Characterisation of Music, Photo and Object Evoked Autobiographical Memories in Healthy Elderly People

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STATEMENT OF CANDIDATE

I hereby confirm that all material contained in this project are my original authorship and ideas, except where the work of others has been acknowledged or referenced. I also confirm that the work has not been submitted for a higher degree to any other university or institution. The research project was approved by the Macquarie University Human Research Ethics Committee (Approval No. 5201700279).

Signed:

Sarah Virginia Ramdoo

ABSTRACT

Recent literature suggests that autobiographical memories can be evoked involuntarily, and in detail, with the use of music and objects – producing evidence across groups of healthy adults and even clinical groups with memory impairments. However, neither music nor objects have been compared with other stimuli amongst healthy elderly people. This thesis compares the incidence of music-evoked autobiographical memories (MEAMs), photo-evoked autobiographical memories (PEAMs) and object-evoked autobiographical memories (OEAMs). Twelve participants (six male and six female) reported memories following exposure to: (1) 16 famous songs across 1930-2010 (rated number one in Australian music charts for the longest duration); (2) 17 photos (of famous events), two from each decade 1930-2010; and (3) 16 iconic household objects, two from each decade 1930-2010. Memories were reported via oral questionnaires. Statistical analyses revealed that there was a significantly lower proportion of MEAMs relative to PEAMs and OEAMs, with the number of PEAMs and OEAMs being statistically similar. There was no significant correlation between the frequency of MEAMs or OEAMs and familiarity ratings, but there was a significant positive correlation between PEAMs and familiarity ratings. There was a clearly defined reminiscence bump for MEAMs, but an extended reminiscence bump for PEAMs/OEAMs. This investigation is the first to characterise and compare autobiographical memories evoked by music, photos and objects amongst a healthy elderly population group. Results are discussed in view of research on age-related memory decline, and the potential to re-activate memories using carefully selected triggers.

CHARACTERISATION OF MUSIC, PHOTO AND OBJECT EVOKED AUTOBIOGRAPHICAL MEMORIES IN HEALTHY ELDERLY PEOPLE

Autobiographical memory (AM) is an integral part of our memory system that comprises our personal history. It includes memories of specific events together with sociohistorical knowledge (Williams & Conway, 2009). It involves two subtypes of memory systems, namely episodic and semantic memory (Tulving, 2005). Episodic memory contains information about personal experiences and events, and often includes the context of the experience, including the time and place in which they happened. It is the type of memory that facilitates the ability for one to 're-live' an experience and to elicit new perspectives, thoughts and emotions from that original experience (Haslam, Jetten, Haslam, Pugliese, & Tonks, 2011; Prebble, Addis, & Tippett, 2013). Semantic memory comprises factual information about the world. A key feature that differentiates these two memory systems is that semantic memory does not allow for personal engagement with time (past or future). Instead, it maintains knowledge (Tulving, 2005). Though distinct in function, the two memory systems work closely in conjunction to maintain our personal history. AM is critical to the development and continuity of the self. One's sense of self is supported by the functioning of both episodic and semantic memory systems.

Numerous authors have proposed an interdependent relationship between AM and the self. Conway and Pleydell-Pearce (2000) suggested a bi-directional relationship with the sense of self, as the quality and content of autobiographical memories affects notions of identity and how the sense of self is maintained (and vice versa). Patterns of AM retrieval, for instance, emphasise what types of memories are considered significant and relevant to maintaining a sense of self.

One of the most iconic and robust findings in AM research is the phenomenon of the 'reminiscence bump'. Named after its visual representation over a lifetime, the reminiscence bump is characterised by a higher frequency of recollections that date back to the ages between 10-30 years of age, becoming a more pronounced pattern of retrieval in people from the age of 40 and older (Rubin, Wetzler & Nebes, 1986). A number of theories have been proposed to account for the existence of the reminiscence bump. In their review of the reminiscence bump, Koppel & Rubin (2016) outlined three contributing factors: identity formation, cognitive ability and life-scripts.

Identity formation highlights the period of life between 10-30 years of age, which is a time when significant life events and first experiences occur. These experiences are crucial for consolidating self-identity, personal goals, expectations and beliefs – the core components of an individual's life story (Rubin, Rahhal & Poon, 1998). Cognitive ability refers to the notion that events that take place between 10-30 years of age require a significant amount of attentional resource at the stages of encoding, as they are often novel experiences that have defining contributions towards life schemas (Koppel & Rubin, 2016). Life scripts refer to the embedded knowledge that is learnt about the sequence of life-defining events and experiences. They characteristically lay emphasis on the events that occur within the time period of 10-30 years old, compared to other time periods of in life. With this knowledge, the processes of memory encoding and retrieval are activated more readily (Schacter & Addis, 2007). Each of these explanations indicate that the time period of the reminiscence bump significantly contributes to the sense of self, and becomes integral to maintaining concepts of the self in older age, particularly when reflecting on major life stages and transitions (Steiner, Pillemer, Thomsen & Minigan, 2014). To date, the reminiscence bump has only been studied across stimuli such as

words and smells, and have not yet been studied in response to cues such as music, photos and objects as of yet (Koppel & Rubin, 2016).

Another trait of ageing which affects retrieval of AMs, is the natural decline of cognitive capacity, whereby the core mental skills and mechanisms required to execute tasks gradually lose efficiency – a normal trend to observe in healthy ageing. One of the main effects of reduced cognitive capacity in age is the reduced availability of attentional resources, which also causes the function of working memory to decline (Schlagman, Kvavilashvili & Schulz, 2007). Overall, these changes in cognitive function have implications on how accessible AMs become with age – making their retrieval a more effortful experience. As a result, the amount, type and specificity of AMs are affected in ageing, causing notions of self-identity to change and adapt.

AM TRIGGERS

While the voluntary retrieval of AM becomes affected in the processes of ageing, various stimuli may be effective in triggering involuntary recall of AMs across a lifetime. These stimuli include music, photos, food, clothing, and a range of household objects. The occurrence of involuntary or spontaneous memory recall is particularly advantageous in older age – as it does not require cognitive effort to retrieve, which is typically diminished in the elderly.

Objects

There is growing evidence that objects are effective triggers of AMs. Studies of object evoked autobiographical memories (OEAMs) to date have been conducted in both healthy and dementia populations and used various types of objects including household items, clothing, tools, gifts, souvenirs, photos and museum artifacts. Two studies of healthy people have explored OEAMS, mainly examining the use of household items and other commonly occurring cues in daily life (Petrelli &Whittaker, 2010; Van Gennip, Van Den Hoven & Markopoulos, 2015). Both studies used interviews to gather data. However, Van Gennip et al. (2015) used interviews as a second part of the investigation, to consolidate what had been self-reported by participants in their diary entries. The diaries contained information about the spontaneous memories that occurred throughout the testing period, and also detailed the cues that evoked them, which were later transcribed before interviewing. Petrelli and Whittaker (2010) did not give the participants diaries to record their OEAMs, but engaged in interviews and made observations within the participants' homes. Interestingly, even though one study took place within the home and another was not exclusive to the home, the results from both studies revealed that physical objects (typically common to the household) evoked spontaneous memories more often than digital or environmental cues.

Petrelli and Whittaker (2010) noted that items including: cups, clock, coffee machine, teapot and children's toys were often characterised as possessing significant value to family memories - usually because of the frequency of use, or because they were associated with a significant relation. Objects that served as mementos of personally significant events (that weren't necessarily functional) were the next most common category of items to be identified, i.e. memorabilia. Digital objects which depicted meaningful family memories were found to not be heavily integrated into everyday life, nor were they likely to be chosen as preferred representations of family memories and were less displayed than physical objects (Petrelli & Whittaker, 2010). Amongst these results, it was also found that personal photographs were not often identified as an important physical or digital memory cue.

Van Gennip et al. (2015) reported similar results. They found that the most commonly identified cues were physical objects, which ranged from tools, clothing, souvenirs, gifts, books, images, food and decorative pieces. Other cues identified included geographical locations, activities (such as cooking) and actions performed in certain locations. Memories surrounding food and food practices were also common amongst the participants, and were generally rich in meaning with multiple thematic crossovers between social gatherings, past events and family members. Surprisingly, photos were not identified as a common cue to all, although some did record photographs as cues. Another notable finding was the tendency for cues to evolve in meaning, whereby personal attachment or significance placed on cues (especially physical objects) either diminished or grew following the passage of time. Lastly, digital cues were rarely identified, and did not convey a high level of personal meaning when referenced (Van Gennip, Van Den Hoven & Markopoulos, 2015). In short, the use of common household items appears to be highly effective for triggering AMs, primarily for their relevance to memories concerning significant relations in the family, as well as early periods of life that fall within the reminiscence bump. Additionally, the use of objects such as tools, clothing, souvenirs, gifts, books, food decorative pieces, and even memorabilia serve as effective object-based stimuli for AM retrieval.

Despite evidence that photos are less effective than objects in triggering AMs, photos have had a recognised history in multidisciplinary research as reliable triggers of memory. Harper (2002) noted that photos are very useful within the context of research interviews on a myriad of topics, including social class, historical events, the family unit, and identity. Harper states that the cognitive processes used for visual stimuli, such as photos, adds depth to processing the verbal information involved in interview dialogue. In terms of memory retrieval,

Harper also states that photographs provide a gateway for quickly engaging with emotional content in recollections of past events and experiences (2002).

There is growing evidence supporting the use of objects to trigger AMs in people with dementia and mild cognitive impairment (MCI). Two studies have used various stimuli, broadly falling into the categories of common household objects, food, clothing and accessories. Both studies included interviews in their experimental method, but conducted these in very different settings and with different cues. Nonetheless, both studies showed that the use of objects, relevant to, or resembling parts of their own personal histories, were effective triggers of AMs.

In one innovative study, Miles, et al. (2013) examined AM retrieval in a reconstructed museum designed to represent an early 20th century home. This room contained nine specific cues to match the time period, including an old-fashioned telephone, marbles, a small slate with chalk, a handheld whisk and an old-fashioned coffee pot (with coffee made in it, in an oldfashioned way) with old fashioned cookies on the side (Miles et al., 2013). The control condition for the museum was a modern conference room inside an aged care residential facility. The cues chosen to contrast with the museum setting and stimuli included a modern cell phone, a calculator, an electric hand-mixer, a modern thermos with modern, organic style coffee in it, and M&M cookies. For both settings, participants (four with dementia, eight with MCI) were interviewed on each of the cues presented, specifically regarding the nature of the cue and their personal experience with it (Miles et al., 2013). The results from both settings revealed that: (1) more AMs were produced in the museum room representing the early 20th century, than to the modern day setting; (2) 11 out of the 12 participants reported more specific events in their AMs in the early 20th century setting, compared to the modern day setting; (3) AMs were more spontaneously evoked in the museum room than in the modern conference room. Though using a

small participant group size, findings from this study demonstrated the effectiveness of using personally relevant, time specific cues to evoke AM - namely objects, but also including other cues such as food. Having a complete physical environment redesigned to resemble a different time period was also shown to be conducive in producing the aforementioned results.

Another museum-related study that included people with dementia investigated the practice of object-handling in museums, and the relationship it may have with overall wellbeing (Camic, Hulbert & Kimmel, 2016). While this study was not linked to AM retrieval in any way, its approach is still relevant and encourages the practice integrating non-clinical environments and museum objects as stimuli into health promotion activities for people with dementia, and for healthy elderly populations. Participants in this study had a range of early to mid-stage dementia, and each participated in small group sessions where a range of relatively unknown artifacts were presented. The types of objects selected, included animal fossils, Stone Age tools, Victorian Era utensils and preserved ancient textiles (Camic, Hulbert & Kimmel, 2016). These artifacts were passed around to each participant and facilitators conducted informal group interviews about the objects and what participants might have thought in regards to them. Results from the study showed that the participants had an overall positive change in wellbeing (measured with the Canterbury Wellbeing Scale) following the object handling session. It was also noted that participants with early-stage dementia demonstrated a larger positive increase in wellbeing than their mid-stage counterparts (Camic, Hulbert & Kimmel, 2016). Overall, the finding of increased well-being also supports the idea of running trial programs and studies that use a similar design for AM retrieval purposes.

As mentioned, the second study regarding AM retrieval in people with dementia focused on using clothing and accessories as cues (Buse & Twigg, 2016). Buse and Twigg conducted

their interviews within the rooms and personal wardrobes of people from various dementia care homes. After coding the interviews conducted, three main categories of memories and reflections emerged based on: 'kept clothes', 'discarded clothes' and 'absent clothes' (Buse & Twigg, 2016). Responses (memories, reflective statements) based on kept clothes revealed aspects of identity that remained important or memorable to participants. Responses triggered from discarded clothes appeared to be representational of the progression of the participants own decaying memory, consequent lifestyle changes and changes in identity. Absent clothes were clothes that had been discarded in the past, but were still recalled by participants at the time of the study. Recalling these absent pieces of clothing had a tendency to reflect characteristic traits of who the participants identified as being in their past, and also provided some sense of continuity into their current identities (Buse & Twigg, 2016). Findings from this study revealed the importance of clothing, and highlighted the embedded meaning they carry for personal memories relating to identity. Memories and conversation elicited from each category of clothing possession (or lack of) revealed aspects of identity for the participants with dementia, and suggest that similar responses may even be triggered by healthy elderly groups.

In summary, these studies demonstrate that objects are effective stimuli for triggering recall of AMs in both healthy and clinical populations. When selecting objects to use as stimuli, the current literature highlights that common household items are more advantageous for triggering AMs. Objects that are more likely to evoke memories from earlier periods of life, namely the reminiscence bump, include dated household items, clothing and memorabilia. Museum artifacts may be particularly useful in gathering common examples of these. While photos did not appear to be significantly identified cues, prior research still supports its use in

research interviews in gaining perspectives on events of the past and emotional recollections from personal histories.

The current literature on OEAMs is clearly still in its beginning stages, with only a very small amount to access. At this point in OEAMs research, it has been established what particular objects are likely to trigger a higher frequency of AMs that also evoke spontaneous and specific AMs. However, one main limitation to the current research, is that it is not yet known whether objects (such as household items, memorabilia, etc.) are more effective than other stimuli of different modalities. In other words, objects are yet to be compared for an objective evaluation on their efficiency in AM retrieval. Additionally, existing OEAMs research have been conducted with smaller participant groups, and would likely benefit from larger participant numbers. There is also a limited amount of studies which have focused on OEAMs in healthy older adults, and tested other potential relationships between objects and AMs, such as: familiarity with stimuli; emotional valence of stimuli and AMs evoked; and further examination of the reminiscence bump.

Music

People often reminisce about past experiences while listening to music, but only in the past decade have researchers begun to systematically investigate the use of music as a trigger of AM. The occurrence of these triggered memories was first characterised by Janata, Tomic and Rakowski (2007), who coined the term "Music-evoked Autobiographical Memories" (MEAMs). Since then, MEAMs studies have been conducted with both healthy and clinical participant groups, with older adults primarily featuring in clinical studies as control groups.

The aim of the study that Janata et al. (2007) conducted was to characterise the content of MEAMs using excerpts of popular music with a participant group of healthy university students. Music was sourced from Billboard charts and Apple Music iTunes charts. The procedure involved the participants consecutively listening to 30 excerpts of songs and answering questionnaires in between, measuring: familiarity, autobiographical salience, affective response to the song and genre of the song. The main results showed that an average of 30% of the songs used triggered AMs, and on average, 54% of the participants rated the songs as familiar. Results on the content of memories showed that a combination of general AMs based on periods of life (e.g. childhood), as well as detailed memories from specific personal events, were evoked from the excerpts. In AM literature, 'general' AMs involve content of repeated events, and tend to be characteristic to a period of time, whereas specific AMs tend to regard particular one-time events or experiences (Janata et al., 2007; Cuddy, Sikka, Silveira, Bai & Vanstone, 2017).

The content of AMs were further coded for content categories of: 'Event', 'Period', 'Person/People', 'Place' or 'None of the above'. The most common type of category was found to be 'Person/People' and 'Period of life', with approximately 40% of songs evoking AMs regarding these. Further analyses on distinct sub-categories reported the following as popular: dancing, driving in the car, friends as well as girlfriend/boyfriend relationships. In regards to emotions, MEAMs had a tendency to elicit positive emotional responses (Janata et al., 2007). Overall, the findings from this study demonstrated that popular music is a potent cue for memory retrieval, particularly triggering AMs related to people/person and period of life.

In the first investigation to compare memories evoked by music with another type of stimuli, Belfi, Karlan and Tranel (2015) compared music with photographs of famous faces. The

participants for this study were healthy adults, with a wide range of age. Each participant listened to 30 songs (Billboard chart excerpts) and viewed 30 photos of famous faces in a counterbalanced design. Between each song/face, the participant was asked to report whether they had an AM come to mind spontaneously during exposure to the stimuli – if they did, they were to then verbally describe the memory. Results from the study showed that near 30% of the music and faces that were presented triggered recall of AMs (Belfi et al., 2015). However, faces triggered a significantly greater number of memories evoked than music.

On the other hand, memories evoked by music revealed greater vividness and specificity than memories evoked by the photos of famous faces. Although it was assumed that there may have been a relationship between familiarity and the number of memories evoked by famous faces, ratings of familiarity were not included in the procedure, and therefore no statistical evidence was able to support this idea. Where there was the option to report either "somewhat autobiographical" or "strongly autobiographical", there was a higher frequency of reported "somewhat autobiographical" responses to faces, than to music (Belfi et al., 2015). In other words, that famous faces were more likely to evoke general AMs than specific AMs. Overall, findings from this study reaffirmed the use of popular music in spontaneously evoking AMs, showing a consistent result of 30% of songs evoking AMs. Furthermore, this study also provided important evidence showing that photos depicting popular culture/iconic sociohistorical content are another highly effective cue in triggering AM.

There is accumulating evidence of preserved MEAMs in people with dementia specifically AD (El Haj et al., 2012; Cuddy et al., 2017; Chevreau, Nizard & Allain, 2017). These studies have used popular instrumental music and favourite music as stimuli. Comparisons between music to other conditions have also been made, such as: silence (El Haj et al., 2012) and

specific word cues (Chevreau et al., 2017). Various qualities of MEAMs occurring in people with dementia were explored in these studies, including: their involuntary nature, the 'positivity effect' (Cuddy et al., 2017) and other characteristics such as specificity and types of AMs.

The main results of both comparison studies between music/silence and music/words revealed that music was more effective at triggering AMs in participants with dementia (El Haj et al., 2012; Chevreau et al., 2017). In the study conducted by El Haj et al. (2012), it was specifically found that exposure to favourite music evoked more spontaneous AMs with greater specificity than silence in young adults, healthy older adults and older adults with AD. Results also showed that AMs evoked by favourite music also contained greater emotional content and were retrieved faster (in all three groups), compared to AMs evoked in silence (El Haj et al., 2012). Overall, each of the findings are characteristic of involuntarily retrieval of AMs. The study conducted by Chevreau et al. (2017), comparing music with word cues, showed that the overall quality of AMs in participants with AD increased with exposure to music stimuli. Healthy older adults, in contrast, showed less quality in AM following exposure to music. Participants with AD also reported a lower quantity of AMs compared to healthy older adults in both conditions (music and words cues), which is likely due to the severity of cognitive impairment (Chevreau et al., 2017).

In the study conducted by Cuddy et al. (2017), MEAMs were compared between young adults, healthy older adults and older adults with AD, but with no additional stimuli. Instrumental tunes were assessed for familiarity across the young adult and older adult groups, with twelve excerpts of popular instrumental tunes being selected for use. In sum, the results showed that MEAMs occurred in all groups, with the median percent of MEAMs responses at 100% for both older adult groups, with the young adult group having a median percent of 90% (Cuddy et al., 2017). Some participants in the AD group did not have any MEAMs, and this was an unclear finding, which required further investigation. AMs reported in the young adult group had a tendency to date back to the time of their adolescence, whereas the reported memories of both older adult groups were more commonly from their early adulthood. These tendencies for AMs to date to back to the specified time periods demonstrated evidence of the reminiscence bump. A 'positivity effect' was also reported across the groups, which meant that more AMs with positive content (i.e. AMs of 'Going out') and positive emotional valence were evoked in older adults than in younger adults (Cuddy et al., 2017).

Overall, these studies highlight that a range of musical stimuli are effective cues for evoking AMs in healthy and clinical populations. AMs evoked by music tend to be retrieved quickly and are more specific, compared with those retrieved in other conditions (e.g. silence). Prior research has also shown that AMs evoked by music are likely to relate to a person/people or periods of life – such as early adulthood, for older adults. One of the main limitations of some of the current MEAMs research is that results have derived from smaller group sizes, particularly concerning older adults. Established findings from these smaller studies would have the potential to be strengthened from being replicated with a larger participant group size. Additionally, MEAMs studies focusing on healthy older adult groups are rare, and have primarily been conducted with older adults with AD. Further comparisons between music and other cues, such as photos with popular culture content, would bring clarity as to whether music is a more effective memory cue for healthy older adults.

Nostalgia

Nostalgia has been broadly defined as an emotional experience, and not specific to any one type of emotion, but associated with a range of contrasting emotions, such as sadness and joy (Barrett, Grimm, Robins, Wildschut, Sedekides & Janata, 2010). While it is primarily an affective response, it has also been characterised as a commonly reported trait of remembering both negatively or positively valenced AMs (Wildschut, Sedikides, Arndt & Routledge, 2006). Since there is an association between remembering and nostalgia, the current study explored whether participants with a higher degree of reported nostalgia (via Southampton Nostalgia Scale) would have more frequent memories evoked by music, photos or objects. Nostalgia proneness has not previously been measured in relation to AMs evoked by photos or objects, but have been previously studied with music. Barrett et al. (2010) investigated the occurrence of "music-evoked nostalgia", and found that the strength of nostalgia evoked by music was significantly influenced by the nostalgia proneness of an individual. Furthermore, these experiences of music-evoked nostalgia were predicted by autobiographical salience associated with the music (Barrett et al., 2010). Therefore it was predicted in the current study that participants with a higher degree of reported nostalgia (as assessed by overall score on the Southampton Nostalgia Scale) would have more frequent memories evoked by any type of stimuli."

To date, no prior study has made a direct comparison of AMs evoked by music, photos and objects – particularly focusing on a healthy elderly population group. The study of this thesis aimed to address this present gap in knowledge, producing findings that will contribute to our understanding of the nature of AMs retrieved in older age from these stimuli. Additionally, the current study aims to build upon evidence of the reminiscence bump evoked by other cues such

as words and smells (Koppel & Rubin, 2016), and compares how this phenomenon is expressed in AMs evoked by music, photos and objects. The results from this investigation will have scientific and clinical implications in providing insights into effective cues of AM which in turn could aid in enhancing the sense of self in older adults (both healthy and clinical groups).

THE CURRENT STUDY

The objective of the current study was to characterise AMs evoked by music, photos and objects, including: frequency of AMs, familiarity with stimuli, memory type (content category), specificity and whether a reminiscence bump exists for these stimuli in healthy elderly people. The study was approved by the Macquarie University Human Research Ethics Committee (HREC).

Hypotheses

It was predicted that: (1) Music will be more likely to trigger AMs compared with objects and photos, based on a greater amount of literature established to support the occurrence of MEAMs; (2) Stimuli with high familiarity ratings will be more likely to evoke AMs than those with low familiarity ratings; (3) A reminiscence bump will be evident for all stimuli. That is, stimuli from when participants were aged 10-30 years will be more likely to produce memories than stimuli from later time periods (when participant was aged 31-50 or 51+ years); (4) Participants with a higher degree of reported nostalgia (as assessed by overall score on the Southampton Nostalgia Scale) will have more frequent memories evoked by any type of stimuli.

METHOD

Participants

Twelve participants (six male and six female) were recruited via the Macquarie University ARC Centre of Excellence in Cognition and its Disorders participant pool online database, and were screened by phone. The mean age was 77 years old, with an age range of 56-89 years old. The inclusion criteria were: fluent in English (native English speaking), residing in Australia since 10 years of age (to ensure familiarity with stimuli) and consent to filming parts of the session. Exclusion criteria were: previous or current neurological condition, previous or current alcoholism, severe psychiatric disorder (e.g. schizophrenia), visual /hearing / language impairments that would prevent communication or ability to hear music and engage with visual/tactile stimuli.

Stimulus selection

All stimulus chosen (songs, photos and objects) chosen were relevant to the decades of 1930-2010, as this range covered childhood through to the present stage for each of the participants. This range of decade also meant stimulus chosen were able to be categorised into the time periods of: (a) 10-30 years old, (b) 31-50 years old, and (c) 51+ years old. These three tie periods were specified to enable an exploration of the reminiscence bump across stimuli.

In total, 16 popular songs were chosen based on sales and the most weeks spent at 'Number One' on the Australian music charts according to: The Kent Music Report (for songs from 1930-1989) and Australian Recording Industry Association (for songs from 1990-2010).Two songs were chosen from each decade of 1930-2010. Songs were purchased via iTunes) For a list of songs used with their corresponding decade, refer to Table 1.1. In total, 17 photos were chosen, instead of 16 as with songs, due to the equal prominence of 2 events in the 1950s (namely the building dispute of the Australian Opera House and the introduction of the first television). The selection of photos was based on the most prominent events during each decade according to records on Wikipedia for each year and verified using online news resources. The photos did not represent an event that spanned a long period of time (e.g. WWII). Rather, they depicted a single event (e.g. "victory over Japan day"). Each photo was individually printed on A5 paper in their original colouring and laminated. For a list of photos of famous events used, matched to their decade, refer to Table 1.2.

A total of 16 objects were chosen based on how common they were to the household and general popularity of use, with the assistance of the curator of the Australian History Museum at Macquarie University. Each object was initially identified using various online sources, mainly news feature articles and Wikipedia. Objects in use from 1930-1980 were loaned from the museum. Objects from 1990-2010 were sourced by the investigators from their personal belongings. Two objects represented each decade. For a list of objects used with their corresponding decade, refer to Table 1.3.

Standardised tasks

Cognitive screen. All participants completed a cognitive screen (the Mini-Addenbrooke's Cognitive Examination (M-ACE, Hsieh et al., 2013) prior to completing the experimental tasks. Two participants (two females) scored below and at the cut off of 25 (cut off for indication of dementia diagnosis, two participants scored 22 and 25) indicating mild cognitive impairment (MCI). However, data from their sessions were still included, as analyses indicated they were not statistical outliers. Their individual descriptive results are outlined in the

Results section of this paper. The remaining 10 participants scored at or above the cut off score of 25 (M=28.6, range 26-30). It is noted that prior MEAMs studies have used the Mini Mental State Examination (MMSE) with dementia and MCI participants, however the M-ACE has been deemed more sensitive than the MMSE and less likely to have ceiling effects (Hsieh et al. 2015).

Questionnaires. To assess nostalgic proneness participants completed the Southampton Nostalgia Scale (Version 2) at the conclusion of the testing session. This scale is made up of seven items, with a Likert response type scale from 1 ("not at all") to 7 ("very much", Barrett et al., 2010).

Experimental tasks

Questionnaires. After each song, photo and object was presented in counterbalanced order across participants, the MEAM questionnaire developed by Baird and Samson (2014) was used and adapted for the PEAMs and OEAMs task, with questions presented orally (see Appendix A).

Procedure

Participants attended the Australian Hearing Hub at Macquarie University and completed the tasks individually in a sound-isolated room. Duration of the entire assessment was approximately two hours. The order in which music, photos and objects were presented were counterbalanced (see Table 1.4). For the MEAM task, approximately 30-60 seconds of each song was played from the start, ensuring the chorus of the song was heard. All 16 songs were played in a randomised order for each participant, via portable speaker connected to a laptop. The MEAM questions were asked during the song excerpt and continued as required after it ended. The questions are outlined in Appendix A. Participants were asked if the song brought any

personal memories to mind, emphasising that they had to be memories from their own life – to distinguish from any semantic associations they may have had. Details about the nature of their personal memories appeared to flow naturally in response to this question, however the investigators asked follow up questions to clarify the content if a memory was reported (i.e. people, time, place, specific event and level of specificity. Specific content of memory was defined as being related to a one-time event, whereas general content of memory was defined as being related to repeated events (Cuddy et al., 2017), and this was later coded when analysing data.

The PEAM and OEAM tasks were asked once the photo or object had been presented to the participant. Each photo and object was presented in a randomised order. As with the MEAMs task, the verbal questionnaire began by first asking whether the participant was familiar with the photo or object presented (see Appendix A), and these were generally asked sooner than with music as photos and objects took less time to present. The investigators were also clear in asking for personal memories and follow up questions to clarify content.

RESULTS

Frequency of MEAMs, PEAMs and OEAMs

First, it was hypothesised that music will be more likely to trigger autobiographical memories compared with photos and objects. We investigated this hypothesis by calculating the proportion of music, photo, and object stimuli that elicited a memory within each stimulus category, rather than across all three stimulus categories combined. There were 16 stimuli in the music category and the objects category, thus a maximum of 16 possible evoked memories for

these stimulus categories. There were 17 stimuli in the photo category, thus a maximum of 17 possible evoked memories for these stimulus categories. These are reported in Figure 1 as a percentage of elicited memories. A within-subjects ANOVA revealed a significant effect of the triggers of memory, F(2,22) = 8.51, p = .002, $\eta^2_p = .436$. Post hoc pair-wise comparisons with Bonferroni correction revealed a significantly lower proportion of MEAMs relative to PEAMs (p = .012, 95% CI [-5.939, -.728]), and OEAMs (p = .011, 95% CI [-7.527, -.973]). Furthermore, the number of PEAMs and OEAMs were statistically similar (p = 1.000, 95% CI [-4.163, 2.330]. Therefore, the hypothesis was not supported.



Figure 1. Mean percentage of music, photo, and object-evoked memories. Percentages were calculated within each stimulus type, rather than across all three stimulus categories combined. Error bars represent the standard error of the mean.

Familiarity of stimuli. Mean familiarity ratings for music, photos, and objects that elicited an autobiographical memory are presented in Figure 2. A within-subjects ANOVA revealed no significant differences between mean familiarity ratings of stimuli that elicited an

autobiographical memory between MEAMs, PEAMs, and OEAMs, F(2,22)=2.83, p=.08, $\eta^2_p =$.205. In other words, stimuli eliciting autobiographical memories were equally familiar to participants, regardless of whether they were a piece of music, a photo, or an object. This means that the possibility of photos or objects being more familiar than music can be ruled out as a confounding factor in the above mentioned proportion of memories elicited by music, photos, and objects. Rather, another unknown factor is at work in influencing the proportion of evoked memories amongst stimulus groups.



Figure 2. Mean familiarity ratings for stimuli that elicited autobiographical memory within music, photos, and objects. Error bars represent the standard error of the mean.

Types of memories evoked by each stimuli. Figure 3 displays the types of MEAMs, PEAMs, and OEAMs according to the categories of content: *Person/People, Place, Period of Life (e.g. young adulthood), Specific Event*, or *Other*. As the content of a memory could fit into more than one category, overall frequency is reported, rather than percentages. It was found that objects elicited the greatest number of memories related to a person/people or period of life,

whereas photos elicited the greatest number of memories related to a specific event – such as memories of watching a significant (one-time) event on TV. Music elicited the greatest number of memories related to one's period of life, such as memories of their childhood, for example¹.



Figure 3. Frequency of types of MEAMs, PEAMs and OEAMs.

Specificity of memories. The specificity of content within each memory was coded as per definitions of specific and general content, also used by Cuddy et al. (2017). Figure 4 shows the frequency of MEAMs, PEAMs and OEAMs according to specificity. It was found that PEAMs were more 'specific' in content (i.e. a single event), whereas OEAMs were more 'general' in content (i.e. repeated events). Specific content often included memories of specific events, such as attending one-time celebrations. General content included memories from periods of life, such as routinely activities that happened throughout young adulthood.

¹ Scoring of content categories allowed for the possibility that a single memory could be represented by multiple categories.



Figure 4. Specificity of MEAMs, PEAMs, and OEAMs.

Relationship between frequency of memories and familiarity of stimuli

Second, it was hypothesised that there would be a significant positive correlation between the number of autobiographical memories reported within each stimuli and participants' ratings of familiarity with those stimuli. Three Spearman's correlational analyses were conducted to determine the relationship between familiarity ratings and frequency of memories elicited by music, photos and objects. There was no significant relationship between frequency of MEAMs and familiarity ratings ($r_s = -.04$, p = .891), or frequency of OEAMs and familiarity ratings ($r_s =$.08, p = .816). In contrast a significant positive correlation was found for PEAMs (rs = .73, p = .007).Therefore, the more familiar a photo (the event in the photo) was to participants, the more likely it elicited an autobiographical memory.

Reminiscence Bump

Third, it was hypothesised that a reminiscence bump will be evident for each type of stimuli. That is, stimuli related to the time period of when participants were aged 10-30 years will produce more memories than stimuli from later time periods of participants' lives (when the participant was aged 31-50 or 51+ years). To investigate this hypothesis, three separate within-subjects ANOVAs were conducted for MEAMs, PEAMS, and OEAMs with time period (10-30 years, 31-50, and 51+ years) as the independent variable. For MEAMs, the within-subjects ANOVA revealed a significant effect of time period, F(2,22) = 17.42, p < .001, $\eta^2_p = .613$. As shown in Figure 5, post hoc pair-wise comparisons with Bonferroni correction show that the mean frequency of MEAMs was significantly greater in the time period of 10-30 years old relative to the time period of 31-50 years old (p = .018, 95% CI [.040, .432]), and 51+ years old (p = .001, 95% CI [.165, .585]). Therefore, these results demonstrate evidence of a reminiscence bump for MEAMs (as defined in this study as stimuli relevant to 10-30 years of age).

For PEAMs, the within-subjects ANOVA also revealed a significant effect of time period, F(2,22) = 7.81, p = .003, $\eta^2_p = .415$. As shown in Figure 5, post hoc pair-wise comparisons with Bonferroni correction show that the mean frequency of PEAMs in the time period of 10-30 years old was not significantly different to the time period of 31-50 years old (p = .232, 95% CI [-.046, 2.52]). Nevertheless, there was a significant difference observed between the mean frequency of PEAMs in the time period of 10-30 years old versus 51+ years old (p = .020, 95% CI [.038, .446]). Finally, the mean frequency of PEAMs in the time period of 31-50 years old was not significantly different to the time period of 51+ years old (p = .102, 95% CI [-.023, .301]). This suggests that the time period outlined in this study as the reminiscence bump (10-30 years of age) is not as clearly defined for photos as it is for music.



Participant Age when Memories Occured

Figure 5. Mean percentage of MEAMs, PEAMs, and OEAMs within three time periods. Percentages were calculated within each stimulus type (music, photo, object), rather than across all three combined. Error bars represent the standard error of the mean.

For OEAMs, the within-subjects ANOVA also revealed a significant effect of time period, F(2,22) = 10.542, p = .001, $\eta^2_p = .489$. As shown in Figure 5, post hoc pair-wise comparisons with Bonferroni correction show that the mean frequency of OEAMs in the time period of 10-30 years old was not significantly different to the time period of 31-50 years old (p = .455, 95% CI [-.081, .275]). There was, however, a significant difference observed in mean frequency of OEAMs between the time periods of: 10-30 years old and 51+ years old (p = .001, 95% CI [.078, .561]), and between 31-50 years old and 51+ years old (p = .004, 95% CI [.045, .399]). As with PEAMs, these results suggest that the time period chosen in this study to represent the reminiscence bump is not as clearly defined in objects as it is for music, and that there is a more extended time period for the reminiscence bump for these stimuli.

Relationship between nostalgia and frequency of memories

It was predicted participants with higher nostalgia ratings (as measured by the overall score on the Southampton Nostalgia Scale version 2) will have more frequent memories evoked by any type of stimuli. To investigate this hypothesis, we conducted Pearson's correlations between participants' rating of nostalgia on the Southampton Nostalgia Scale and frequency of MEAMs, PEAMs and OEAMs. There were no significant relationships between any type of stimuli and nostalgia ratings [MEAMs (r = -.308), PEAMs (r = -.067) and OEAMs (r = -.315), all (p > .05)]. Therefore, the hypothesis was not supported.

MCI Results

Having addressed each of the hypotheses, it is also worth noting that data produced from the two participants who achieved scores that were either below or at the cut-off score of 25 in the M-ACE (indicative of MCI), were still included in the results, as they were not statistically reported as outliers in comparison with participants who achieved scores above the cut-off. Further elaboration on their individual descriptive results below, and sheds some light as to how they were not obvious outliers, as first assumed.

Participant eight, who achieved a M-ACE score of 22, had a frequency of: one MEAM, four PEAMs and 10 OEAMs. The mean familiarity across all stimuli was a rating of 1.27 and the majority of these evoked AMs were of general type, eight of which were evoked by objects – which was consistent with the overall characterisation of AM specificity. Of all evoked AMs,

period of life was the most common content category reported, and these were evoked from objects – also consistent with the overall findings for content category in OEAMs. The one MEAM they had was evoked from a song that was matched to the decade prior to when they were 10-30 years old. Out of their four PEAMs, two were from photos matched to the decades from when they were 10-30 years old. Out of the 10 OEAMs, only three were from objects matched to the decades when they were 10-30 years old. Overall, there was no clear evidence of a reminiscence bump across all stimuli, perhaps with the exception of PEAMs. Finally, this participant had the highest Southampton Nostalgia Scale (version 2) overall score of the whole participant group, with a score of 42. This score, highlights an example of how nostalgia proneness alone, without comparison measurements, does not necessarily predict the frequency of evoked AMs (as discussed previously).

Participant six, who achieved a M-ACE score of 25, had a frequency of: eight MEAMs, 12 PEAMs and eight OEAMs. The mean familiarity across all stimuli was a rating of 1.56 with an equal total amount of general and specific AMs evoked. Out of this equal distribution of specificity, objects evoked the most amount of general AMs, whereas photos evoked the most amount of specific AMs – which again is consistent with the overall characterisation of AM specificity. Of all evoked AMs, specific events were the most common content category reported, and these were evoked by photos – also a consistent finding of content categories of PEAMs. Out of their eight MEAMs, four were from songs matched to the decades from when they were 10-30 years old. Out of their eight OEAMs, four were from photos matched to the decades from when they were 10-30 years old. Out of their eight OEAMs, four were from objects matched to the decades when they were 10-30 years old. It appeared that there was more persuasive evidence of a reminiscence bump for all stimuli, albeit not as clearly defined (also

consistent with overall reminiscence bump findings). Finally, this participant had an SNS (version 2) overall score of 31, which was above the group average score (28.42).

DISCUSSION

The past decade has witnessed an increase in research concerned with the identification of cues that spontaneously trigger recall of AM. Research conducted on this topic has continued to focus on expanding our current knowledge on cues that are more effective and on what types of AMs they tend to trigger. Furthermore, the usefulness of AMs evoked by cues continues to be a relevant research topic concerning elderly population groups as the function of their AM is known to decline with age. This study aimed to address a current gap in the literature by comparing AMs evoked by music with two other types of stimuli, namely photos and objects, in healthy elderly people. The memories evoked by each stimuli were characterised according to frequency, type, specificity and content. Stimuli from specific time periods (1930-2010) were chosen to allow for an exploration of the reminiscence bump. Lastly, a relationship between frequency of AMs and nostalgia proneness was also examined.

Three main experimental tasks were conducted, each testing AMs evoked music, photos and objects. These experimental tasks were adapted from Baird and Samson's MEAMs questionnaire (2014), which gathered data to characterise AMs evoked by stimuli. Nostalgia proneness was measured using version 2 of the Southampton Nostalgia Scale (Barrett et al., 2010).

Frequency of memories evoked by music, photos and objects

Previous studies of MEAMs in healthy and dementia populations have compared music to silence (El Haj et al., 2012), photos (Belfi et al., 2015) or words (Chevreau et al., 2017). Various music stimuli have been used including personally preferred favourite music (El Haj et al., 2012), researcher chosen (El Haj, Postal & Allain, 2012), popular songs (Janata et al., 2007; Belfi et al., 2015) or instrumental pieces (Cuddy et al., 2017) etc. Overall, the current literature has a greater amount of evidence to support music evoking AMs, than photos or objects. One study found that photos evoked a greater number of AMs compared with music, however this was narrowly focused to photos of famous faces (Belfi et al., 2015). Presently, there has been scarce research investigating the use of objects as stimuli for involuntary AM retrieval – however, the current literature on objects has not made direct comparisons with other stimuli, such as music.

The first hypothesis of this study was that music would trigger more frequent autobiographical memories than objects or photos. This hypothesis was not supported, as the findings showed that photos and objects evoked more memories than music. Importantly, there was no difference in familiarity ratings between the stimuli. Therefore, the difference in frequency of memories between stimuli cannot be accounted for by varying familiarity of the stimuli. Previous MEAMs research have screened/pilot tested their selection of musical stimuli for familiarity (Belfi et al., 2015; Cuddy et al., 2017), but many have not recorded ratings of familiarity of stimuli. Janata et al. (2007), however, did rate familiarity of popular songs they used with their participants, and their results showed that on average 54% of songs a participant heard were considered to either be *somewhat* or *very familiar*. The current literature on PEAMs and OEAMs have not yet included ratings of familiarity with stimuli. The finding that photos and objects evoked more memories than music is consistent with results published by Belfi et al (2015). In their study, photos of famous faces were used from the Iowa Famous Faces test, and were compared to excerpts of songs from the Billboard Hot 100 charts, specifically the top 20 songs of each year from 1950-2013 (Belfi et al., 2015). The results showed that the photographs of famous faces evoked a greater number of AMs than music did (Belfi et al., 2015). To support the stimulus selection made between photos of famous faces and popular music, Belfi et al. (2015) suggested that the two stimuli types were on par, as they both contained associations with specific time periods and references to popular culture - making them likely to be highly familiar amongst the general population and more likely to be linked to AMs. The authors further suggested that the results may be attributed to the famous faces being more familiar than the excerpts used of popular music, however ratings of familiarity between the stimuli were not included in their study to confirm this speculation.

Previous studies of OEAMs have found that objects are highly efficient at triggering memories, but have not directly compared objects with other stimuli, precluding any examination of differences in frequency. This study provides the first comparison of stimuli involving objects, with the results reiterating that common household objects in particular, are potent cues for evoking AMs (Petrelli &Whittaker, 2010; Van Gennip, Van Den Hoven & Markopoulos, 2015). Moreover, the inclusion of dated common household objects from earlier decades also proved to be effective in the current study. This particular inclusion was motivated from the use of preserved early 20th century household objects used in the study conducted by Miles et al. (2013), which demonstrated to trigger a greater number of AMs compared to modern household objects with older adults with dementia and MCI.

The methodological difference in the choice of music stimuli is likely to account for the different findings in regard to frequency compared with other studies of MEAMs. In the current study, the music stimuli selected were popular songs from specific decades chosen from the Billboard Charts. While Befli et al. (2015) and Janata et al (2007) also used songs from the same source, they both used a larger pool of popular songs to choose from, including all songs rated as top 20 within each year of their decade range, increasing the likelihood that their participants were familiar with their music selection. Cuddy et al (2017) also applied a thorough process of pilot testing to ensure above average familiarity for excerpts of popular instrumental tunes used.

Whereas the study conducted by Belfi et al. (2015) was with a participant group of healthy undergraduate students, instead of healthy older adults, their results relating to frequency of AMs evoked are still relevant, as a similar trend was paralleled in the current study. Though the current study did not use photos of famous faces, photos of prominent world events proved to be effective, likely due to similar associations with specific time periods and to popular culture. This selection of photo stimuli was compared with a similar selection of popular music, using the decades of 1930-2010 instead. Future studies using other stimuli would appear to benefit from taking a similar approach in selecting well-recognised cues with various sociohistorical content from across a range of decades.

Additionally, it could be considered that the results of frequencies may have reflected effects of modality, as photos and objects are primarily visual stimuli, whereas music is an auditory stimuli. While this speculation is beyond the scope of this thesis, previous sensory processing research has shown that visual stimuli has a higher recognition rate than other competing stimuli in the real word, such as auditory and kinaesthetic materials (Schmid, Büchel & Rose, 2011).

Types of memories evoked by each stimuli

The types of memories evoked by each type of stimuli were characterised according to the following categories: People, Place, Period of Life, Specific Event, or Other. These categories were not mutually exclusive, however, as some memories comprised several categories. Descriptive analyses showed that music typically evoked memories of a period of life, such as childhood or early adulthood. This supports the findings of Janata et al. (2007) who used the same content categories in their analysis. Cuddy et al. (2017) had a more in depth content analysis (based on the Schlagman, Schulz & Kvavilashvili (2006) categories), and found that for the healthy older adult group, the two most common categories of MEAMs were "Going Out" (26.1%) or "Leisure/Sports" (24.8%). It could be inferred that AMs about going out or leisure/sports relate to periods of life and people involved, but further details were not provided by Cuddy et al. (2017) to confirm this, with their main focus being on the emotional valence of the categories.

Memories evoked by photos in the current study were most frequently of a specific event, namely the event presented in the photos, while memories evoked by objects were most commonly of a person/people (n=65), followed closely by a period of life (n=52). Previous research on PEAMs and OEAMs have not analysed the types of AMs to the same extent as prior MEAMs research, but have given some general remarks on content categories. Van Gennip et al. (2015) found that photos identified as cues by participants were framed within the home, depicting family members or specific events, with a variety of common objects reported to evoke AMs related to a person/people (from varied social connectedness, i.e. acquaintance to significant other). Similarly, Petrelli and Whittaker (2010) noted that photos identified as cues were also within the home environment, and were of family members. Household objects on the

other hand were found to evoke a broader category range of AMs on: periods of life, a person/people or even specific events. Overall, the descriptive results from the current study on types of memories appear to be consistent with the findings on content categories from other previous MEAMs research, as well as general characterisations from studies on PEAMs and OEAMs.

Specificity of memories

As mentioned previously, specific content of memory was defined as being related to a one-time event, whereas general content of memory was defined as being related to repeated events (Cuddy et al., 2017). Findings from the current study revealed that PEAMs were more specific, whereas MEAMs and OEAMS were more general in content. Some examples of specific AMs evoked from photos, include: watching TV for the first time and hearing radio announcements of breaking news in current affairs. Some examples of general AMs evoked by music and objects, include: regularly going to parties in early adulthood and playing board games throughout childhood.

Cuddy et al. (2017) also examined specificity of AMs, showing a percentage of episodic memories that were classified as being specific, and also comparing these percentages of specificity between a younger adult group, an older adult group and an older adult group diagnosed with AD. The results showed an effect of age, with both older adult groups reporting a lower proportion of specific AMs than younger adults (Cuddy et al., 2017).

Relationship between frequency of memories and familiarity of stimuli

Previous MEAMs research has suggested that familiarity of stimuli is an important factor for stimulus selection (El Haj et al., 2012; Belfi et al., 2015; Cuddy et al., 2017). For example, Janata et al. (2007) found a significant correlation between ratings of familiarity with popular songs and autobiographical salience. Therefore, the second hypothesis predicted a positive association between familiarity ratings and frequency of AMs for each stimuli. This was only supported for one type of stimuli, namely photos.

The absence of a significant relationship between familiarity ratings and frequency of memories evoked by music or objects is unexpected, given the rationale that prior research has used for choosing their stimulus. Janata et al. (2007) also found that out of the songs which triggered AMs rated as strongly autobiographical, 88% were related to songs that were rated as very familiar (Janata et al., 2007). However, it was also noted that a minority of 7% of songs that were rated as unfamiliar elicited AMs, but not of strong autobiographical salience. From these results, we expected that there would at least be a significant correlation between ratings of familiarity of music and frequency of AMs, however this was not found in the current study. Previous studies using objects and photos as stimuli have not included ratings of familiarity with stimuli, and therefore have not analysed for correlations between familiarities of objects/photos with frequency of AMs. In light of this, the current study provides novel results regarding correlations between familiarity of music, photos and objects and prequency of AMs.

Reminiscence bump

Previous studies have typically identified a reminiscence bump in AMs evoked from cue words and self-narrative/cultural life script methods (Janssen, Rubin & St. Jacques, 2011; Koppel & Bernsten 2015; Koppel & Rubin, 2016), but more recent studies have provided evidence that a reminiscence bump can also be observed from AMs evoked by music (Cuddy et al, 2017), as well as objects (Miles et al., 2013). The third hypothesis predicted that there would be evidence of the reminiscence bump across all stimuli. Results supported a distinct reminiscence bump for music, as songs from the period when the participant was aged 10-30 elicited significantly more memories than those from the later decades. This supported previous results Cuddy et al. (2017) had found of older adults (both healthy and with AD) reporting that AMs evoked by instrumental excerpts of popular music were more likely to be from early adulthood. This was determined by analysing the ages that participants had reported each MEAM occurred in/related to, however, the ages they considered as early adulthood was not clearly defined.

For photos, there was no significant difference in frequency of memories evoked by stimuli from 10-30 years or 31 to 50 years, but there was a significant difference between the younger age period (10-30 years) and the more recent decades (51 years +). The same pattern of results was observed for objects. This suggests that the reminiscence bump may not be as clearly defined as it is for music and appears to extend beyond 10-30 years for photos and objects used in the current study. These particular results were unexpected, as Miles et al. (2013) had previously shown a clear reminiscence bump with their participant group of older adults with dementia and MCI using objects as cues and some food cues. They found a clear majority of AMs evoked from the ages of 6-15 years old, as well as 16-30 years old (Miles et al., 2013).

Differences in reminiscence bump time periods for different stimuli has been previously raised by Koppel and Rubin (2016) in their review of methodologies used to study this phenomena. Historically, the use of word cues and self-narrative/cultural life scripts have been the two most common stimuli used. To give a brief explanation, the use of word cues requires a participant to recount AMs that are associated with words given (such as words relating to activity or affect), meaning that the AMs retrieved are inclusive of any possible AM association with the word. Self-narrative /cultural life scripts, on the other hand, require the participant to report significant memories that have happened across their lifetime. The main findings from studies using these stimuli have consistently found that the location of a reminiscence bump depends on which stimuli is used. Previously, the use of word cues tend to show that AMs recalled start from a mean age of nine years old and span through to a mean age of 23 years old; whereas the use of self-narratives or cultural life scripts have shown that AMs recalled start from a mean age of nine years old and span through to a mean age of 28 years old (Koppel & Bernsten, 2015).

Apart from differences of stimuli, the use of time periods to sort results can also alter the age range that a reminiscence bump might cover. For example, past studies using five year periods had reported a reminiscence bump from the ages of six to 10 years. In contrast, using a ten year period showed a reminiscence bump from the ages of 11 to 20 years (Janssen, Rubin & St. Jacques, 2011; Koppel & Bernsten 2015). Considering the results produced from PEAMs and OEAMs specifically, it is possible that the defined time periods chosen to analyse this data (10-30, 31-50 and 51+ years) were too broad, causing the location of the reminiscence bumps to also widen, spanning into the later period of 31-50 years for PEAMs and OEAMs.

Relationship between nostalgia and frequency of memories

As mentioned previously, there are various definitions of 'nostalgia', but it is widely regarded as an emotional experience which encompasses a range of positive and negative emotions. It is often characterised as 'mixed feelings' that can be attributed to certain AMs, and has previously been identified as a triggered emotion when listening to music rated as being autobiographically salient (Barrett et al., 2010; Janata et al., 2007). To date, however, no studies have investigated ratings of nostalgia in specific relation to MEAMs, PEAMs and OEAMs. To address this, the fourth hypothesis of this study predicted that participants with higher nostalgia proneness ratings (total score on SNS version 2) would have more frequent memories evoked by any type of stimuli. This was not supported, as there were no significant relationships between self-reported nostalgia proneness and frequency of memories evoked by any stimuli.

Previously, Barrett et al. (2010) had used excerpts of popular music to explore features of nostalgic experiences. The main results showed that nostalgia was more likely to be experienced when listening to songs that had higher ratings of autobiographical salience (i.e. the relationship a song had with past life events), though familiarity and emotional valence also contributed the likelihood of nostalgic experiences (context-level constructs). Importantly, it was also found that scores from the Southampton Nostalgia Scale version 2 were positively associated with nostalgia. In other words, participants who demonstrated nostalgia proneness were more likely to have stronger nostalgic experiences elicited by music (Barret et al., 2010). A key methodological difference of this study is that participants were asked to rate nostalgia proneness after listening to each song presented. In contrast, the current study assessed nostalgia proneness after the MEAMs, PEAMs and OEAMs tasks were completed, and this is likely to have contributed towards the non-significant finding.

Limitations, Clinical Implications and Future Directions

A key finding of the current study was the preservation of MEAMs, PEAMs and OEAMs in participants with undiagnosed MCI. This supports previous findings of preserved MEAMs and OEAMS in groups of people with dementia and MCI (Miles et al., 2013) and suggest that the use of these cues is effective for triggering memories even in the face of cognitive impairment. With the findings of the current study, and prior research, future studies with larger group sizes should make further comparisons between: MCI only participants, MCI and healthy participants, as well MCI and dementia participants. Results from these group comparisons would likely provide clinical implications for characterising MEAMs, PEAMs and OEAMs in people with MCI, and the differences they show in AM retrieval in healthy and clinical groups more broadly.

With regards to examining the relationship between the frequency of memories and familiarity of stimuli, future studies could perhaps benefit from adapting how ratings of familiarity are measured. The current study used a three point Likert type scale (0 "not at all" to 2"I know it almost perfectly") which may not have provided adequate detail. A different scale could potentially lead to different correlation results across stimuli.

Future studies replicating the procedure of the current study to examine the reminiscence bump, using the same stimuli, would benefit from applying shorter time periods, such as five years or perhaps less – which are more commonly used. Implementing this would likely produce different results and may provide evidence of a more clearly defined reminiscence bump in PEAMs and OEAMs. These changes would hopefully offer more clarity in locating the reminiscence bump. On the other hand, it is also possible that the nature of music, photos and objects contributes to varying locations of the reminiscence bump. Relating back to the

speculation of effects of modality and higher recognition rates reported for visual stimuli (Schmid et al., 2011), it is plausible that photos and objects continue to be highly memorable in later stages of life, which could be related to the higher frequencies reported in later time periods for both PEAMs and OEAMs. This would also be consistent with changes in cognitive ability through ageing, meaning that the reduced attentional resources would likely process and recall visual stimuli more effectively than perhaps auditory stimuli.

Future studies intending to investigate nostalgia proneness using the same MEAM, PEAMs and OEAMs tasks, would more aptly investigate the proposed relationship between nostalgia and frequency of evoked AMs, if the assessment of nostalgia was administered after each stimuli type was presented, instead of after all tasks.

Overall, findings from the current study encourage the use of similar stimuli and methods in programs to assist older people experiencing memory decline to recall AMs. The methods used in the current study were reported to be an enjoyable and intriguing experience by the participants. In particular, the expressed great interest in the objects loaned from the Australian History Museum, not only helped to stimulate a receptive attitude in participants throughout the testing sessions, but also suggests promising potential for future memory research and clinical programs using objects.

An additional rationale for using of these stimuli and methods, is the potential contribution of this paradigm for the wellbeing of older adults experiencing memory decline. Haslam et al. (2014) found that reminiscence through the use of songs that were both familiar and meaningful (religious songs) were effective in fostering a sense of wellbeing. Efficacy of using these songs to facilitate reminiscence also stemmed from the level of social identification experienced within the group (Haslam et al., 2014). In other words, if the participants felt that

they shared aspects of identity with the group they were listening to songs with, they were more likely to experience reminiscence and other therapeutic benefits of wellbeing. Future research would benefit from ensuring familiarity and personal identification with stimuli, for a higher frequency and quality of AM retrieval. While the method of the current study was performed individually with each participant, conducting the procedure with groups would warrant both stimuli selection and participant grouping to be chosen based on shared identification for holistic program outcomes, inclusive of wellbeing and AM retrieval.

CONCLUSION

The findings from the current investigation provide new insights into the occurrence of MEAMs, PEAMs and OEAMs in healthy older adults. The inclusion of objects based on previous literature is a novel comparison condition, as objects were found to evoke even more AMs than music – which is an unprecedented outcome. The current study also demonstrated a reminiscence bump across all stimuli used, although it was extended past the typical age range of 10-30 years old for photos and objects. Future studies addressing the limitations mentioned would hopefully clarify the inconclusive findings, namely the potential relationship between familiarity of stimuli and frequency of AMs, as well as nostalgia proneness and frequency of AMs.

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TABLES

Table 1.1

| Music Stir | nuli |
|------------|---|
| Decades | Artists and their songs used |
| 1930s | Cab Calloway & his Cotton Club Orchestra – "Minnie the Moocher" |
| | Judy Garland – "Over the Rainbow" |
| 1940s | Glenn Miller & Joe Loss – "In the Mood" |
| | Dinah Shore; Gene Autry – "Buttons and Bow" |
| 1950s | Nat "King" Cole; Toni Arden – "Too Young" |
| | Bill Haley & His Comets – "Joey's Song" |
| 1960s | The Beatles – "I Feel Fine" |
| | The Beatles – "Hey Jude" |
| 1970s | Daddy Cool – "Eagle Rock" |
| | ABBA- "Fernando" |
| 1980s | USA for Africa –"We Are the World" |
| | The B-52's – "Love Shack" |
| 1990s | Bryan Adams – "(Everything I Do) I Do It for You" |
| | Coolio featuring L.V "Gangsta's Paradise" |
| 2000s | Eminem – "Lose Yourself" |
| | Sandi Thom – "I Wish I Was a Punk Rocker (With Flowers in My Hair)" |

Table 1.2

| Photo Stimuli | | | |
|---------------|---|--|--|
| Decades | Prominent world events and year they occurred | | |
| 1930s | Sydney Harbour bridge opens – 1932 | | |
| | King Edward VIII abdicates the British Throne for Mrs Wallis Simpson -1936 | | |
| 1940s | Victory over Japan Day – 1945 | | |
| | French engineer Louis Réard introduced the modern bikini, modeled by Micheline Bernardini – 1946 | | |
| 1950s | The Coronation of Queen Elizabeth II – 1953 | | |
| | Jorn Utzon wins the competition for a design of Sydney Opera House – 1957 | | |
| | 'Bandstand', hosted by Brian Henderson, begins on television – 1958 | | |
| 1960s | Assassination of John F. Kennedy – 1963 | | |
| | Neil Armstrong and Buzz Aldrin take historic first steps on the Moon – 1969 | | |
| 1970s | Munich massacre – 1972 | | |
| | Australian Prime Minister Gough Whitlam is dismissed – 1975 | | |
| 1980s | Wedding of Charles, Prince of Wales, and Lady Diana – 1981 | | |
| | Fall of the Berlin Wall – 1989 | | |
| 1990s | Nelson Mandela is released from Victor Verster Prison, near Cape Town – 1990 | | |
| | Death of Diana, Princess of Wales in Paris - 1997 | | |
| 2000s | 9/11 attacks at the World Trade Center in New York – 2001 | | |
| | Wedding of Charles, Prince of Wales, and Camilla Parker Bowles – 2005 | | |

Table 1.3

| Object Stin | muli |
|-------------|--|
| Decades | Common objects |
| 1930s | Castor Oil bottle |
| | Commonwealth Bank money tin |
| 1940s | Poker Rummy game |
| | Brownie Camera |
| 1950s | Toy train |
| | Dry goods measuring cup |
| 1960s | Squatter board game |
| | Aeroplane Jelly box |
| 1970s | Matches or \$5 and \$1 notes |
| | 1 x "Sounds of the 70's" cassette tape set |
| 1980s | Commemorative plaque – Charles and Diana |
| | Polaroid EE100 Special |
| 1990s | CD Walkman |
| | Rubik's cube |
| 2000s | Early generation iPod |
| | Nokia mobile |

Table 1.4

Counterbalanced MEAM/PEAM/OEAM task sequence

| Task sequence | | | | |
|---------------|-------------------------|------|------|------|
| | Participant Initials | MEAM | PEAM | OEAM |
| 1 | J.H | 1 | 2 | 3 |
| 2 | I.W | 3 | 1 | 2 |
| 3 | F.J | 1 | 3 | 2 |
| 4 | R.M | 2 | 1 | 3 |
| 5 | M.B | 3 | 2 | 1 |
| 6 | C.M | 1 | 3 | 2 |
| 7 | M.F.L | 2 | 1 | 3 |
| 8 | B.S. | 3 | 2 | 1 |
| 9 | S.H. | 2 | 3 | 1 |
| 10 | G.W. | 1 | 2 | 3 |
| 11 | S.W. | 2 | 3 | 1 |
| 12 | T.B. | 3 | 1 | 2 |

APPENDICES

Appendix A

MEAM questionnaire developed by Baird and Samson (2014)

MEAMS

Written questionnaire administered during each song excerpt to assess music evoked autobiographical memories

| • | How familiar are you with this song? | |
|---------------------|--|---|
| 0 Not at a | 1111 | 2 I know it almost perfectly |
| • + | How much do you like the song? | |
| 0 Not at a | 11 | 2 It's one of my favourite songs |
| • [| Does this song bring to mind a memory? Ye | es / No |
| • !: | s this memory negative or positive? | |
| 0 Very ne | 111 | 2 Very positive |
| • | What is the memory about? | |
| Person/ Please o | /people Place Period of my life describe it briefly | A specific event Other |
| | | |
| | | |
| • (| Can you place yourself back into this memo | pry? |
| 0 No | 111 | 2 Yes, it feels like I'm right there |
| • | Can you name the song? | |
| • | Can you name the singer/band? | |
| • | Can you name the year/decade that the so | ong came out? |

Appendix B

Final HREC Ethics Approval Correspondence

Request for Amendment form Re: The stability of music-evoked autobiographical memories over time in a healthy aging population

