Pharrell Williams	2013	40	18(45.00%)	5.63(2.10)	3.65(2.05)	3.03(2.18)	5.03(2.54)	5.65(2.23)	4.50(2.36)
Can't Hold Us	Macklemore and Ryan Lewis feat. Ray Dalton	2013	41	19(46.34%)	5.59(1.80)	3.78(2.06)	2.22(1.80)	5.80(2.20)	6.02(2.27)	4.59(2.50)
Ho Hey	The Lumineers	2013	45	2(46.67%)	6.63(2.16)	4.98(2.35)	1.98(1.65)	6.30(2.36)	7.07(1.92)	6.18(2.19)
I Knew You Were Trouble	Taylor Swift	2013	39	16(41.03%)	6.49(2.01)	4.92(2.60)	2.18(1.68)	6.18(2.22)	7.15(2.01)	5.59(2.68)
Thrift Shop	Macklemore and Ryan Lewis feat. Wanz	2013	41	17(41.46%)	5.56(1.91)	3.68(2.52)	2.00(1.53)	6.22(2.07)	6.20(2.14)	4.49(2.09)
Wake Me Up	Avicii	2013	40	21(52.50%)	6.63(2.06)	4.78(2.52)	2.10(1.75)	6.58(2.16)	6.83(2.30)	6.15(2.24)
Wrecking Ball	Miley Cyrus	2013	40	17(42.50%)	5.95(2.01)	5.30(2.54)	3.03(2.19)	5.72(2.42)	6.08(2.35)	5.18(2.60)

Note 1. SNG TIT = song title, SNG ART = song artist, SNG YR = year of popularity, N = number of participants rating the song, AM EVO = specific AM evoked, EMO VAL = emotional valence, EMO INT = emotional intensity, NEG EMO = negative emotion, POS EMO = positive emotion, ENJ = enjoyment, REL = personal relevance.
Note 2. M(SD) provided.

Table 72. Study 1 Database: 2013 (Part 2 of 2: Familiarity and accuracy measures).

Song Information				AM		Knowledge Measures		
SNG TIT	SNG ART	SNG YR	N	AM EVO	FAM	TIT ACC	ART ACC	YR ACC
Blurred Lines	Robin Thicke feat. T.I. and Pharrell Williams	2013	40	18(45.00%)	8.38(0.91)	1.95(0.32)	1.30(0.94)	0.94(0.79)
Can't Hold Us	Macklemore and Ryan Lewis feat. Ray Dalton	2013	41	19(46.34%)	7.38(1.94)	1.34(0.88)	1.37(0.94)	1.29(1.71)
Ho Hey	The Lumineers	2013	45	2(46.67%)	7.42(1.53)	1.18(0.96)	1.20(0.99)	1.24(1.39)
I Knew You Were Trouble	Taylor Swift	2013	39	16(41.03%)	8.14(1.18)	1.49(0.56)	1.90(0.45)	1.59(1.61)
Thrift Shop	Macklemore and Ryan Lewis feat. Wanz	2013	41	17(41.46%)	8.50(0.96)	1.90(0.44)	1.85(0.53)	0.85(0.83)
Wake Me Up	Avicii	2013	40	21(52.50%)	8.08(1.21)	1.85(0.53)	1.60(0.81)	1.14 (2.15).
Wrecking Ball	Miley Cyrus	2013	40	17(42.50%)	6.20(1.80)	1.93(0.35)	1.93(0.35)	0.84(0.96)

Note 1. SNG TIT = song title, SNG ART = song artist, SNG YR = year of popularity, N = number of participants rating the song, AM EVO = specific AM evoked, FAM = familiarity, TIT ACC = title accuracy, ART ACC = artist accuracy, YR ACC = year accuracy (years away from song year, absolute value)
Note 2. M(SD) provided.

Table 73. Study 1 Database: 2014 (Part 1 of 2: Emotion measures, enjoyment, and relevance).

Song Information				AM	Emotional Measures					Other
SNG TIT	SNG ART	SNG YR	N	AM EVO	EMO VAL	EMO INT	NEG EMO	POS EMO	ENJ	REL
All About That Bass	Meghan Trainor	2014	41	16(39.02%)	4.49(1.90)	3.44(2.12)	3.20(2.49)	4.15(2.26)	4.34(2.43)	3.93(2.52)
All of Me	John Legend	2014	45	19(42.22%)	6.48(1.77)	5.16(2.52)	2.41(2.20)	5.63(2.51)	6.67(2.01)	6.11(2.15)
Fancy	Iggy Azalea feat. Charli XCX	2014	39	21(53.85%)	5.72(2.36)	4.51(2.45)	2.21(1.82)	5.26(2.56)	6.08(2.42)	4.64(2.85)
Happy	Pharrell Williams	2014	41	24(58.54%)	5.66(2.04)	4.34(2.02)	2.95(2.28)	5.37(2.60)	5.34(2.27)	5.42(2.13)
Let it Go	Idina Menzel	2014	41	28(68.29%)	6.12(2.19)	4.72(2.48)	2.33(2.04)	6.29(2.29)	6.22(2.36)	5.05(2.64)
Talk Dirty	Jason Derulo feat. 2 Chainz	2014	41	16(39.02%)	6.02(2.15)	3.68(2.61)	1.40(0.96)	6.65(2.27)	7.07(1.72)	4.66(2.63)
Story of My Life	One Direction	2014	41	10(24.39%)	5.78(1.82)	4.13(2.14)	2.33(1.94)	5.53(2.51)	5.98(2.06)	4.54(2.17)
Turn Down for What	DJ Snake and Lil Jon	2014	40	26(65.00%)	6.03(2.24)	5.08(2.53)	1.89(1.43)	6.55(1.93)	6.88(1.57)	5.33(2.22)

Note 1. SNG TIT = song title, SNG ART = song artist, SNG YR = year of popularity, N = number of participants rating the song, AM EVO = specific AM evoked, EMO VAL = emotional valence, EMO INT = emotional intensity, NEG EMO = negative emotion, POS EMO = positive emotion, ENJ = enjoyment, REL = personal relevance.
Note 2. M(SD) provided.

Table 74. Study 1 Database: 2014 (Part 2 of 2: Familiarity and accuracy measures).

Song Information				AM		Knowledge Measures		
SNG TIT	SNG ART	SNG YR	N	AM EVO	FAM	TIT ACC	ART ACC	YR ACC
All About That Bass	Meghan Trainor	2014	41	16(39.02%)	7.66(1.39)	1.73(0.67)	1.32(0.96)	0.85(1.14)
All of Me	John Legend	2014	45	19(42.22%)	7.84(1.38)	1.62(0.78)	1.47(0.89)	0.93(1.32)
Fancy	Iggy Azalea feat. Charli XCX	2014	39	21(53.85%)	8.18(1.31)	1.87(0.34)	1.95(0.32)	0.63(0.88)
Happy	Pharrell Williams	2014	41	24(58.54%)	8.59(0.71)	1.95(0.31)	1.54(0.84)	0.58(0.55)
Let it Go	Idina Menzel	2014	41	28(68.29%)	8.15(1.49)	1.95(0.31)	1.32(0.96)	0.63(1.29)
Talk Dirty	Jason Derulo feat. 2 Chainz	2014	41	16(39.02%)	8.00(1.54)	1.37(0.54)	1.42(0.92)	1.61(1.99)
Story of My Life	One Direction	2014	41	10(24.39%)	7.37(2.15)	1.95(0.31)	1.56(0.84)	1.22(1.49)
Turn Down for What	DJ Snake and Lil Jon	2014	40	26(65.00%)	8.23(1.16)	1.78(0.62)	1.30(0.94)	1.22(1.34)

Note 1. SNG TIT = song title, SNG ART = song artist, SNG YR = year of popularity, N = number of participants rating the song, AM EVO = specific AM evoked, FAM = familiarity, TIT ACC = title accuracy, ART ACC = artist accuracy, YR ACC = year accuracy (years away from song year, absolute value)
Note 2. M(SD) provided.

Table 75. Study 1 Database: 2015 (Part 1 of 2: Emotion measures, enjoyment, and relevance).

Song Information				AM	Emotional Measures					Other
SNG TIT	SNG ART	SNG YR	N	AM EVO	EMO VAL	EMO INT	NEG EMO	POS EMO	ENJ	REL
Blank Space	Taylor Swift	2015	41	16(39.02%)	6.29(2.18)	4.76(2.62)	1.90(1.43)	6.29(2.36)	6.95(2.01)	5.46(2.40)
Earned It	The Weeknd	2015	39	5(12.82%)	5.79(1.75)	4.11(2.09)	2.38(1.83)	5.82(2.27)	6.26(2.24)	4.54(2.75)
See You Again	Wiz Khalifa feat. Charlie Puth	2015	39	23(58.97%)	6.59(2.02)	6.74(2.12)	2.95(2.39)	6.08(2.26)	6.67(2.06)	6.54(2.36)
Shut Up and Dance	Walk The Moon	2015	40	22(55.00%)	6.33(2.20)	3.74(2.69)	1.79(1.79)	6.78(1.95)	7.15(1.70)	5.18(2.16)
Sugar	Maroon 5	2015	45	17(37.78%)	6.26(2.20)	4.27(2.39)	1.84(1.55)	6.11(2.63)	6.84(1.88)	5.78(2.65)
Take Me to Church	Hozier	2015	45	23(51.11%)	5.75(2.27)	5.31(2.82)	3.09(2.53)	5.47(2.52)	6.52(2.30)	6.30(2.31)
Thinking Out Loud	Ed Sheeran	2015	41	19(46.34%)	6.61(2.02)	5.85(2.24)	2.37(2.13)	6.56(2.46)	7.05(2.00)	6.40(2.47)
Uptown Funk	Mark Ronson feat. Bruno Mars	2015	39	27(69.23%)	7.18(1.90)	5.13(2.52)	2.05(1.82)	6.95(2.00)	7.44(1.88)	6.18(2.43)

Note 1. SNG TIT = song title, SNG ART = song artist, SNG YR = year of popularity, N = number of participants rating the song, AM EVO = specific AM evoked, EMO VAL = emotional valence, EMO INT = emotional intensity, NEG EMO = negative emotion, POS EMO = positive emotion, ENJ = enjoyment, REL = personal relevance.
Note 2. M(SD) provided.

Table 76. Study 1 Database: 2015 (Part 2 of 2: Familiarity and accuracy measures).

Song Information				AM		Knowledge Measures		
SNG TIT	SNG ART	SNG YR	N	AM EVO	FAM	TIT ACC	ART ACC	YR ACC
Blank Space	Taylor Swift	2015	41	16(39.02%)	8.29(1.44)	1.61(0.80)	1.95(0.31)	0.85(1.19)
Earned It	The Weeknd	2015	39	5(12.82%)	7.74(1.81)	1.31(0.95)	1.64(0.78)	0.50(0.81)
See You Again	Wiz Khalifa feat. Charlie Puth	2015	39	23(58.97%)	8.21(1.44)	1.72(0.56)	1.54(0.85)	0.41(1.34)
Shut Up and Dance	Walk The Moon	2015	40	22(55.00%)	7.78(1.42)	1.90(0.38)	0.85(1.00)	0.95(1.69)
Sugar	Maroon 5	2015	45	17(37.78%)	7.98(1.44)	1.91(0.42)	1.69(0.70)	0.56(0.78)
Take Me to Church	Hozier	2015	45	23(51.11%)	7.67(2.04)	1.84(0.52)	1.33(0.95)	0.98(1.16)
Thinking Out Loud	Ed Sheeran	2015	41	19(46.34%)	8.12(1.21)	1.37(0.94)	1.71(0.72)	1.00(1.47)
Uptown Funk	Mark Ronson feat. Bruno Mars	2015	39	27(69.23%)	8.62(0.78)	2.00(0.00)	2.00(0.00)	0.62(0.88)

Note 1. SNG TIT = song title, SNG ART = song artist, SNG YR = year of popularity, N = number of participants rating the song, AM EVO = specific AM evoked, FAM = familiarity, TIT ACC = title accuracy, ART ACC = artist accuracy, YR ACC = year accuracy (years away from song year, absolute value)
Note 2. M(SD) provided.

Appendix F: Study 2 Song Stimuli (Selected from Study 1 Database)

Practice Task

1) Party Rock Anthem – LMFAO feat. Lauren Bennett and GoonRock
2) California Gurls – Katy Perry feat. Snoop Dogg

Phase 1 (Memory-Generation Phase)

1) You Belong with Me – Taylor Swift
2) Love the Way You Lie – Eminem feat. Rihanna
3) Wake Me Up – Avicii
4) All of Me – John Legend
5) Someone Like You – Adele
6) Uptown Funk – Mark Ronson feat. Bruno Mars
7) Thinking Out Loud – Ed Sheeran

Phase 3 (Music Cue-Rating Phase)

1) Low – Flo Rida feat. T-Pain
2) You Belong with Me – Taylor Swift
3) Party Rock Anthem – LMFAO feat. Lauren Bennett and GoonRock
4) California Gurls – Katy Perry feat. Snoop Dogg
5) Love the Way You Lie – Eminem feat. Rihanna
6) Wake Me Up - Avicii
7) All of Me – John Legend
8) Someone Like You – Adele
9) Uptown Funk – Mark Ronson feat. Bruno Mars
10) Thinking Out Loud – Ed Sheeran

Table 77. Study 1: Database of music cues rated highest on relevance (Top 25). Part 1 of 2.

Track	Artist	Year	Personal Relevance	Familiarity	AM Evoked (%)	Emotional Valence	Emotional Intensity	Negative Emotion	Positive Emotion
See You Again***	Wiz Khalifa feat. Charlie Puth	2015	6.54(2.36)	8.21(1.44)	23(58.97)	6.59(2.02)	6.74(2.12)	2.95(2.39)	6.08(2.26)
Thinking Out Loud*	Ed Sheeran	2015	6.40(2.47)	8.12(1.21)	19(46.34)	6.61(2.02)	5.85(2.24)	2.37(2.13)	6.56(2.46)
Take Me to Church***	Hozier	2015	6.30(2.31)	7.67(2.04)	23(51.11)	5.75(2.27)	5.31(2.82)	3.09(2.53)	5.47(2.52)
Ho Hey	The Lumineers	2013	6.18(2.19)	7.42(1.53)	21(46.67)	6.63(2.16)	4.98(2.35)	1.98(1.65)	6.30(2.36)
The Climb***	Miley Cyrus	2009	6.15(2.33)	8.02(1.97)	23(56.10)	6.80(1.62)	5.45(2.32)	2.39(2.01)	6.32(1.99)
Wake Me Up*	Avicii	2013	6.15(2.24)	8.08(1.21)	21(52.50)	6.63(2.06)	4.78(2.52)	2.10(1.750	6.58(2.16)
I'm Yours	Jason Mraz	2008	6.10(2.25)	7.50(1.80)	19(46.34)	6.76(1.84)	4.77(2.44)	1.53(0.96)	7.05(2.00)
Love the Way You Lie*	Eminem feat. Rihanna	2010	6.13(2.29)	8.40 (1.15)	16(40.00)	6.50(2.01)	5.43(2.40)	2.33(1.62)	6.23(2.38)
All Star***	Smash Mouth	1999	6.11(2.67)	7.75(1.88)	24(60.00)	7.03(1.91)	5.69(2.50)	1.64(1.42)	6.79(2.28)
All of Me*	John Legend	2014	6.11(2.15)	7.84(1.38)	19(42.22)	6.48(1.77)	5.16(2.52)	2.41(2.20)	5.63(2.51)
Low**	Flo Rida feat. T-Pain	2008	6.10(2.26)	8.05(1.86)	27(67.50)	6.68(1.80)	4.98(2.31)	1.51(0.79)	6.63(2.17)
How to Save a Life	The Fray	2007	6.09(2.56)	7.31(2.24)	16(35.56)	6.49(2.20)	5.66(2.55)	2.51(2.32)	6.13(2.43)
I Gotta Feeling	The Black Eyed Peas	2009	6.07(2.15)	8.12(1.00)	27(65.85)	6.54(1.63)	4.76(2.13)	1.93(1.63)	6.85(1.81)
Dynamite	Taio Cruz	2010	6.00(2.37)	8.20(1.29)	30(73.17)	6.41(1.94)	4.59(1.88)	1.76(1.39)	6.34(2.30)
You Belong With Me*	Taylor Swift	2009	5.95(2.60)	8.17(1.51)	16(35.56)	6.41(2.06)	4.71(2.43)	1.73(1.40)	5.89(2.68)

Note 1. High relevance (6+) and high familiarity (7.5+) were taken into account when choosing the main cueing study stimuli. Additionally, since most songs with these criteria were positively rated, effort was taken to choose 1 or 2 that were rated as less positive and more negative. Additionally, the researchers attempted to sample for diversity of genre, gender, and year.

Note 2. * - cueing stimuli for main study, ** - practice and/or Phase 3 stimuli for main study, *** - song eliminated from stimuli selection due to numerous responses regarding a popular culture event, movie associated with the song, or notable music videos (due to popular culture or themes).

Table 78. Study 1: Database of music cues rated highest on relevance (Top 25). Part 2 of 2.

Track	Artist	Year	Personal Relevance	Familiarity	AM Evoked (%)	Emotional Valence	Emotional Intensity	Negative Emotion	Positive Emotion
Uptown Funk*	Mark Ronson feat. Bruno Mars	2015	6.18(2.43)	8.62(0.78)	27(69.23)	7.18(1.90)	5.13(2.52)	2.05(1.82)	6.95(2.00)
Breaking Free***	High School Musical	2006	5.91(2.76)	7.51(2.35)	25(56.82)	6.58(2.34)	4.98(2.83)	1.60(1.14)	6.40(2.70)
Some Nights	Fun.	2012	5.86(2.24)	7.35(1.80)	18(40.00)	6.23(2.00)	4.39(2.70)	2.43(2.15)	5.93(2.68)
Sugar	Maroon 5	2015	5.78(2.65)	7.98(1.44)	17(37.78)	6.26(2.20)	4.27(2.39)	1.84(1.55)	6.11(2.63)
Someone Like You*	Adele	2011	5.73(2.21)	8.05(1.54)	15(36.59)	5.56(2.15)	5.39(2.18)	3.44(2.20)	5.63(2.21)
Since U Been Gone	Kelly Clarkson	2005	5.71(2.57)	7.55(2.08)	19(48.72)	6.21(2.13)	5.13(2.16)	2.34(1.91)	6.15(2.15)
Chasing Cars	Snow Patrol	2006	5.69(3.66)	6.70(2.68)	16(41.03)	5.97(1.80)	5.33(2.57)	2.76(2.01)	5.51(2.14)
California Gurls**	Katy Perry feat. Snoop Dogg	2010	5.68(2.58)	8.46(1.39)	24(60.00)	7.05(1.80)	4.54(2.14)	1.50(1.22)	7.10 (1.71)
Party Rock Anthem**	LMFAO feat. Lauren Bennett and GoonRock	1999	5.63(1.93)	8.36(1.01)	21(52.50)	6.33(1.80)	4.53(2.32)	2.15(1.78)	6.15(1.94)
Umbrella	Rihanna feat. Jay-Z	2014	5.61(2.25)	8.37(1.22)	23(56.10)	6.20(1.90)	4.34(2.01)	1.93(1.69)	6.25(2.24)

Note 1. High relevance (6+) and high familiarity (7.5+) were taken into account when choosing the main cueing study stimuli. Additionally, since most songs with these criteria were positively rated, effort was taken to choose 1 or 2 that were rated as less positive and more negative. Additionally, the researchers attempted to sample for diversity of genre, gender, and year.

Note 2. * - cueing stimuli for main study, ** - practice and/or Phase 3 stimuli for main study, *** - song eliminated from stimuli selection due to numerous responses regarding a popular culture event, movie associated with the song, or notable music videos (due to popular culture or

Appendix H: Study 2 Demographic Questions

1. How old are you? (Text box)
2. Gender (1 – male, 2 – female, 3 – other)
3. What is your first language? (Text box)
4. Where did you spend the majority of your childhood and youth years? (Text box)
5. Do you have a diagnosed hearing disability? (1-yes, 2-no)

Appendix I: Study 2 Practice Trial and Phase 1 (Memory-Generation Phase) Instructions

Music Cueing Condition – "Emotional Memory" Instruction Type

There are three phases to the study. In this first phase, you will write descriptions of emotional memories you have for past events from your own life in response to short clips of popular music.

For the purpose of the experiment, an emotional memory is an event from your own life, lasting no longer than a few hours that happened on a specific day at a specific time that has emotional significance to you. You should provide enough detail in your description of the event that another person could read it and understand the details of the event memory, such as the people, location, and activities involved.

During this phase of the task, you are first going to see an "*" on the computer screen, then a short (30 second) popular music song clip will begin playing. Your task is to listen to the song and think of **the first emotional memory of an event from your past** that comes to mind. It is important that you write about the *first* memory that comes to mind here. When you have a memory in mind, press the SPACE bar **as quickly as possible**, and a box will appear on the screen where you are asked to type a description of the memory. All of the text *must* fit inside the box. When you are done typing press ENTER to move onto the next song. NOTE: Please be careful not to press enter before you are finished typing your description as the program will move forward and you will not be able to go back. You **DO NOT have to wait until the song ends** to press the space bar and start writing a description of your memory. Please press the SPACE bar as soon as an emotional memory comes to mind.

This process will happen SEVEN times. That is, you are going to listen to 7 short (30 second) clips of popular music one at a time, and describe a memory each time. NOTE: It is not necessary that the memory be related to the song played (though it might be). Please recall the FIRST emotional memory that comes to mind.

So, to summarize, you will see an "*" followed by a short musical clip taken from a popular song. In response to this clip, you must think of an emotional memory of an event from your life and press the SPACE bar. It is important that this is the FIRST emotional memory that comes to mind. Type a description of this event with sufficient detail as described above. When you are done typing, press enter to start the next trial. Do you have any questions?

Now I will lead you through a practice trial. The other two phases will *not* have a practice trial.

Music Cueing Condition – Control ("Memory", no emotionality mentioned) Instruction Type

There are three phases to the study. In this first phase, you will write descriptions of memories you have for past events from your own life in response to clips from popular music.

For the purpose of the experiment, a memory is an event from your own life, lasting no longer than a few hours that happened on a specific day at a specific time. You should provide enough detail in your description of the event that another person could read it and understand the details of the event memory, such as the people, location, and activities involved.

During this phase of the task, you are first going to see an "*" on the computer screen, then a short (30 second) popular music song clip will begin playing. Your task is to listen to the song and think of **the first memory of an event from your past** that comes to mind. It is important that you write about the *first* memory that comes to mind here. When you have a memory in mind, press the SPACE bar **as quickly as possible**, and a box will appear on the screen where you are asked to type a description of the memory. All of the text *must* fit inside the box. When you are done typing press ENTER to move onto the next song. NOTE: Please be careful not to press enter before you are finished typing your description as the program will move forward and you will not be able to go back. You **DO NOT have to wait until the song ends** to press the space bar

and start writing a description of your memory. Please press the SPACE bar as soon as an emotional memory comes to mind.

This process will happen SEVEN times. That is, you are going to listen to 7 short (30 second) clips of popular music one at a time, and describe a memory each time. NOTE: It is not necessary that the memory be related to the song played (though it might be). Please recall the FIRST memory that comes to mind.

So, to summarize, you will see an "*" followed by a short musical clip taken from a popular song. In response to this clip, you must think of a memory of an event from your life and press the SPACE bar. It is important that this is the FIRST memory that comes to mind. Type a description of this event with sufficient detail as described above. When you are done typing, press enter to start the next trial. Do you have any questions?

Now I will lead you through a practice trial. The other two phases will *not* have a practice trial.

Control Cueing Condition – "Emotional Memory" Instruction Type

There are three phases to the study. In this first phase, you will write descriptions of emotional memories you have for past events from your own life.

For the purpose of the experiment, an emotional memory is an event from your own life, lasting no longer than a few hours that happened on a specific day at a specific time that has emotional significance to you. You should provide enough detail in your description of the event that another person could read it and understand the details of the event memory, such as the people, location, and activities involved.

During this phase one task, you are first going to see an "*" on the computer screen, then a blank screen. Upon viewing the blank screen, your task is think of **the first emotional memory of an event from your past** that comes to mind. It is important that you write about the *first* memory that comes to mind here. When you have a memory in mind, press the SPACE bar **as quickly as possible**, and a box will appear on the screen where you are asked to type a description of the memory. All of the text *must* fit inside

the box. When you are done typing press ENTER to move onto the next song. NOTE: Please be careful not to press enter before you are finished typing your description as the program will move forward and you will not be able to go back.

This process will happen SEVEN times. That is, you are going to view 7 sets of "*" followed by a blank screen, one at a time, and describe a memory each time. NOTE: Please recall the FIRST emotional memory that comes to mind.

So, to summarize, you will see an "*" followed by a blank screen. In response to this clip, you must think of an emotional memory of an event from your life and press the SPACE bar. It is important that this is the FIRST emotional memory that comes to mind. Type a description of this event with sufficient detail as described above. When you are done typing, press enter to start the trial. Do you have any questions?

Now I will lead you through a practice trial. The other two phases will *not* have a practice trial.

Control Cueing Condition – Control ("Memory", no emotionality mentioned) Instruction Type

There are three phases to the study. In this first phase, you will write descriptions of memories you have for past events from your own life.

For the purpose of the experiment, a memory is an event from your own life, lasting no longer than a few hours that happened on a specific day at a specific time that has significance to you. You should provide enough detail in your description of the event that another person could read it and understand the details of the event memory, such as the people, location, and activities involved.

During this phase one task, you are first going to see an "*" on the computer screen, then a blank screen. Upon viewing the blank screen, your task is think of **the first memory of an event from your past** that comes to mind. It is important that you write about the *first* memory that comes to mind here. When you have a memory in mind, press the SPACE bar **as quickly as possible**, and a box will appear on the screen where

you are asked to type a description of the memory. All of the text *must* fit inside the box. When you are done typing press ENTER to move onto the next song. NOTE: Please be careful not to press enter before you are finished typing your description as the program will move forward and you will not be able to go back.

This process will happen SEVEN times. That is, you are going to view 7 sets of "*" followed by a blank screen, one at a time, and describe a memory each time. NOTE: Please recall the FIRST memory that comes to mind.

So, to summarize, you will see an "*" followed by a blank screen. In response to this clip, you must think of a memory of an event from your life and press the SPACE bar. It is important that this is the FIRST memory that comes to mind. Type a description of this event with sufficient detail as described above. When you are done typing, press enter to start the trial. Do you have any questions?

Now I will lead you through a practice trial. The other two phases will *not* have a practice trial.

Appendix J: Study 2 Phase 2 (Memory-Rating Phase) Instructions and Questions

Phase Two: Instructions (Same for All Conditions)

In this second phase of the study, the memory descriptions you generated in the first phase will be presented back to you one at a time, randomly. You will be asked to rate the experience of thinking about this memory DURING THE Phase 1 exercise (i.e. the experience of recalling the memory that the description refers to).

Your memory descriptions will appear at the top of the screen and 7-point rating scales will appear underneath each description. Use the number line at the top of the keyboard and try to use the entire range of numbers. Please note that 0 can be indicated for an "unsure" or "prefer not to answer" response. Again, please rate the following based on your experience of recalling (thinking about) the memory DURING THE PHASE 1 exercise.

1) Emotional experience from: 1-very negative, to 7-very positive

2) How emotionally intense this memory is from 1-not intense at all, to 7-very intense

3) How important this memory is to you: from 1-not significant to 7-very significant

4) How vivid this memory is: from 1-not vivid at all to 7-very vivid

5) How frequently DOES this memory comes to mind: on a scale of 1-never to 7-very often

6) How old you were approximately when the event occurred.

    a. To input this answer, again, press space, and a text box will appear. When you are finished typing, press enter.

You do not have to memorize the scales or questions, they will be presented underneath your memory description, one at a time with a detailed scale underneath. Do you have any questions? Do you need any clarification on any of the terms? I will be in the other room if you have any questions. Please press SPACE to continue.

Appendix K: Study 2 Phase 3 (Music Cue-Rating Phase) Instructions and Questions

Phase Three: Instructions

Note: These instructions were the same for all participants except music condition participants who answered 2 additional text box style questions after completing the listening task (see below for instructions and see text for wording of these questions).

Instructions

In this final phase of the experiment you will listen to **ten** short 30-second popular music clips and answer questions about your perception/experience of listening to the music. Similar to Phase Two, you will answer these questions on a scale of 1 to 7 for the following variables of interest:

1) Your overall emotional experience: from 1 – very negative to 7 – very positive
2) How emotionally intense the listening experience was from: 1 – very negative to 7 – very positive
3) How familiar the song is to you: from 1 - not familiar at all to 7 - very familiar
4) How personally relevant the song is to you: from 1 – not relevant at all to 7 – very relevant

For these questions please use the number line on the top of the keyboard and try to use the entire range of numbers in your answers. (*Music conditions only*) Following these rating questions, you will be asked two additional questions about the musical stimuli that you will answer in text box format. After you have read the question and are ready to answer, please press SPACE. A text box will appear. Please type your answer and press ENTER when finished to move onto the next question.

(*All participants*) Do you have any questions? Do you need any clarification on any of the terms? If a song leads to discomfort, hit SPACE to move the program forward. If you are unsure of a response or prefer not to answer, please press 0 for any question. After you complete this task, the study will be done. Please come see me when you are finished.

Appendix L: Study 2 Cue Type X 2 Instruction Type Supplementary Analyses

Table 79. Study 2: Supplementary Analyses.

	Current Study				**Comparisons**	
	Cue Type		**Instruction Type**			
	Control	**Music**	**Memory**	**Emotional Memory**	**Zator & Katz (2017)**	**LIWC 2015**
Relativity	22.09(5.32)	20.87(5.71)	22.56(5.75)	20.35(5.12)	20.74(0.58)	14.26(3.18)
Motion	3.40(1.56)	3.87(2.02)	3.99(1.86)	3.29(1.72)	3.56(0.28)	2.15(1.03)
Space	9.48(4.04)	9.41(3.41)	**10.23(4.47)**	**8.64(2.54)***	9.02(0.49)	6.89(1.96)
Engagement of Self Pronouns						
Personal Pronouns	11.53(4.22)	12.04(3.74)	11.72(4.23)	11.84(3.76)	11.35(0.51)	9.95(3.02)
Time Orientations						
Past Focus	7.17(3.58)	8.29(3.96)	7.69(3.89)	7.75(3.73)	7.04(0.37)	4.64(2.06)

Note 1. LIWC 2015 = LIWC 2015 Grand Mean.
Note 2. Zator and Katz (2017) reported *M*(*SE*). All other measures report *M*(*SD*).
Note 3. *** - $p < .001$, ** - $p < .02$, [1] – approaching significance ($0.2 < p < .06$).

Table 80. Study 2: Popular music-cued participants only: Inter-correlations between Phase 2 (Memory-Rating) measures and Phase 1 (Memory-Generation) measures (Part 1 of 2).

	FRE	IMP	VIV	MEM VAL	MEM INT	MEM REC	RT	WC	LIWC AFF	POS	NEG	ANX	ANG	SAD
FRE	-	**.62****	**.54****	**.21****	**.45****	**-.22****	**-.16****	.01	.02	.06	-.04	-.01	-.01	-.03
IMP		-	**.59****	**.39****	**.61****	**-.15****	**-.16****	.04	.05	.08	-.04	-.05	-.02	.03
VIV			-	**.22****	**.51****	**-.24****	**-.18****	.11*	.02	.06	-.07	-.09	-.03	-.02
MEM VAL				-	**.40****	-.07	-.12*	-.07	-.14**	.09	**-.37****	-.14**	**-.25****	**-.25****
MEM INT					-	-13**	-**.15****	.06	.03	.06	-.06	-.05	-.04	-.02
MEM REC						-	.08	.04	-.09	-.10*	.02	.06	-.01	.00
RT							-	.06	.00	-.07	.11**	.06	**.17****	.00
WC								-	.09	-.01	**.17****	.07	**.17****	.04
LIWC AFF									-	**.81****	**.46****	**.19****	**.24****	**.30****
POS										-	-.14**	-.07	-.10*	-.10*
NEG											-	**.44****	**.56****	**.67****
ANX												-	.05	-.01
ANG													-	.08
SAD														-

Note 1.** - $p < .01$, * - $p < .05$.
Note 2. Phase 2 (Memory-Rating) measures are presented first. FREQ = frequency, IMP = importance, VIV = vividness, MEM VAL = memory valence, MEM INT = memory intensity, MEM REC = memory recency.
Note 3. Phase 1 (Memory-Generation) measures are presented next. RT = response time to cue, WC = word count, LIWC AFF = affective processes, POS = positive emotion, NEG = negative emotion, ANX = anxiety, ANG = anger, SAD = sadness.

Table 81. Study 2: Popular music-cued participants only: Inter-correlations between Phase 2 (Memory-Rating) measures and Phase 1 (Memory-Generation) measures (Part 2 of 2).

	SOC	FAM	FR	LEI	COG PRO	PER	SEE	HEA
FRE	.04	-.04	.12*	-.01	-.08	-.10	-.08	-.09
IMP	.11*	.02	**.17****	-.06	**-.16****	**-.24****	**-.16****	**-.21****
VIV	.12*	-.02	**.18****	-.01	-.10*	-.13*	-.11*	-.08
MEM VAL	.05	-.03	**.15****	**.**14**	**-22****	-.02	-.03	.00
MEM INT	.07	-.04	.10*	.01	-.10*	-.13**	-.06	-.13**
MEM REC	-.10*	.02	**-.17****	-.03	.01	.04	.11*	-.03
RT	-.09	-.05	-.05	-.05	.08	.05	.03	.03
WC	-.08	**-.15****	**-.22****	**-.25****	**.42****	-.09	-.14**	-.05
LIWC AFF	-.07	-.08	-.07	**.17****	**.15****	.00	-.02	-.04
POS	-.03	-.06	-.08	**.34****	.03	.04	.04	-.01
NEG	-.07	-.04	.00	**-.23****	**.20****	-.06	-.10*	-.05
ANX	-.08	-.05	-.04	-.14**	.08	-.04	-.04	-.09
ANG	-.02	-.04	-.04	-.13**	**.17****	-.06	-.09	-.02
SAD	-.01	.00	.09	**-.15****	.07	-.01	-.05	.01
SOC	-	**.40****	**.33****	**.05**	-.10*	**-.22****	**-.16****	-.14**
FAM		-	-.12*	-.04	**-.17****	-.14**	-.04	**-.15****
FR			-	-.04	**-.18****	-.13**	-.13**	**-.05**
LEI				-	**-.20****	**.48****	**.30****	**.44****
COG PRO					-	-.02	-.06	-.04
PER						-	**.74****	**.74****
SEE							-	.13**
HEA								-

Note 1. ** - $p < .01$, * - $p < .05$.

Note 2. Phase 2 (Memory-Rating) measures are presented first. FREQ = frequency, IMP = importance, VIV = vividness, MEM VAL = memory valence, MEM INT = memory intensity, MEM REC = memory recency.

Note 3. Phase 1 (Memory-Generation) measures are presented next. SOC = social, FAM = family, FR = friend, LEI = leisure, COG PROC = cognitive processes, PER = perceptual processes, SEE =seeing, HEAR = hearing.

Appendix N: Study 2 Additional Multiple Regression Models on Non-Emotional Memory Qualities

Recall that regression models for Phase 2 memory intensity and valence ratings were presented in Section 3.1. The following presents regression models for the other Phase 2 memory ratings. This data is presented to help understand what factors of the music cue experience are associated with different measures of memory saliency and experience. While this helps add to knowledge of how music is tied to AM organization, this also informs better use of the Study 1 stimuli database in making focused stimuli lists for future research in popular music-cued AMs.

Frequency of Recall

The regression was statistically significant (R = .44), $F(5, 415) = 19.54$, $p < .001$, R^2 = .19. The regression model equation is as follows: predicted score = 3.41 + .24 (cue intensity) + .22 (cue relevance) - .25 (cue familiarity) - .12 (song recency). As can be seen, participant ratings of music cue intensity and relevance independently predicted higher frequency ratings (b = .24 and .22, respectively, both $p < .001$) accounting for approximately 3.6% and 3.4% percent of the variance in frequency scores, respectively. Two other significant predictors, familiarity and how many years old the song was predicted lower frequency ratings (b = -.25 and -.12, respectively, both $p < .001$) both accounting for 2.7% of the variance in frequency reported scores. The specifics are found in Table 82.

Table 82. Memory frequency ratings regression model using Phase 3 (Music Cue-Rating) ratings as predictor variables.

	FRE	CUEFAM	CUE INT	CUE VAL	CUE REL	SNG REC	*US B*	*S b*	*Sr²*
CUE FAM	**-.03**	**-**					**-.25****	**-.18**	**.027**
CUE INT	**.34****	**.25****	**-**				**.24****	**.25**	**.036**
CUE VAL	**.08**	**.30****	**.33****	**-**			**-.07**	**-.07**	**.004**
CUE REL	**.32****	**.40****	**.64****	**.37****	**-**		**.22****	**.25**	**.034**
SNG REC	**-.16***	**-.04**	**-.03**	**-.17****	**-.03**	**-**	**-.12****	**-.17**	**.027**
							I 3.41**		
Mean	**2.90**	**6.27**	**4.47**	**4.85**	**4.14**	**4.59**	***R²***	**.44**	
SD	**1.70**	**1.21**	**1.73**	**1.65**	**1.94**	**2.27**	***R²adj***	**.19**	
							R	**.18**	

Note 1. ** - $p < .001$, * - $p < .01$.
Note 2. FRE = memory frequency rating, MEM INT = memory intensity, CUE INT = music cue intensity, CUE REL = music cue relevance, SNG REC = song recency, CUE VAL = music cue valence, CUE FAM = music cue familiarity. I = intercept.

Importance of Memory

The regression was statistically significant (R = .49), $F(5, 415) = 25.32$, $p < .001$, R^2 = .24. The regression model equation is as follows: predicted score = 2.57 + .20 (cue intensity) + .33 (cue relevance) - .11 (song recency). As can be seen, participant ratings of music cue intensity and relevance predicted higher importance ratings (b = .20 and .33, p = .002, and $p < .001$, respectively) accounting for approximately 1.9% and 5.9% of importance score variance, respectively. A third significant predictor, how many years old the song is predicted lower importance ratings (b = -.11, p = .004), accounting for approximately 1.6% of the variance in reported importance scores of the recalled event. The specifics are presented in Table 83.

Table 83. Memory importance ratings regression model using Phase 3 (Music-Rating) ratings as predictor variables.

	IMP	CUE FAM	CUE INT	CUE VAL	CUE REL	SNG REC		*US B*	*S b*	*Sr²*
CUE FAM	**.15***	**-**						**-.07**	**-.04**	**.001**
CUE INT	**.39****	**.25****	**-**					**.20***	**.18**	**.019**
CUE VAL	**.21****	**.30****	**.33****	**-**				**.02**	**.02**	**<.001**
CUE REL	**.44****	**.40****	**.64****	**.37****	**-**			**.33****	**.34**	**.059**
SNG REC	**-.14***	**-.04**	**-.03**	**-.17****	**-.03**	**-**		**-.11***	**-.13**	**.016**
							I	**2.57****		
Mean	**4.04**	**6.27**	**4.47**	**4.85**	**4.14**	**4.59**		R^2 **.49**		
SD	**1.93**	**1.21**	**1.73**	**1.65**	**1.94**	**2.27**		R^{2adj} **.24**		
								R **.23**		

Note 1. ** - $p < .001$, * - $p < .01$.
Note 2. IMP = memory importance rating, MEM INT = memory intensity, CUE INT = music cue intensity, CUE REL = music cue relevance, SNG REC = song recency, CUE VAL = music cue valence, CUE FAM = music cue familiarity. I = intercept.

Vividness of Memory

The regression was statistically significant (R = .40), $F(5, 415) = 15.97$, $p < .001$, R^2 = .16. The regression model equation is as follows: predicted score = 3.44 + .23 (cue intensity) + .24 (cue relevance) - .07. As can be seen, participant ratings of music cue intensity and relevance predicted higher importance ratings (b = .23 and .14, $p < .001$, and p = .013, respectively), accounting for approximately 3.4% and 1.3% of the variance in reported vividness scores, respectively. The specifics are found in Table 84.

Table 84. Memory vividness ratings regression model using Phase 3 (Music-Rating) ratings as predictor variables.

	VIV	CUE FAM	CUE INT	CUE VAL	CUE REL	SNG REC		*US B*	*S b*	*Sr²*
CUE FAM	**.17****	**-**						**.05**	**.04**	**.001**
CUE INT	**.36****	**.25****	**-**					**.23****	**.24**	**.034**
CUEVAL	**.19***	**.30****	**.33****	**-**				**.03**	**.03**	**<.001**
CUEREL	**.34****	**.40****	**.64****	**.37****	**-**			**.14***	**.16**	**.013**
SNG REC	**-.12***	**-.04**	**-.03**	**-.17****	**-.03**	**-**		**-.07**	**-.10**	**.009**
							I	**3.44****		
Mean	**5.16**	**6.27**	**4.47**	**4.85**	**4.14**	**4.59**		**R^2**	**.40**	
SD	**6.27**	**1.21**	**1.73**	**1.65**	**1.94**	**2.27**		**R^{2adj}**	**.16**	
								R	**.15**	

Note 1. ** - $p < .001$, * - $p < .01$ for correlations, $p < .02$ for regression coefficients.
Note 2. VIV = memory vividness rating, MEM INT = memory intensity, CUE INT = music cue intensity, CUE REL = music cue relevance, SNG REC = song recency, CUE VAL = music cue valence, CUE FAM = music cue familiarity. I = intercept.

Appendix O: Study 1 Ethics Approval

Western Research

Western University Non-Medical Research Ethics Board
NMREB Delegated Initial Approval Notice

Principal Investigator: Dr. Albert Katz
Department & Institution: Social Science\Psychology,Western University

NMREB File Number: 107758
Study Title: Popular Music Listening: Knowledge and Perception

NMREB Initial Approval Date: March 08, 2016
NMREB Expiry Date: March 08, 2017

Documents Approved and/or Received for Information:

Document Name	Comments	Version Date
Western University Protocol	Received March 1, 2016	
Letter of Information & Consent	Poster Participants	2016/02/28
Recruitment Items	SONA Advertisement	2016/02/28
Letter of Information & Consent	SONA Participants	2016/02/28
Other	Debriefing Form	2016/02/28
Instruments	Questionnaire and Demographics Items	2016/02/28
Instruments	Stimuli List	2016/02/28
Recruitment Items	Poster Participant Advertisement	2016/02/28

The Western University Non-Medical Research Ethics Board (NMREB) has reviewed and approved the above named study, as of the NMREB Initial Approval Date noted above.

NMREB approval for this study remains valid until the NMREB Expiry Date noted above, conditional to timely submission and acceptance of NMREB Continuing Ethics Review.

The Western University NMREB operates in compliance with the Tri-Council Policy Statement Ethical Conduct for Research Involving Humans (TCPS2), the Ontario Personal Health Information Protection Act (PHIPA, 2004), and the applicable laws and regulations of Ontario.

Members of the NMREB who are named as Investigators in research studies do not participate in discussions related to, nor vote on such studies when they are presented to the REB.

Appendix P: Study 2 Ethics Approval

Western Research

Research Ethics

Western University Non-Medical Research Ethics Board
NMREB Delegated Initial Approval Notice

Principal Investigator: Dr. Albert Katz
Department & Institution: Social Science\Psychology,Western University

NMREB File Number: 108991
Study Title: Popular Music and Autobiographical Memories

NMREB Initial Approval Date: March 02, 2017
NMREB Expiry Date: March 02, 2018

Documents Approved and/or Received for Information:

Document Name	Comments	Version Date
Western University Protocol	Received February 3, 2017.	
Instruments	Appendix B - Questions and Instructions	2017/01/30
Other	Appendix A - Stimuli List	2017/01/30
Advertisement	Appendix D - SONA Advertisement	2017/01/30
Other	Appendix C - Debriefing Form	2017/01/30
Advertisement	Appendix E - Poster Advertisement	2017/01/30
Letter of Information & Consent	SONA	2017/02/23
Letter of Information & Consent	Poster	2017/02/23

The Western University Non-Medical Research Ethics Board (NMREB) has reviewed and approved the above named study, as of the NMREB Initial Approval Date noted above.

NMREB approval for this study remains valid until the NMREB Expiry Date noted above, conditional to timely submission and acceptance of NMREB Continuing Ethics Review.

The Western University NMREB operates in compliance with the Tri-Council Policy Statement Ethical Conduct for Research Involving Humans (TCPS2), the Ontario Personal Health Information Protection Act (PHIPA, 2004), and the applicable laws and regulations of Ontario.

Members of the NMREB who are named as Investigators in research studies do not participate in discussions related to, nor vote on such studies when they are presented to the REB.

Curriculum Vitae

Name:	Krysten D. Zator
Post-secondary Education and Degrees:	The University of Western Ontario London, Ontario, Canada 2008 - 2012 B.Mus. (Honors Specialization: Music History) The University of Western Ontario London, Ontario, Canada 2012 - 2015 B.A. (Honors Specialization: Psychology) The University of Western Ontario London, Ontario, Canada 2015 - 2017 M.Sc. (Cognitive Psychology)
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Publications:

Zator, K., & Katz, A. N. (2017). The language used in describing autobiographical memories prompted by life period visually presented verbal cues, event-specific visually presented verbal cues and short musical clips of popular music. *Memory*, *25*(6), 831-844.

Zator, K. (2014). Obsessive compulsive disorder as stress and coping: Cognitive models and associated treatments. *Western Undergraduate Psychology Journal, 2*(1). Retrieved from http://ir.lib.uwo.ca/wupj/vol2/iss1/3

Presentations:

Zator, K. D. (2017, November, accepted). *Musical cues and emotionality in autobiographical memory.* Future poster presentation at the 58th Annual Meeting of the Psychonomic Society, Vancouver, British Columbia.

Zator, K. D. (2016, November). *Linguistic content of autobiographical memories cued by popular music and words.* Poster presented at the 57th Annual Meeting of the Psychonomic Society, Boston, Massachusetts.

Zator, K. D. (2016, October 5). *Cueing methods in autobiographical memory (ABM) research: Popular music.* Guest lecture presented at Western University for Psychology 4195 (Special Topics in Psychology: Autobiographical Memory).

Zator, K. D. (2015, March). *Cueing autobiographical memories with popular music and words*. Poster presented at the Western Students' Research Conference, Western University, London, Ontario.

Zator, K. D. (2014, May). *Cueing autobiographical memories with popular music*. Poster presented at the 44th Annual Ontario Psychology Undergraduate Thesis Conference, Queen's University, Kingston, Ontario.