The Benefits of The Autobiographical Significance of General Knowledge in Young and Older Adults

By

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Abstract

This thesis presents an investigation into autobiographical significance (AS) for general knowledge in young and older adults. Across four experimental chapters, we examined the effect of stimuli modality and type of knowledge on AS, the influence of type of associated memories, and the impact of healthy ageing on this process. In our first three experimental chapters, we linked participants' prior experience, factual knowledge and personal memories for famous person or public event stimuli, with their earlier performance in semantic and episodic judgement tasks. For famous persons, participants were more accurate and faster for AS stimuli, compared to those associated with prior knowledge only, and this was found for any associated episodic memory. In contrast, for public events, significant improvements in episodic accuracy were only present if the associated memory contained specific location details, suggesting AS varies with type of knowledge. The effect of AS was found to be reduced in healthy ageing, except when factual knowledge and familiarity for the stimuli were controlled. Event-related potential (ERP) correlates of AS in a group of older adults were measured in chapter two, which revealed that AS effects in ageing may involve elaborate semantic processing, rather than recollection, as previously reported in young adults.. In the final experimental chapter, we compared AS and the self-reference effect. Participants encoded trait adjectives through AS, self-reference or a word frequency judgement, and their memory for these traits was then compared. Encoding through AS resulted in superior recognition memory and free recall performance, similar to self-reference. These findings provide early support for the relevance of AS for use in memory training. Taken together, this research advanced our current understanding of the underlying processes of AS and its applications for future research.

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Author's declaration

I declare that the work contained in this thesis has not been submitted for any other award and that it is all my own work. I also confirm that this work fully acknowledges opinions, ideas, and contributions from the work of others.

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Any ethical clearance for the research presented in this thesis has been approved. Approval has been sought and granted by the School of Psychology Ethics Committee at the University of East Anglia.

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Date: **27th November 2020**

CHAPTER ONE

–

General Introduction

1.1. Thesis Objective

In this thesis, we will discuss utilising interactions between episodic and semantic memory to boost performance in experimental tasks. In particular, we explored the effect of autobiographical significance (AS) of general knowledge on task performance within young and older adults. AS is conceptual knowledge (e.g., knowledge of famous persons) that has become associated with an episodic memory, this enhances the concept and has been shown to improve related task performance (Denkova et al., 2006b; Renoult et al., 2015; Westmacott et al., 2004; Westmacott & Moscovitch, 2003). Further examining AS our main objectives in this thesis were:

i. To directly contrast the beneficial effects of AS for stimuli on associated task performance, with task performance for stimuli associated with only prior knowledge.
ii. Investigate whether the benefits of AS on task performance vary with the modality of stimulus presentation (e.g., names versus faces presentation of famous persons)
iii. Examine whether these benefits vary with the type of knowledge episodic memories are attached to (knowledge of celebrities versus knowledge of public events)
iv. Examine whether the effects of AS are varied within healthy ageing.
v. Contrast the influence of AS with the self-reference effect.
vi. Examine differences in the neural correlates of AS in healthy older adults.
vii. To examine the influence of time on both the existence of AS for stimuli and the strength of the effect on associated task performance.

1.2. Semantic-Episodic distinction and interaction

Tulving initially proposed a distinction within long-term declarative memory, between episodic and semantic memory (Tulving, 1972). Although memory theorists have largely progressed from focus on the distinction of these systems, his theory largely influenced memory research, both experimentally and theoretically (Renoult & Rugg, 2020).

This original proposal considered episodic memory to be primarily made up of unique autobiographical episodes or specific events within the life of the individual. It was also thought to include spatial information or the temporal context and permit a level of mental time travel or re-experiencing of the original event (Moscovitch, 1995; Tulving, 1985).

In contrast, semantic memory was initially proposed to be primarily language-based; made up of an individual's organised knowledge of meanings, associations, concepts and rules (Tulving, 1983), but is now considered to extend beyond language (Binder & Desai, 2012). Accordingly, semantic memory is conceptualised as our general knowledge of the world this knowledge is taken from our life experiences, but it is devoid of the spatial-temporal context (Renoult et al., 2019b).

Tulving proposed these memory systems could largely '…operate independently of the other' (Tulving, 1983, p.66), which finds support from both neuropsychological findings and investigations within brain lesion research. Functional neuroimaging indicates that the medial temporal lobe (MTL), particularly the hippocampus and its surrounding regions (perirhinal, entorhinal and parahippocampal) are primarily involved in episodic memory, particularly when temporal-spatial context is required by the task (Gilboa, 2004; Graham et al., 2003; Svoboda et al., 2006). Brain lesion research also shows damage to these regions, known as the Episodic Core Recollection Network (Rugg & Vilberg, 2013), results in spatial and autobiographical memory deficits (Moscovitch & McAndrews, 2002; Yonelinas, 2002), with patients demonstrating severe episodic impairment including anterograde or retrograde amnesia for events (Bayley et al., 2006; Rosenbaum et al., 2008). Interestingly, these same patients consistently show spared semantic knowledge (Manns et al., 2003; Spiers et al., 2001), and some retain the ability to learn new semantic information (Kitchener et al., 1998; Vargha-Khadem et al., 1997).

Conversely, semantic memory, although dependent on the task undertaken (Renoult et al., 2019b), appears to be mediated by largely left-lateralised structures within the lateral and anterior temporal cortex and ventrolateral prefrontal cortex (Binder et al., 2009a; Graham et al., 1999; Martin & Chao, 2001), dubbed the semantic or conceptual hub network (Binder, 2016). This is consistent with semantic dementia patients who have progressive degeneration within the anterolateral temporal lobe, show severe impairment within semantic knowledge for words, objects, and people (Hodges & Graham, 2001; Hodges & Patterson, 2007; Nestor et al., 2006). Notably, despite their deficits, their episodic memory performance is relatively preserved (Chan et al., 2001; Graham, Becker, et al., 1997; Irish et al., 2011; Mayberry et al., 2011). This, therefore, provides a double dissociation with that observed in amnesia patients, indicating that episodic memories rely on the MTL, whereas anterolateral temporal lobe regions have a critical role in semantic memory.

The distinction between the two memory forms is also observable within healthy ageing both neurologically and behaviourally. Substantial reductions of brain volume within the MTL (Fjell & Walhovd, 2010) and the hippocampus (Raz et al., 2005) occur during natural ageing, this links to a consistent decline in episodic memory performance in tasks of free recall (Craik & McDowd, 1987; Danckert & Craik, 2013), source memory (Jennings & Jacoby, 1993; Old & Naveh-Benjamin, 2008; Spencer & Raz, 1995) recognition memory (Fraundorf et al., 2019) and has been observed in naturalistic settings, such as for actors learning lines (Wilson et al., 1989). In contrast, the semantic hub network of brain regions appears primarily preserved during the healthy ageing process (Salat et al., 2005) and behaviourally semantic memory is typically maintained (Nyberg et al., 1996; Park et al., 2002) or in some cases particularly for vocabulary and general knowledge improves during natural ageing (Ackerman & Rolfhus, 1999; Beier & Ackerman, 2001; Castel, 2005; Giambra et al., 1995; Verhaeghen, 2003).

Despite a level of distinction between these two systems, the Episodic Core Recollection Network and the Semantic/Conceptual Hub network share a number of the same regions of functional activation including parahippocampal, middle temporal, ventral parietal, midline frontal and posterior regions (Binder et al., 2009b; Burianova et al., 2010; Renoult et al., 2019a) indicating a level of overlap between the two systems. This overlap correlates with the general consensus that retrieved episodic memories, contain not only details of the unique episode and its related spatial-temporal context, but also the conceptual processing that was undertaken when the initial event was experienced (Moscovitch, 1995; Tulving, 1983). Anecdotally, when you try to access the memory of your last visit to the cinema, you automatically also access the meaning of the word, as well as the general schema of a visit to the cinema based on numerous past experiences (Mace et al., 2019b).

Even Tulving reflected that tasks designed to test one distinct memory forms could often be influenced by the alternate system, either through participants already held semantic knowledge, or their past episodic experiences (Tulving, 1983). For example, an fMRI investigation designed to test semantic knowledge by asking participants to list general household objects found that participants began accessing memories for specific items within their own kitchens which was reflected by activation within medial temporal lobe regions (Sheldon & Moscovitch, 2012). This suggests that relevant episodic memories may be automatically activated in tasks that are traditionally considered semantic, this will be discussed in greater detail within section 1.6. Equally, participants prior semantic knowledge of stimuli has also been shown to influence episodic performance, for example, when asked to remember grocery item prices, healthy participants and amnesic patients were more accurate when the prices matched their already held knowledge, i.e. milk is £1.09, and were less accurate when prices were incongruent to that information, i.e. soup is £14.99, (Kan et al., 2009). Indicating activation of semantic knowledge during episodic tasks. This will be discussed further in section 1.4.

In summary, although a level of distinction and dissociation is present between the two declarative memory systems, a clear pattern of interaction is ~~apparent~~ observable in both everyday retrieval of memories, and during lab-based memory tasks, and that this interaction may in some cases improve behavioural performance.

1.3. Autobiographical Memory, Personal Semantics and Self-Knowledge

Autobiographical memory is a useful method of observing the interaction between the semantic and episodic memory systems alongside a third element - the involvement of one's self construct. Autobiographical memory has been defined as 'memory for the events of one's life' (Conway & Rubin, 1993), p.103), and these memories naturally include episodic and semantic components (Levine, 2004).

The episodic elements involve a conscious recollection of unique events from one's personal past, which are associated with temporal and spatial details, consistent with our understanding of episodic memories, but autobiographical memories are tightly linked to the self and first-person experience, particularly in respect to visualising and re-experiencing the event (Tulving, 1985; Tulving, 2002; Wheeler et al., 1997). Functional neuroimaging studies of episodic autobiographical memory (EAM) show a considerable overlap within the core episodic recollection network (Svoboda et al., 2006), but also report a higher level of activation of the prefrontal cortex, an area often activated during self-referential processing (Cabeza & St Jacques, 2007; Conway et al., 2002; Maguire, 2001b; Svoboda et al., 2006). They also observe activation within occipital areas which are reflective of the increased level of visual imagery (Addis et al., 2004; Addis, McIntosh, et al., 2004; Conway et al., 2002) and within the amygdala, largely involved in emotional processing (Cabeza & St Jacques, 2007; Svoboda et al., 2006). Consistently patient studies show damage to medial temporal regions results in impairment within the production of EAM, but sparing of SAM (Hirano et al., 2002; McCarthy et al., 2005; Oxbury et al., 1997; Viskontas et al., 2000), and we also observe a reduction in the specificity of episodic details within healthy ageing (Levine et al., 2002; Piolino et al., 2002).

Semantic autobiographical memory (SAM), or personal semantic memory contains knowledge devoid of spatial and temporal context similar to general semantic processing, but within autobiographical memory, this knowledge can also be highly personalised. It includes the knowledge and facts of one’s past (e.g. I have a brother, I used to work at Starbucks) but can also contain the knowledge of repeated events, information extracted from similarities across multiple events (e.g. I caught the school bus every day) and the knowledge of one’s personality and preferences, (e.g. I am an organised person, I don’t like the colour green; (Renoult et al., 2012).

AS one would expect SAM overlaps considerably with general semantic knowledge in areas within the general semantic hub, and patient studies indicate damage to these regions exclusively affects the production of SAM over EAM details during autobiographical retrieval (Eslinger, 1998; Hodges et al., 1992; Maguire et al., 2010; Piolino et al., 2003). Predictably as with semantic processing, SAM is well-preserved in healthy ageing (Buckley et al., 2013; Levine et al., 2002; Piolino et al., 2010; St. Jacques & Levine, 2007).

However, SAM in addition to the ATL also shows varying patterns of functional activation based on the type of knowledge being retrieved, for example retrieving autobiographical facts results in greater activation within the medial prefrontal cortex, retrosplenial cortex and temporoparietal junction (Maguire & Frith, 2003; Maguire & Mummery, 1999) and a level of activation within the MTL (Brown et al., 2018; Grilli & Verfaellie, 2014). Retrieval of repeated events activates areas similar to that observed within episodic processing, including the hippocampus and MTL (Brown et al., 2018; Holland et al., 2011; Maguire & Frith, 2003). Indicative of a greater level of and interaction between the semantic and episodic processing within SAM.

The third key element within autobiographical memory is the self-construct, whereby both episodic and semantic autobiographical memories involve associating or organising details and events around one's self (Rathbone et al., 2008). The self is a robust construct; it is preserved both when the episodic memory system is impaired (Rathbone et al., 2009) and also after degradation within the semantic network (Philippi et al., 2017). There has also been some evidence to suggest that it can be preserved even when both episodic and semantic memory are impaired (Klein et al., 1999, 2002), indicating the self may function not only within the interaction but also independently as a distinct system.

Self-referential processing within autobiographical memory results in a greater level of activation within the MPFC (Addis et al., 2004; Cabeza et al., 2004; Macrae et al., 2004; Svoboda et al., 2006) compared to non-personal episodic or semantic memory. Interestingly, although the medial prefrontal cortex suffers age-related volume shrinkage (Raz et al., 2005), the knowledge of one's self in ageing (one's personality and preferences) is not reduced (Terracciano et al., 2005). Instead, functional neuroimaging has indicated an age-related change in medial prefrontal cortex usage, with a reduction of activation within the left hemisphere countered by an increase in the right hemisphere (Grady, 2002; Grady et al., 1995; Nyberg et al., 2003; Rosen et al., 2002), which may explain the behavioural resilience.

There is strong evidence to suggest that involvement of the self-enhances behavioural performance. Autobiographical memory research points to memory retrieval being grouped around periods of self-importance (Illman et al., 2011;

Rathbone et al., 2008, 2009, 2011), and that 'self' involvement may enhance the recall of these memories. This is most apparent within the 'reminiscence bump' seen during retrieval of lifespan autobiographical memories (Conway et al., 2005; Koppel & Berntsen, 2015; Rubin et al., 1998); whereby individuals recall a disproportionate number of events from their adolescence or young adult period of life (10-30 years of age). One explanation for this imbalance is that this time period is reflective of rapid-change and contain several distinct and novel events, i.e., graduation, marriage, first home purchase (Janssen et al., 2011; Pillemer, 2001) which are of high self-importance and crucial for formation of the self-view (Conway & Holmes, 2004; Habermas & Bluck, 2000). Therefore, the personal significance of these events may increase the likelihood of their later recall, this has been observed for recall of public events around these life periods (Janssen et al., 2008a).

There is also robust empirical evidence that referencing information to the self-construct (i.e., does it apply to me? Do I like this object?) improves later memory performance for those items (Gutchess, Kensinger, & Schacter, 2007; Gutchess, Kensinger, Yoon, et al., 2007; Klein, 2012b; Symons et al., 1997), known as the self-reference effect which will be discussed in greater detail in section 1.5.

In summary, there are clear patterns of interaction between the semantic and episodic memory systems and between these systems and the self-construct. These interactions can be observed both within laboratory tasks and autobiographical memory retrieval and it also appears these interactions lead to improved memory performance across several tasks. Within the next sections, I will focus on the different ways the semantic, self, and episodic systems interact to improve memory performance.

1.4. Improving Episodic Performance using Semantic Knowledge

The influence of semantic memory is observable in many forms; Bartlett (Bartlett, 1932) first introduced the idea that memories are not purely a reproduction of the event, but a reconstruction and one's semantic knowledge acts as the scaffolding on which this construction is built.

Semantic schemas are units of information and associations that are taken from numerous event episodes. Instead of specific details, they consist of themes or commonalities of the event from across multiple episodes (for review see (Ghosh & Gilboa, 2014). They can entail generalised events (i.e., birthdays will likely have cake, candles and balloons), locations (i.e. the cinema will likely have a large screen, seating and popcorn), non-specific items (i.e. teapot will have a handle, spout and lid) or scripts (the set order of actions in certain situations, e.g. going food shopping, you would enter the shop, then select groceries and finally pay at check-out).

These semantic schemas improve our ability to assimilate new information (Eichenbaum, 2013; Tse et al., 2007; Wang & Morris, 2010), by providing expectations and additional context to new experiences Memories that are therefore congruent with present schema are preferentially and more easily consolidated (Durrant et al., 2015; Groch et al., 2017). Schemas also help focus our attention (Pezdek et al., 1989), guide our behaviour (Cooper & Shallice, 2006; Shea et al., 2008), influence our decision making (Kumaran et al., 2009) and allow more organised memory searches or assist in the reconstruction of missing details of a memory during retrieval (Anderson et al., 1979; Rumelhart, 1980).

Functional neuroimaging studies have revealed a strong role for the medial prefrontal cortex during schema activation, both for encoding schema congruent information (Brod et al., 2015; Crespo-Garcia et al., 2012; van Kesteren et al., 2010, 2013), but also retrieving scripts which contain representations of the order of information (Hsieh & Ranganath, 2015). Activation of mPFC is also observed for naturalistic scripts such as eating at a restaurant or boarding a plane (Baldassano et al., 2018). Consistently, damage to the medial prefrontal cortex results in problems with accessing schematic information (Ghosh et al., 2014; Spalding et al., 2015).

Experimentally, the influence of semantic schema has been observed by providing schematic knowledge as a prime, for example, the word ‘summer’, this resulted in a greater number of retrieved autobiographical memories compared to using no primes (Mace et al., 2019a). However, for the most part, the impact of this knowledge is observed within semantic-relatedness or semantic-congruency paradigms; wherein researchers manipulate either the relationship between two items (i.e. chalk-classroom versus ladle-tennis court; (van Kesteren et al., 2013) or they manipulate the context of the article to fit or oppose your prior knowledge (i.e. a bottle of milk paired with a price tag of £1.09 or £12.76; (Castel, 2005; Kan et al., 2009). Associative memory studies utilising these paradigms typically find enhanced memory performance for pairings that are semantically related or consistent with your knowledge (van Kesteren et al., 2010, 2013).

Older adults can use their preserved semantic memory to improve their weakened episodic memory performance, they can perform as well as young adults when they utilise semantic relatedness during associative memory tasks (Badham et al., 2012; Castel, 2005; Crespo-Garcia et al., 2012; M. M. Patterson et al., 2009) and when they apply semantic context to word learning (Matzen & Benjamin, 2013). Similar benefits of the semantic-episodic interaction have also been observed in Alzheimer's patients (Delhaye et al., 2019).

However, in the same vein, the influence of semantic memory can also negatively influence episodic memory by causing false memories, most notably studied within the Deese-Roediger-McDermott paradigm (Roediger & McDermott, 1995). In this paradigm, participants study related concepts (e.g., cold, blizzard, winter), but when tested on their memories for these words would also produce unstudied but related words (e.g. snow). Older adults show a higher level of these false memories than young adults (Balota et al., 1999; Chan et al., 2006; Koutstaal et al., 2001; Koutstaal & Schacter, 1997), indicating a higher reliance of semantic influence. Consistently they also demonstrate poorer performance in recalling information that does not fit with prior knowledge, such as incorrect multiplication equations, e.g., 2 x 4 = 3 (Ruch, 1934), incorrect word spellings (MacKay et al., 1999), fairy tales with alternate details (Barba et al., 2010) or grocery items with non-market value prices (Amer et al., 2018; Castel, 2005; Kan et al., 2009). They also spend longer on visual search tasks investigating congruent locations, when the items are located somewhere inconsistent with their prior knowledge (Wynn et al., 2020). The influence of semantic memory can therefore help compensate for episodic degradation, but overreliance on this system can negatively influence episodic performance and can lead to false memories.

1.4.1. Influence of Prior Knowledge

In addition to the influence of general semantic memory of rules and associations, more personalised prior knowledge (one's specific expertise or learnt knowledge) can also influence episodic task performance, which is of particular interest to this thesis. For example, participants' prior knowledge of baseball improved performance during a reading comprehension task; the greater their previous knowledge of the sport, the greater their later recall of the text was (Recht & Leslie, 1988). The benefit of prior knowledge has also been shown to outweigh general aptitude for the subject (Schneider et al., 1989). Low-aptitude experts (individuals with poor comprehension and vocabulary skills, but high levels of subject knowledge) were able to outperform high aptitude novices (those with strong language task ability, but poor subject knowledge) on several comprehension and memory tasks. Similarly, van Kesteren and colleagues (van Kesteren et al., 2014) showed when learning vocabulary students were much better at recalled terms similar to their studies subjects than similar non-subject relevant details.

This performance boost also seems to increase with the increased level of prior knowledge; participants recall a greater number of newly learnt facts for concepts they had a high level of prior known facts for, compared to concepts they had a single known fact for (van Overschelde & Healy, 2001). Even short-term associated prior knowledge can boost performance, for example, when children (aged 5-7 years) were given relevant information one day before their visit to see a pirate, they demonstrated superior recall for the event immediately after, and four months later, compared to the children given no prior information (Sutherland et al., 2003).

There is also considerable research using ‘assumed’ prior knowledge of famous persons; where prior knowledge of the stimuli is based on the likelihood the participant would have been exposed to the stimuli. In these studies, famous faces compared to non-famous faces are associated with greater recognition accuracy within old-new tasks and greater recollection within the remember-know paradigm (Bellana et al., 2019). Older adults also show better face recognition for dated famous faces compared to contemporary famous faces, whereas the reverse is true of young adults (Backman & Herlitz, 1990; Bäckman & Karlsson, 1985; Wahlin et al., 1993), greater recognition performance was based on stimuli they had likely been most exposed to, this was translated as an improved free recall for these faces due to prior knowledge (Bäckman et al., 1987).

This performance advantage in both young and older adults also extended to improved knowledge when answering factual questions (Bäckman & Karlsson, 1985) and producing factual statements (Lipinska et al., 1992). More recently, a similar finding has been observed when testing individuals on Pokémon-related knowledge: participants showed enhanced recognition memory for first-generation Pokémon characters that they likely had prior knowledge of, compared to newer generations they had less experience of (Xie & Zhang, 2017).

Theories of memory consolidation (Squire & Alvarez, 1995) and the transformation hypothesis (Moscovitch et al., 2016) propose that information may become more semanticised over time, indicating that dated information is more semantic and new information is more episodic. This is supported by patients with deficits within their semantic store that show poorer recall for dated information, that has become more consolidated within their impaired semantic system, compared to contemporary information that is accessible through their relatively intact episodic memory (Lambon Ralph et al., 1998; Snowden et al., 2004)

However, the reverse is not consistently observed within Alzheimer's disease patients, who should show a greater recognition for more dated famous persons if they are stored within their semantic system. Yet, when tested they are equally impaired for both contemporary and dated famous faces (Backman & Herlitz, 1990). This could therefore indicate that utilising task-relevant prior knowledge may not solely depend on semantic memory but may also involve an element of episodic processing.

This interaction proposal is further supported by functional neuroimaging showing involvement within the hippocampus and MTL, previously shown to be involved in episodic retrieval (Gilboa, 2004; Graham et al., 2003; Svoboda et al., 2006), specifically for famous faces over non-famous faces during an associative memory task (Bernard et al., 2004; Douville et al., 2005; Liu et al., 2016; Nielson et al., 2006) which may relate to the retrieval of episodic memories for the famous faces during the task. In line with this, one study (Liu et al., 2016), asked participants if viewing the face triggered an episodic memory of a prior experience related to that famous person, the authors found these episodic associations were quite common and were associated with greater prior knowledge ratings from participants. They also observed stronger activation within the hippocampus, antero-temporal lobe, and medial prefrontal cortex when famous faces did elicit high emotion or associated memories within the participant.

So, it appears that utilising semantic schema or learnt associations between words or concepts or accessing relevant prior knowledge can result in the enhanced episodic memory performance. However, it is worth noting that accessing more personal prior knowledge may also involve a level of episodic involvement.

1.5. Self-Referential Processing

The effect of self-reference is a robust finding; when participants encode information in reference to themselves, their later memory performance for that information is improved compared to either semantic encoding (is this word desirable?), or surface-level encoding (is this word in capitals?) or compared to asking if it reflects another person (Gutchess, Kensinger, Yoon, et al., 2007). The memory benefit occurs spontaneously, with little cognitive effort (Yang et al., 2012), and has been observed within the lab for personality trait adjectives (Gutchess, Kensinger, Yoon, et al., 2007; Howell & Zelenski, 2017; Yang et al., 2012) self-encoded narratives (Carson et al., 2016) and self-encoded objects (Kim et al., 2010), but has also been observed naturalistically when individuals have better memory for birthdays that fall closer to their own (Kesebir & Oishi, 2010).

Self-referential processing is primarily modulated by the medial prefrontal cortex; when participants encode adjectives through self-reference (D'Argembeau et al., 2007; Gutchess, Kensinger, & Schacter, 2007; Sajonz et al., 2010; Zhu et al., 2012), during recognition or retrieval of these self-referenced stimuli (Yaoi et al., 2015), and also when considering a close friend's personality or taking their perspective (D'Argembeau et al., 2007).

There is a theoretical view that self-reference relies in part on episodic processing (Conway & Pleydell-Pearce, 2000; Gardiner, 2001) as deciding whether a stimulus is self-relevant or not, may lean on a person's life history and particularly recalling relevant past experiences. In support of this view, both older and young adults report more episodic details (unique episodes with temporal or spatial details) than conceptual details about self-referential items (Leshikar et al., 2015).

When self-referential and episodic processing were contrasted in an fMRI investigation (Sajonz et al., 2010), pictures that were considered relevant to the person and were self-referenced activated distinct areas within anterior precuneus an the ventral and dorsal medial prefrontal cortex whereas pictures the individual was able to be recognised from the previous day activated posterior precuneus and the anterior prefrontal cortex, but there was also considerable overlap in activations between the two methods of processing within the precuneus and the inferior parietal cortex. This overlap suggests a level of interaction of the episodic memory system within self-reference.

Consistent with this, there is a trend within patients with semantic dementia to show preservation of knowledge of objects, people or places that are personally relevant to them (Giovannetti et al., 2006; Snowden et al., 1994; Snowden et al., 1996). For example, patients are better able to recognise and understand the use of their own teapot, as compared to a generic one, or to identify their next-door neighbour over a famous person. Self-relevance in semantic dementia appears to provide a layer of protection from degradation of semantic information and is likely to rely on the spared episodic system. This is supported by the level of specificity present within the spared semantic knowledge, for example, one patient when asked the function of 'oil' detailed how it was used to fill her radiators and where it was stored in the house but gave no other general semantic details (Snowden et al., 1996).

Due to the likely interaction between self-reference and episodic memory you could expect the effects of self-reference to be reduced within healthy ageing, but findings are mixed. When trait adjectives are used, older adults exhibit the same self-reference effect as their young counterparts relative to semantic encoding (Gutchess, Kensinger, & Schacter, 2007; Leshikar et al., 2015; Yang et al., 2012), whereas when stimuli are based on tastes and interests and self-reference items are contrasted against general items, the effect is reduced (Kalenzaga et al., 2015) and in older adults over the age of 75, when the episodic system has greatly degenerated the self-reference effect is all but eliminated (Glisky & Marquine, 2009), this is despite the MPFC showing little age-related decline (Salat et al., 2005).

The same mixed pattern is observed in patients with Alzheimer's disease and those with mild cognitive impairment. In mild cognitive impairment, patients show an enhanced ability to recall narrative text that they encoded in relation to the self (Carson et al., 2019), but typical self-reference encoding of trait adjectives show limited (Leblond et al., 2016) or no benefit (Carson et al., 2018). Similarly, patients with Alzheimer's disease have been shown to benefit by producing more contextual autobiographical details after completing 'who am I?' statements (El Haj & Antoine, 2017), but do not consistently show self-reference concerning trait adjectives (Genon et al., 2014).

It is clear that self-referential processing contains elements of episodic processing as evidenced by the presence of increased episodic details for self-referenced items and overlap in neural correlates (Leshikar et al., 2015; Sajonz et al., 2010). However, evidence suggests it is not exclusively episodic otherwise it would show a consistent reduction in healthy ageing, amnesia, and Alzheimer’s disease (Carson et al., 2019; Leshikar et al., 2015; Yang et al., 2012).

1.6. The Impact of Autobiographical Significance on Memory

In the previous sections we have discussed how associations with semantic knowledge, or the self can boost episodic memory performance, and that both of these processes show elements of interaction of the episodic system, despite this, limited research has been conducted on the association of episodic memories on later task performance.

1.6.1 Flashbulb Memory

One area of episodic association that has received considerable interest are flashbulb memories, these are a unique form of autobiographical memory that occur when the learning of a public event experience is encoded. For example, people may have a vivid memory for where they were when they heard about the assassination of President Kennedy (Brown & Kulik, 1977), the Hillsborough disaster (Wright, 1993) the 9/11 terrorist attacks (Conway et al., 2009; Davidson et al., 2005; Paradis et al., 2004; Pezdek, 2003; Tekcan et al., 2003; Wolters & Goudsmit, 2005) or even the EU referendum results (Raw et al., 2020).

These memories are typically associated with emotionally salient or traumatic events, but can also occur without strong emotions (Weaver, 1993) or surprise (Curci & Luminet, 2009). What makes these memories particularly interesting is the memory and the (Weaver, 1993) associated event knowledge are stable (information is consistent across multiple retreats) over long periods of time (Curci et al., 2015; Hirst et al., 2015; Schmolck et al., 2000), and they are recalled with consistently high confidence (Conway et al., 2009; Day & Ross, 2014; Hirst et al., 2015; Talarico & Rubin, 2007).

It is important to note, these ‘flashbulb’ memories are not just observed in association with public events but have also been observed for private events such as finding out about a pregnancy, or the death of a loved one (Demiray & Freund, 2015; Peace & Porter, 2004; Rubin & Kozin, 1984).

Interestingly, the ability to recall flashbulb memories appears to be unaffected by healthy ageing (Berntsen & Thomsen, 2005; Davidson et al., 2006; Kvavilashvili et al., 2010; Wolters & Goudsmit, 2005), and the associated source memory (how they received the news) is also not impacted (Davidson & Glisky, 2002; Otani et al., 2005), despite robust evidence for degradation of other episodic and autobiographical memory retrieval (Danckert & Craik, 2013; Old & Naveh-Benjamin, 2008).

Research indicates that the strength of these autobiographical associations is dependent on proximity to the event; those with the first-hand experience of the event showed the greatest level of follow-up memory strength and consistency (Er, 2003; Neisser, 1996; Pezdek, 2003), and those that viewed media sources (television coverage, newspaper) at the time of the event show a higher level of memory vividness than those that heard from social media or another person later in time (Kopp et al., 2020; Talarico et al., 2019.).

Flashbulb memories can also be affected by the valence of the event: events that are associated with negative experience result in superior later recollection, whereas events related to positive experience tend to result in overconfidence but not consistency (Bohn & Berntsen, 2007; Kensinger & Schacter, 2006; Peace & Porter, 2004; Raw et al., 2020).

As expected, neuroimaging findings demonstrate flashbulb memories primarily activate autobiographical memory networks (Metternich et al., 2020), and specific damage to the MTL results in the impairment in the recall of flashbulb memories (Davidson et al., 2005). This indicates that the resilience of associated information related to flashbulb memories is mostly dependent on episodic memory involvement.

1.6.2. Investigations within Autobiographical Significance

As previously discussed, patients with semantic dementia have been shown to benefit from AS, whereby their relatively spared episodic system can preserve a level of their semantic knowledge of personally relevant persons, places and objects compared to their knowledge of famous or well-known exemplars (Giovannetti et al., 2006; Snowden et al., 1994; Snowden et al., 1996). These patients typically have a higher level of preservation for more recent autobiographically significant knowledge (e.g., current next-door neighbour) over more dated knowledge (e.g. best friend in school; Snowden et al., 1996). Experimentally, recent autobiographical experience of playing a sport allowed two semantic dementia patients to perform better on a name matching task for current sports partners, compared to both past partners and famous sporting celebrities (Graham, Lambon Ralph, et al., 1997). This likely reflects frequently used information, that is well-rehearsed and not yet semanticised, consistent with findings of superior performance for more recent over past information within these patients (Snowden et al., 1996).

This preserved semantic knowledge in semantic dementia is very specific in nature, focused largely on personal experience rather than the general world knowledge typical of semantic memory, as evidenced previously with the patient whose unique knowledge of oil related exclusively to her radiators at home, rather than any other use (Snowden et al., 1996). This type of specificity is consistent with other findings in semantic dementia patients, that AS can preserve some limited semantic information. For example, although AS was able to provide a level of resilience to names of current sporting partners (Graham, et al., 1997), it was not able to preserve their knowledge of the sport in general when tested on terminology, e.g., ‘bunker’, ‘caddie’ etc. despite presenting no issues with playing or adhering to rules of the game (Graham, et al., 1997). Considering the apparent effect of episodic associations on event and fact recall, limited experimental work has been completed in the area.

Westmacott & Moscovitch (2003) developed a unique paradigm to examine the implicit effects of AS on semantic concepts. They first gathered normed data of famous persons from across 1940-2002 using the remember-know paradigm. Famous names were classified as ‘remember’ if the participant could ‘re-experience a particular episode in which they watched, listened to, or heard about the famous person or if reading the person’s name triggered some other specific personal memory’. Whereas famous names were associated with a ‘know’ response if ‘the participants knew their identity but could not recall a specific episode involving him or her’. Participants were also asked to rate the familiarity of the famous person, and how vivid the associated memory was. The experimental stimuli set was then created with 25 famous names that were considered highly remembered (High-R), these had a high proportion (over 80%) of remember ratings from the norming study, and the other 25 were less well-remembered (Low-R), these had a low proportion (under

20%) of remember ratings, and instead were associated with predominantly know responses. These two sets of names were matched in familiarity and character length.

For the experiment, sixteen 45-55-year-old and sixteen 65-80-year-old participants completed four tasks. Firstly, they completed a free recall task whereby the normed names plus some buffer items were read aloud by the researcher, and participants had to immediately recall as many names as they could remember. Following a short distractor phase, they completed an episodic old-new recognition task where they were presented with the names previously read aloud in the free recall task, plus an equal number of novel names. Next, they then completed two semantic-based tasks, in the first one, a fame judgement task, participants were presented with the 50 target stimuli plus 50 non-famous distractors, they had to select if they believed the names presented were famous or not as quickly as possible by pressing one of two computer keys. Finally, they completed a speeded reading task where they were asked to read each name from the previous task into a microphone as quickly and as accurately as possible.

Within both age groups, participants showed a definitive performance advantage for the High R names compared to the low R names, demonstrating better free recall, more accurate recognition and faster reaction times within the fame judgement task and shorter voice onset times in the reading task. Indicating a clear performance boost for autobiographically significant names within both episodic and semantic tasks.

The authors also replicated this performance boost using participants' own remember-know ratings, ensuring the observed effect was due to the associated episodic memory, and not due to a higher degree of fame or other concurring variables.

An adapted version of this paradigm was also run on some patient samples (Westmacott et al., 2004) to examine the underlying processing. Four amnesia patients with MTL damage, two semantic dementia patients and eighteen patients with Alzheimer's disease participated. In the first task, participants were asked to distinguish between famous and non-famous names and to provide identifying information (what were they famous for?) as well as remember-know responses. Amnesia patients performed close to healthy controls in the number of famous names recognised, but provided far fewer remember responses, consistent with their functioning semantic but impaired episodic memory system. Equally, the reverse was apparent within the semantic dementia patients who recognised very few famous names but provided a large portion of remember responses for those they did recognise. Whereas patients with Alzheimers diseases recognised very few famous names and also provided very few remember responses for those names that they did recognise.

In line with the expectation that AS is largely episodic in nature, there was no difference in recognition of pre-rated High R and Low R names in the amnesic patients nor in the Alzheimer patients. Whereas in contrast, semantic dementia patients were more likely to recognise High R names and to associate a remember response to these names compared to low-R names. Equally, neither the amnesic nor the Alzheimer patients showed any task performance benefit for the pre-rated High R names across either the semantic or episodic tasks, whereas the semantic dementia patient demonstrated higher recall, greater recognition memory and even demonstrated fame judgement and speeded reading semantic tasks for High R names compared to Low R names. These results support the idea that the benefit of AS is grounded within episodic memory.

Although interestingly, when the names were categorised according to patients own remember-know responses, all patients demonstrated a performance advantage across tasks for their autobiographically significant names. This is an important finding as despite episodic degradation within the amnesic and Alzheimer patients, they still showed a level of performance advantage for the names that retain some episodic details, indicating AS can still provide a level of preservation in these circumstances.

Previous neuroimaging studies have found MTL activation for famous persons over non-famous (Bernard et al., 2004; Douville et al., 2005) an area often associated with episodic memory retrieval (Gilboa et al., 2004; Graham, Becker, et al., 1997; Svoboda et al., 2006), which could be explained by the retrieval of associated memories for these names during the task. However, as the presence of associated memories were not examined in these participants, no firm conclusions can be drawn. Denkova, Botzung & Manning (2006) adapted the Westmacott & Moscovitch (2003) paradigm within an fMRI investigation and examined participants associated prior knowledge and AS for the famous persons, to investigate what impact this personal relevance would have on the underlying brain processes.

The day before scanning they gathered participants remember-know judgements for a series of famous names to create a personalised stimulus set to be used within the scanner. The set used the 30 most richly detailed 'remember' names and 30 'know' names matched closely for familiarity.

Within the scanner, participants completed three tasks; one autobiographical memory task for the 'remember' stimuli, where they were asked to actively retrieve a unique episodic for the presented celebrity; one semantic task for the 'know' stimuli where they were asked if they recognised the presented famous person, and one baseline task where they were asked to note the gender of the celebrities. Unknown persons were intermixed into each task to ensure participants attended to the stimuli.

The study revealed enhanced MTL activation during the episodic retrieval of 'remember' persons, but not for the recognition of the 'know' persons. Although at first glance these findings appear to reflect the different tasks used within the scanner, episodic recollection versus prior knowledge recognition, it is important to note that previous studies showed consistent MTL activation during prior knowledge recognition of famous persons (Bernard et al., 2004; Douville et al., 2005; Leveroni et al., 2000), so the lack of this activation within this recognition task for the 'know' persons can be justified by the lack of AS within these stimuli.

Episodic involvement within AS names was also examined within an ERP investigation (Renoult et al., 2015). Similar to the Westmacott paradigm (Westmacott & Moscovitch, 2003), famous names were previously normed for fame, emotional salience, number of associated facts, and level of associated personal memories. From this norming, 30 stimuli considered high AS (over 70% memory ratings) and 30 low AS (less than 30% memory ratings) were used, the number of facts and familiarity were matched between the two sets.

Participants then undertook two tasks; a semantically driven fame-judgement task followed by an episodic recognition task while their EEG was being recorded. Unique to this paradigm, participants incidentally encoded the stimuli during the fame judgement task, this ensured they had no expectation of the memory task, and all information related to the association of AS was gathered after the tasks had been completed, ensuring any impact of AS on task performance was entirely implicit.

Consistent with previous studies (Westmacott et al., 2004; Westmacott & Moscovitch, 2003), reaction times were faster in the fame judgement task for high rather than low AS names, whether based on pre-experimental norms or on the participants' own AS ratings. Similarly, the hit rate was higher for high than low AS names, but this effect was only significant when using participants' own AS ratings (this difference only approached statistical significance when using pre-experimental norms). The fame judgement task required four repetitions of each stimulus to allow a high number of trials to form ERPs, unfortunately, this meant participants performed close to ceiling within the recognition task, which may have decreased the magnitude of some of the effects.

ERP results revealed that in both tasks names associated with high AS and the stimuli participants had their own associated memories for, were associated with an increased amplitude of the late positive component (LPC) ERP, typically associated with episodic processing (Voss & Paller, 2008). In contrast, the N400 typically associated with semantic processing (Kutas & Federmeier, 2011) was not modulated in either task by the AS of the stimuli. This is consistent with earlier conclusions that AS and its associated benefits may be related to episodic and not semantic processing.

Although the evidence has highlighted a clear benefit of AS for both semantic and episodic task performance, little is understood about the underlying influences on this phenomenon.

Proximity to the event (Pezdek, 2003; Talarico et al., 2019) and emotional salience (Kensinger & Schacter, 2006; Manzanero et al., 2015; Raw et al., 2020) have both been shown to influence the performance advantage seen within flashbulb memories and so may likely modulate the effects of AS. However, other than studies noting a strong association between emotional salience and remember/high AS responses (Renoult et al., 2015; Westmacott & Moscovitch, 2003), no investigation into the interaction of AS and emotional salience on task performance has been undertaken.

Additionally, the time of fame and time of associated memories may have an influence. Previous studies have indicated that in line with consolidation theory (Squire & Alvarez, 1995), tasks involving dated famous persons may be influenced by prior semantic knowledge more so than for contemporary faces (Bäckman et al., 1987; Backman & Herlitz, 1990; Wahlin et al., 1993)However, the date of fame has not been investigated within AS. It is possible that AS may improve task performance for more recent compared to dated knowledge, or AS may benefit knowledge held throughout the lifespan.

In addition, little attention has been paid to the content of the associated memory and whether specific factors such as temporal detail (unique or repeated event memory), level of detail or vividness may influence task performance. Earlier investigations ensure associated memories were unique events with associated spatial or temporal details (Westmacott & Moscovitch, 2003), but the considerable overlap of episodic processing has been found with some types of personal semantic memories (Maguire

& Frith, 2003; Maguire & Mummery, 1999; Renoult et al., 2012), so it is of interest to determine if memory type can influence the observed AS performance benefits.

Finally, limited research has contrasted effects of self-reference, prior knowledge, and AS, despite the high level of overlap between these three processes. It is therefore of interest to determine which of these processes have the greatest effect on the observed boosts in task performance and to better understand any interactions between these processes.

1.7. General Aims

The aim of this thesis is to develop an understanding surrounding the effect of AS and its beneficial impact on experimental task performance. Particularly in respect to the relation between AS and prior knowledge for the stimuli and between AS and the self-reference effect. Limited research has been undertaken in this area so this thesis will also examine the impact of healthy ageing, time, and stimuli modality. We will also, for the first time, examine the associated memory, to determine whether factors such as level of detail, emotional salience, or proximity, modulate the task enhancement effect.

1.7.1 Contrasting Prior Knowledge and Autobiographical Significance

Prior knowledge (Backman & Herlitz, 1990; van Kesteren et al., 2014; van Overschelde & Healy, 2001; Xie & Zhang, 2017) and AS (Renoult et al., 2015; Westmacott et al., 2004; Westmacott & Moscovitch, 2003) have been shown to boost memory performance when associated to certain stimuli, however considerable overlap between the underlying processing systems have been observed (Bellana et al., 2019; Liu et al., 2016). By asking participants to disclose when they have prior knowledge, their associated factual knowledge and associated AS for each presented stimuli, we aim to separate these two processes, to examine differences or similarities within both the prevalence of these associations and the associated effect of these on experimental task performance.

1.7.1.1. Investigating the Impact of Time. Consolidation theory (Squire & Alvarez, 1995) and the transformation hypothesis *(Moscovitch et al., 2016; Winocur & Moscovitch, 2011)* propose that memory becomes more semantic over time, this is apparent within semantic dementia patients who demonstrate higher recall for more recent compared to past events (Snowden et al., 1996). It may then be the case that the association of prior semantic knowledge is more prevalent for dated stimuli. Whereas episodic AS may be associated more frequently with more recent stimuli. Studies on prior knowledge have previously demonstrated greater benefits for dated stimuli over contemporary (Bäckman et al., 1987; Backman & Herlitz, 1990; Wahlin et al., 1993; Xie & Zhang, 2017), however, this was 'assumed' prior knowledge based on stimuli the participant would likely have been exposed to, rather than asking participants about their experience of the stimuli, and date of stimuli has not previously been a factor within investigations of AS (Renoult et al., 2015; Westmacott et al., 2004; Westmacott & Moscovitch, 2003). By using stimuli from across the lifespan of participants within this thesis, we are able to determine if the prevalence of associated prior knowledge and AS changes with time, and also if the associated benefit of these processes on experimental task performance is modulated by time.

1.7.1.2. **Investigating the Associated Memory.** Within this research, by asking participants to disclose any associated memories for each of the presented stimuli, we have the opportunity to further explore the memory details within AS. For example, prior investigations have previously required the association of unique events with spatial and temporal detail for AS (Westmacott & Moscovitch., 2003), which was a useful tool for ensuring episodic involvement within the process. However, other memory types have also been found to involve episodic processing including some forms of personal semantic memory; autobiographical facts and repeated events (Brown et al., 2018), which can frequently be associated with stimuli, e.g. I listened to Johnny Cash every day after school, or Adele is my favourite artist. By examining these details, we can examine whether the type of associated memory effects the boost in task performance boost observed with AS. Equally, flashbulb memory research indicated several factors which influence the later recall of event memory and knowledge, including personal proximity (Er, 2003; Neisser, 1996; Pezdek, 2003), event valence (Peace & Porter, 2004; Raw et al., 2020), and vividness (Gandolphe & El Haj, 2016), by asking participants to disclose memory details we are also able to examine whether any of these factors might modulate the task performance benefit observe with associated AS.

1.7.1.3. Stimuli Modality. The large majority of research on the benefits of associated prior knowledge on task performance has used famous faces as stimuli (Bäckman et al., 1987; Backman & Herlitz, 1990; van Kesteren et al., 2014; van Overschelde & Healy, 2001). In contrast, the research examining AS has been focused on famous name (Renoult et al., 2015; Westmacott et al., 2004; Westmacott & Moscovitch, 2003). However, there is a general consensus that individuals often better recognise and recall names than face stimuli *(Borges & Vaughn, 1977; Clarke, 1934; Yarmey, 1971)*, and findings from both EEG *(MacKenzie & Donaldson, 2016)* and fMRI (Nielson et al., 2010) investigations suggest there may be different underlying processes for these modalities, indicating that task performance for faces and names may not be directly comparable. Denkova, Botzung & Manning (2006) examined both faces and names within their fMRI paradigm and noted that individuals reported more associated memories within the famous name condition, indicating the proportion of prior knowledge and AS may differ between modalities. For these reasons, this thesis will examine both famous faces and famous names, to determine if modality will affect the prevalence of reported prior knowledge or AS, or if stimuli modality will impact the associated enhancement within task performance.

1.7.1.4. Type of Knowledge. Additionally, we will examine whether the task enhancement observed for both prior knowledge and AS for famous person stimuli will extend to public events. All prior research within prior knowledge and AS has focused on the effect on famous person knowledge, so it is of interest to determine if these phenomena are limited to person knowledge or whether it can extend to other semantic knowledge such as public events.

Limited research has been undertaken on the semantic and episodic involvement within public event knowledge; one study noted that both episodic recollection and semantic familiarity both contributed to public event recognition, but that relative contributions of these two memory processes varied according to date of the event (Petrican et al., 2010). The most dated events were associated with a greater proportion of episodic recollection, whereas semantic familiarity judgements were more prevalent for recent events. This is contrary to the findings discussed previously within famous person knowledge (Bäckman et al., 1987; Backman & Herlitz, 1990; Wahlin et al., 1993) and consolidation theory (Squire & Alvarez, 1995). It is therefore of interest to examine whether there will be time-related variation within participants association of prior knowledge and AS for events and whether this will differ from that observed for famous person knowledge.

Studying public events is also of interest to contrast with the behavioural effects discussed previously surrounding flashbulb memory (Curci et al., 2015; Hirst et al., 2015; Kvavilashvili et al., 2010; Schmolck, Buffalo & Squire, 2000). For this reason, participants will be asked to disclose, in addition to any associated memory, if they can remember any source details surrounding how they found out about the event.

This will allow us to examine if associated flashbulb memory results in similar task performance improvement to that observed from associated AS.

1.7.2. Autobiographical Significance in Healthy Ageing

Memory complaints are one of the most declared problems within healthy ageing (Hertzog et al., 2008), so understanding the way in which memory systems interact and function within ageing is increasingly important.

Traditionally older adults show the greatest degradation within the episodic memory system (Nyberg et al., 1996; Denise C. Park et al., 2002), particularly within recognition (Fraundorf et al., 2019) and recall (Craik & McDowd, 1987; Danckert & Craik, 2013), and so developing active methods to support this system is beneficial. Both the association of semantic knowledge (Bäckman et al., 1987; Backman & Herlitz, 1990; Kan et al., 2009; Wahlin et al., 1993) and referencing items to the self (Gutchess et al., 2007; Leshikar et al., 2015; Yang et al., 2012) have both been shown to improve episodic task performance in both young and older adults. Interestingly, despite the strong episodic involvement, presence of AS, and the associated improvement in task performance for AS stimuli are also observed within older adults (Westmacott & Moscovitch, 2003), and even patients with high levels of degradation of the episodic system (Westmacott et al., 2004), so this process is also beneficial at countering episodic memory decline.

To date, all investigation within AS have been conducted on either young (Renoult et al., 2015) or older adults (Westmacott & Moscovitch, 2003), no direct comparison has been undertaken. As older adults can at times show an overreliance on the semantic system (Kan et al., 2009), it will be of interest to compare the proportion of prior knowledge and AS for the stimuli between the age groups, and also any variation in the effect of these associations on task performance.

1.7.3. Neural Correlates of Autobiographical Significance

Limited research has been undertaken to examine the underlying neural correlates of AS. A recent ERP investigation (Renoult et al., 2015) demonstrate differing underlying processes for stimuli associated with high levels of AS, and stimuli associated with low AS but high levels of prior knowledge. They noted a higher amplitude within the late positive component, typically linked with episodic processing (Voss & Paller, 2008), for stimuli associated with high AS, whereas stimuli low in AS and predominantly associated with prior knowledge were associated with greater amplitude within the N400 ERP, typically linked to semantic processing (Kutas & Federmeier, 2011). This provided a useful dissociation and supported the idea that AS is largely episodic in nature, whereas prior knowledge functions through semantic memory.

Due to the degradation of episodic memory (Nyberg et al., 1996; Park et al., 2002) and often over-reliance on semantic memory (Roediger & McDermott, 1995; Kan, Alexander & Verfaellie, 2009) within older adults, it is of interest to re-examine the underlying neural correlates of AS and prior knowledge within these participants, in order to determine if age impacts the presence or magnitude of the LPC and N400 ERPs.

Additionally, as participants provide details for each presented stimuli for associated prior knowledge, factual knowledge, emotion, and disclose the associated memory, we are able to extend the work to examine what impact these factors have on the underlying neural correlates.

1.7.4. Contrasting Autobiographical Significance and Self-Reference

The self-reference effect is a robust finding which demonstrates consistent memory performance boosts when participants encode information in relation to themselves (Gutchess, Kensinger, Yoon, et al., 2007; Howell & Zelenski, 2017). Investigations into this effect demonstrate considerable overlap with episodic processing (Conway & Pleydell-Pearce, 2000; Gardiner, 2001; Sajonz et al., 2010), and that participants report a greater level of episodic details (unique events, with temporal or spatial elements) than conceptual details for stimuli that are self-referenced (Leshikar et al., 2015). Despite this overlap in processing, no research has directly contrasted this effect with AS to determine if the effects are detachable from one another, or if AS is an extension of self-reference or vice versa. This thesis will directly compare self-reference and AS as encoding methods within a single paradigm, to determine if there are any marked differences in task performance between the two methods, and to examine which method is most efficient at improving later episodic memory.

It is also worth noting that the self-reference effect is largely an explicit process whereby participants actively consider their self-whilst encoding items (Gutchess et al., 2007; Howell & Zelenski, 2017), whereas the task performance benefit observed for AS has been consistently implicit (Westmacott & Moscovitch, 2003; Renoult et al., 2015), in this case, participants disclose associated memories following the experimental tasks. Therefore, any improvement in performance is incidental. In this thesis, we will also examine whether the same improvement in episodic task performance is observed if participants actively retrieval AS during encoding.

1.8. Chapter Breakdown

1.8.1. Chapter Two: Autobiographical Significant Knowledge of Famous Persons: Behavioural Correlates in Young and Older Adults.

The first experimental chapter examines the impact of prior knowledge and AS for famous person knowledge on the associated experimental task performance. Both young and older adults participated and viewed either famous faces or famous names as stimuli. Within this study, participants completed two experimental tasks, one semantic dead or alive judgement task, followed by an episodic old-new recognition task. Following this, they completed an in-depth questionnaire in which they are asked about their prior knowledge, associated factual knowledge, familiarity, opinion, and emotional salience towards the presented stimuli, and if they have any associated memories. The results examine what factors from this follow-up questionnaire influenced task performance for each stimulus within-subjects and determine the effects of age and stimuli modality on task performance between-subjects.

This first chapter confronts several of the theses aims. It contrasts an individual's prior knowledge and AS for stimuli within a single paradigm and allows the behavioural effects of these associations to be more clearly separated. Further details surrounding the level of factual knowledge and specifics surrounding the associated memory can also be examined to determine if they modulate participants task performance. Additionally, as stimuli from across the participants' lifespan are used within this chapter, we are able to examine the impact of time on both the prevalence of prior knowledge and AS, but also whether time modifies the observed performance boost. Finally, this chapter examines between-subject age-related and modality related differences, for both prior knowledge and AS.

1.8.2. Chapter Three: Neural Correlates of Autobiographical Significant Concepts within Older Adults

The second experimental chapter examines the underlying neural correlates of both prior knowledge and AS within healthy older adults utilising an ERP design. Within this chapter, participants complete the same two experimental tasks from chapter one while their EEG is being recorded. Following this, participants complete the same follow-up questionnaire in which they are asked about their prior knowledge, associated factual knowledge, familiarity, opinion, and emotional salience towards the presented stimuli, and if they have any associated memory. The results examine what factors from this follow-up questionnaire influence both behavioural task performance and the electrophysiological responses for each stimulus within-subjects.

This chapter again contrasts participants' own prior knowledge and AS for famous persons, but this time extends this to the underlying neural correlates. Previous ERP investigations of AS have been conducted on young adults, so this chapter will give important insight into age-related differences in the underlying processing of both prior knowledge and AS.

1.8.3. Chapter Four: Autobiographical Significant Knowledge of Public Events and the Connection to Flashbulb Memory

Within the fourth chapter, we determine whether the observed task performance enhancement relating to prior knowledge and AS of the famous person stimuli can be extended to public events. In this study, both young and older participants view public events from across their life span and complete two experimental tasks. Firstly, they encode the stimuli through a semantic knowledge judgement of whether the event occurred in the UK or overseas, then following this, they undertake an episodic old-new recognition task. At the end of the experimental session, they complete an in-depth questionnaire asking participants about their prior knowledge, associated factual knowledge, proximity, familiarity and emotional salience towards the event, they are also asked to disclose any associated memory, and if they can recall any source details about how they first learnt about the event. Results examine what factors from this follow-up questionnaire influence behavioural task performance for each stimuli within-subjects.

This chapter again contrasts the effects of associated prior knowledge and AS for stimuli on episodic and semantic task performance, but for the first time examines an alternative stimuli modality in the form of public events. Utilising events from the lifespan of the participant allows the investigation of the effect of time on the prevalence of prior knowledge and AS for events, and if time modulates the associated performance advantage. This chapter will also examine between subject age-effects to determine any differences in prevalence and linked task performance boost for stimuli associated with prior knowledge or AS between young and older adults.

1.8.4. Chapter Five: Contrasting the Effects of Autobiographical Significance and Self-Reference on Experimental Memory Performance

The final experimental chapter directly compares self-reference and AS within a single experiment using explicit encoding. Participants first encode trait adjectives through self-reference (Does this word apply to me?), subjective semantic (is this a common word?) or AS (can you remember a time when you were this word), then following a short distractor they free recall as many words as they can remember, and then complete an old-new recognition, and a source memory task. Results compare recall, recognition, and source memory within-subjects between the three encoding methods.

There are two primary aims for this chapter, firstly to contrast the well-established self-reference effect with AS. This provides the unique opportunity to determine if the processes are detachable or merely extensions of one another, by comparing later memory performance for the encoded stimuli. Secondly, it explores for the first time whether AS can be utilised as an explicit encoding method, and therefore a useful mnemonic technique.

1.8.5. Chapter Six: General Discussion

The final chapter summarises the findings of the four experimental chapters and examines these against the original aims of the thesis. Theoretical outcomes of the work and future directions are also discussed.

CHAPTER TWO

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Autobiographical Significant Knowledge of Famous Persons: Behavioural Correlates in Young and Older Adults

2.1. Introduction

Although Tulving's distinction between episodic (specific re-experienceable episodes that contain spatial or temporal context) and semantic (general knowledge of word meanings or associations and schematic representations of events) memory was useful at driving memory research (Renoult & Rugg, 2020) it is now more widely accepted that these memory forms intersect and interact. This is observable through overlapping regions of functional activation within the brain (Binder et al., 2009b; Renoult et al., 2019b), and behaviourally through semantic knowledge influencing episodic memory performance, and episodic memory informing processing during semantic tasks.

Influence of the semantic system on episodic memory performance is observable within faster memory consolidation of information that is consistent with schema knowledge (Durrant et al., 2015; Groch et al., 2017) and through greater recognition memory for information that is either semantically related (van Kesteren et al., 2013) or congruent with one's general semantic knowledge (Castel, 2005; Kan et al., 2009).

This benefit of semantic interaction can extend beyond this to more personal involvement where one's prior knowledge formed from their experience can influence their task performance. For example, participants prior knowledge of baseball, was shown to improve their performance on a later reading comprehension task on the sport (Recht & Leslie, 1988). Benefits were also seen for greater recognition of stimuli that participants likely had prior experience of, such as for famous persons compared to non-famous persons (Bäckman et al., 1987; Backman & Herlitz, 1990; Wahlin et al., 1993).

Equally relying on interactions with episodic memory has also shown to be beneficial; most notably in the case of selectively preserved semantic knowledge in semantic dementia patients. These patients suffer from progressive degeneration of the anterolateral temporal lobe causing severe impairment of semantic knowledge for words, objects, and people (Graham et al., 2000; Hodges & Graham, 2001). These patients appear to utilise their spared episodic memory to preserve a level of semantic knowledge, particularly for personally relevant persons, places, and objects, compared to famous or well-known exemplars (Giovannetti et al., 2006; Snowden et al., 1994; Snowden et al., 1996).

Experimentally, limited work has been completed examining the task performance resulting from semantic-episodic interaction. One such unique paradigm (Westmacott & Moscovitch, 2003) measured the implicit effect of episodic involvement through AS of famous persons on subsequent semantic and episodic task performance. Famous name stimuli were prior-rated and controlled so that half were considered highly autobiographical significant (High-AS), these were associated with a high proportion of 'remember' responses (could remember a specific episode involving the famous person) and half were Low-AS; associated with low levels of remember responses but high levels of know responses (knew who the famous person is, or has factual knowledge, but no specific memory). Examining participants performance for these stimuli across a series of semantic and episodic tasks, they found participants demonstrated better episodic free recall and more accurate recognition memory for the High-AS names compared to the Low-AS names. High-AS names were also associated with faster responses within the semantic speeded reading and fame judgement tasks. These performance boosts were also observed when using participants' own remember-know ratings (rather than preestablished norms collected from other participants), indicating the performance boosts observed within semantic and episodic tasks were related to the associated episodic memories rather than increased familiarity for the famous person. Findings from this experimental paradigm are clever, as the observed effects on task performance are incidental, as participants were not asked to report on their remember-know ratings until after the experimental tasks, and were also not instructed to retrieve any prior experience of the stimuli during the tasks.

There is considerable conceptual overlap between prior knowledge and AS, as by nature both prior knowledge and AS are made up of an individual's experiences. Research in the field of prior knowledge (Bäckman et al., 1987; Backman & Herlitz, 1990; Wahlin et al., 1993; Xie & Zhang, 2017) did not ask participants to fully disclose the nature of their previous experience with the stimuli. These paradigms typically only ask participants to state 'if' they had any prior experience and did not distinguish between associated factual knowledge or any event memories. Therefore, it is difficult to distinguish the two processes and any associated performance benefits.

Within this first experimental chapter, we will be directly contrasting semantic and episodic behavioural performance for stimuli participants have associated prior knowledge for, and those they have associated AS for, based on their self-report disclosures at the end of the experiment for each of the presented stimulus. This allows the performance advantage of prior knowledge and AS to be contrasted at the participant level to determine if these two processes are divorceable or largely intertwined.

The association of prior knowledge (Badham et al., 2012; Crespo-Garcia et al., 2012) and AS (Westmacott & Moscovitch, 2003; Westmacott et al., 2004) have both been shown to boost episodic recognition performance within older adults. However, to date, the limited research surrounding AS has focused on either young (Renoult et al., 2015) or older adults (Westmacott & Moscovitch, 2003) separately, so it is difficult to draw clear conclusions on the impact of ageing on this process. Due to older adults having a natural degradation of episodic memory compared to young adults (Nyberg et al., 1996; Park et al., 2002) within recognition and recall performance (Danckert & Craik, 2013; Fraundorf et al., 2019) and often over-reliance on their intact semantic memory (Kan et al., 2009) it is of interest to examine whether older adults have a higher proportion of semantically driven prior knowledge responses for stimuli and a lower proportion of episodically driven AS responses compared to young adults, and whether the boost on task performance awarded by these two processes will differ between young and older adults.

Modality of stimuli is also of interest when investigating the respective benefits of associated prior knowledge and AS. Incidentally, previous investigations on the benefits of prior knowledge have used famous faces as stimuli (Backman & Herlitz, 1990; Wahlin et al., 1993) whereas the few studies that have examined AS have used names of famous persons (Westmacott & Moscovitch, 2003; Renoult et al., 2015). It will be thus important to investigate whether modality has an impact (comparing faces and names), and to compare the respective benefits of prior knowledge and of AS for the same stimulus modalities. There is a general consensus that although individuals believe their memory for faces is greater than names when asked through self-report, participants generally have greater objective memory performance for names over face stimuli (Borges & Vaughn, 1977; Burton et al., 2019; Clarke, 1934;

Yarmey, 1971), indicating that modality may impact memory performance. Additionally, findings from both EEG (MacKenzie & Donaldson, 2009) and fMRI (Nielson et al., 2010) have suggested there may be different underlying processes between these modalities. Therefore, the previous investigations on prior knowledge using face stimuli and those examining AS using name stimuli, may not be directly comparable. Therefore, this study will examine the effect of prior knowledge and AS across a matched set of famous faces and famous names to determine any impact of modality on these processes.

The impact of time is also of interest for this study, several theoretical models such as Consolidation theory (Squire & Alvarez, 1995) and The Transformation Hypothesis (Moscovitch et al., 2016) propose that memory may become more semantic over time, which is apparent for example within semantic dementia patients who demonstrate a higher recall for more recent, compared to past events (Snowden et al., 1996). In line with these proposals, one would predict the semantic-based prior knowledge would more often be associated with dated stimuli, and the episodic AS may be more prevalent for recent stimuli. This pattern was observed when investigating the effects of prior knowledge in older (Backman & Herlitz, 1990; Wahlin et al., 1993) and young (Xie & Zhang, 2017) adults who performed better for dated compared to more recent stimuli. However, when investigating AS for public events (Petrican et al., 2010), participants reported a greater proportion of remember responses for dated events and a higher level of know responses for more recent events, contrary to the semanticisation proposal. Within this study, by using famous person stimuli from across the lifespan of participants, the effect of time on prior knowledge and AS can be examined. We will examine the effect of time on both the prevalence of prior knowledge and AS responses given by participants for stimuli across time periods, but also examine whether the effect of these processes on behavioural task performance varies by time.

Previous investigations on AS have focused on the use of normed stimuli to contrast those that typically trigger personal memories and those that are typically known but are not often associated with episodic memory (Westmacott & Moscovitch, 2003; Westmacott et al., 2004; Renoult et al., 2015). This method is useful for ensuring equal balance between conditions and allows the researcher to control for other variables including familiarity, number of facts and associated emotional salience, however as both prior knowledge and AS are highly personal and based on personal experience, there will naturally be considerable individual variance. Although each of these studies followed up by asking participants for their own remember-know or AS ratings (Westmacott & Moscovitch, 2003; Renoult et al., 2015) and found that the beneficial effect of AS was still present for these personal ratings, these comparisons then lacked the control of other concurring variables including familiarity, factual knowledge and emotional salience of the stimuli, which are typically higher for autobiographically significance stimuli (Westmacott & Moscovitch, 2003; Renoult et al., 2015) and can influence memory performance (Levine & Pizarro, 2004; van Overschelde & Healy, 2001; Xie & Zhang, 2017).

Therefore, in the present study, stimuli were not pre-normed. Both AS and prior knowledge will be examined incidentally. Participants will encode a series of stimuli through a semantic task, followed by an episodic recognition task. Then following both tasks, they are asked about their prior experience of the stimuli. Within subject analysis can then be run, examining behavioural performance for stimuli associated with or without prior knowledge and with or without AS. This method of analysis reduces the individual variance that can limit normed stimuli studies.

As stimuli were not pre-normed, a large set of stimuli were required to increase the likelihood of participants providing prior knowledge or associated AS responses for a portion of the stimuli. This also meant that all stimuli needed to be known, so were all famous persons. Therefore, the semantic judgement task was changed from fame judgement (Renoult et al., 2015; Westmacott & Moscovitch, 2003) to a dead or alive judgement task (Kapur et al., 1997), a task typically used as a measure of general knowledge and so therefore is an appropriate semantic measure.

Another novel addition to this study, is the use of an in-depth follow-up questionnaire completed after the experimental tasks. In this questionnaire participants were asked about their prior experience of each stimuli they were presented within the two tasks; specifically their prior knowledge (whether they had heard or seen the famous person before), their level of associated knowledge (how much factual knowledge they held about the celebrity), their familiarity with the celebrity (how frequently they had encountered the person), their ratings of emotional salience (feelings or opinions about the celebrity), and for details surrounding any associated memory. This allowed a valid examination of the effect of both personalised prior knowledge and AS on task performance for each stimulus, while controlling for possible confounding variables such as familiarity at the participant level.

Data from this questionnaire also allows further investigation into the associated memory within AS. Previous investigations have required the association of unique events (with spatial and temporal details) for stimuli to be considered as autobiographically significant (Westmacott & Moscovitch, 2003), which although useful to ensure episodic processing was present, this restriction may be unnecessary. It may be that other memory forms including repeated events (e.g., I always listened to Spice Girls when I was in school; Brown et al., 2018; Renoult et al., 2012) can also result in AS and result in a task performance boost. This study will ask participants to disclose any associated memories to examine whether AS and the associated task performance boost is restricted to unique events or whether other forms including repeated events, or personal factual knowledge can influence task performance. Additionally, other factors of the memory including vividness and emotional salience will also be examined, as these factors were found to influence flashbulb memory (Gandolphe & Haj, 2016; Peace & Porter, 2004; Raw et al., 2020), so may impact the effect of AS on task performance. Gaining a greater understanding of the associated memory will provide an insight into the underlying processes of AS.

2.1.1. Chapter Aims & Hypotheses

1. To contrast differences in the prevalence of both prior knowledge and AS responses for stimuli and contrast the behavioural task performance for stimuli associated with prior knowledge and for stimuli associated with AS
    i. Based on previous research contrasting remember and know responses (Westmacott & Moscovitch, 2003; Westmacott et al., 2004; Denkova et al., 2006), we expect association of AS to lead to superior task performance, as compared to prior knowledge alone.

2. To examine the effect of healthy ageing on both the prevalence of responses and the associated task performance boosts for stimuli associated with prior knowledge and AS responses.
    i. Due to degradation of episodic memory and general preservation of semantic memory in ageing, we expect a greater proportion of prior knowledge and a lower proportion of AS for stimuli in older adults compared to young adult participants.
    ii. As AS is largely episodic in nature, based on patient studies (Westmacott et al., 2004) and ERP investigations (Renoult et al., 2015), we expect the performance benefit of AS to be reduced in older adults compared to young adults.
3. To investigate the impact of stimuli modality; comparing famous faces and famous names on participants' task performance, and to examine any interaction between modality of stimuli and the effect of AS on task performance.
    i. Research suggests recognition of names is better than faces (Clarke, 1934; Yarmey, 1970), therefore we predict better episodic performance for name stimuli compared to faces.
    ii. Denkova et al., (2006) highlighted participants produced more memories for stimuli presented as names compared to faces. We therefore predict an interaction effect between AS and modality of stimuli.
4. To examine the impact of time period of stimuli, both on prevalence of prior knowledge and of AS responses to stimuli and on the associated task performance for those stimuli.

i. Consolidation theory (Squire & Alvarez, 1995) and the Transformation Hypothesis (Moscovitch et al., 2016) propose that memories become more semantic over time. Investigations on the benefits of prior knowledge (Backman & Herlitz, 1990; Wahlin et a., 1993; Xie & Zhang, 2017) found performance was better for dated stimuli, and patients with semantic dementia have better memory performance for recent information (Snowden et al., 1996), conversely Petrican et al., (2010) found participants were more likely to have episodic memories for dated compared to recent public events. We therefore predict time will significantly affect prevalence of prior knowledge and AS responses, but it is not clear in which direction.

ii. In an extension of this, we expect the impact of prior knowledge and AS on task performance to be significantly affected by the time period of the presented stimuli.

5. To investigate the impact of elements of the associated memory on task performance

i. Previous investigations have focused on unique events (Westmacott & Moscovitch, 2003; Renoult et al., 2015), but due to the similar processing methods and areas of activation between unique events and personal semantic memories such as repeated events (Brown et al., 2018; Renoult et al., 2012), we expect these to also act as AS and benefit task performance.

ii. Emotional salience (Peace & Porter, 2004; Raw et al., 2020) and vividness (Gandolphe & Haj, 2016) of memories have both been associated with superior memory performance, so for this reason we expect these to modulate the level of effect on task performance of AS.

2.2. Method

2.2.1. Participants

Fifty-one young adults (39 female) aged 18-31 years (*M* = 20.53, *SD* = 2.70), were first- or second-year psychology students recruited from the University of East Anglia School of Psychology. Of these, 26 (18 female) aged 18-31 (*M* = 20.96, *SD* = 3.29) viewed famous faces as the experimental stimuli, and 25 (21 female) aged 18-28 (*M* = 20.08, *SD* = 1.87) viewed famous names.

Forty older adults (28 female) aged 64-83 years (*M* = 71.7, *SD* = 5.00) were also recruited from the University of East Anglia's School of Psychology paid participant panel. Of these, 20 (14 female) aged 66-83 years (*M* = 73.5, *SD* = 4.92) viewed famous faces as the experimental stimuli, and 20 (14 female) aged 64-82 years (*M* = 69.9, *SD* = 4.51) viewed famous names.

All participants were free from any known neurological or cognitive impairment (older adults M-ACE score > 25, *M* = 28.12, *SD* = 1.39), and all had resided in the UK for the majority of their lives. Young and older adult participants were matched in education, with young adults having on average 14.67 years of education (*SD* = .53) which did not significantly differ from the older adults' average of 14.25 years of education (*SD* = 2.33), $t(89) = 1.107$, $p = .275$. All participants gave their informed consent, young adults were compensated with partial course credits, and the older adults were financially compensated for their time.

2.2.2. Stimuli

This study utilised the dead or alive judgement paradigm (Kapur et al., 1989) as an objective semantic task. For this reason, our stimuli consisted of names and faces of both famous dead and famous alive persons.

Firstly, famous persons who died between 2008-2016 for the young adults or between 1961-2016 for the older adults, were selected from ‘onthisday.com’ of famous individuals who died. This time range was chosen to try to capture autobiographical memories across the lifespan of the participants, whilst also ensuring the participants were at least ten years old at the time of the individual’s death to improve the chance of having prior knowledge or associated memory for the celebrity. We recruited participants aged 18-30, and 65-80 years, this meant that the youngest individuals would be born in 1998 and 1951, respectively. Therefore, the stimulus set began in 2008 for the young adults and 1961 for the older.

Alive famous people were then matched to the selected famous dead people by gender, occupation and according to a peak of fame falling within their year of death. The peak of fame was selected according to film and television awards (Oscars.org, Bafta.org), chart success (officialcharts.com), sporting achievements (fifa.com, bbc.co.uk/sport, onthisday.com/sport), or state leaders that year (Wikipedia). For instance, a famous actor dying in 2008 would be matched to an Oscar-winning actor for that year.

The matched dead and alive celebrities for each time period were included in two pilot studies, one for young adults (*N* = 79, 61 Female, 18-35 years, *M* = 22.46 SD = 4.13), and one for the older adult (*N* = 82, 63 female, 58-75 years, *M* = 58.62, *SD* = 6.36) participants. The pilot asked, ‘Do you recognise this famous person?’ and participants chose between ‘I do not recognise them’, ‘I recognise their face or name’ or ‘I know who they are (their profession or what they are famous for)’. These were awarded a recognition score from 0-2, respectively. Mean recognition scores were then calculated for each celebrity. Famous people with the highest mean recognition score were used as experimental stimuli (Young adult; *M* = 0.50, *SD* = .034, Older adult; *M* = 1.54, *SD* = 0.87).

For the experimental tasks, participants were presented with an equal number of dead and alive famous people. These were matched across four occupational categories; Screen (Actors, Television Stars, Presenters etc.); Music (Musicians, Singers, Radio Disc Jockeys etc.); Sport (Athletes or Commentators) and Other (Politicians, Activists, Writers, Artists, or alternative reason for fame). They were also counterbalanced by either the date of their death or their peak of fame and distributed across three time periods for the young adults (2008-11; 2012-15; 2016), and eleven time periods for the older adults (1961-65, 1966-70, 1971-75, 1976-80, 1981-85, 1986-90, 1991-95, 1996-2000, 2001-05, 2006-10, 2011-16), to ensure a relatively even spread across the lifespan.

Unfortunately, the gender of the celebrities could not be counterbalanced across time periods, occupation or between the older and young adult groups, as the initial list piloted naturally contained a larger number of notable male deaths than female (young adults; 127:52, older adults; 1094:370).

This resulted in 144 famous person stimuli (Appendix A), 72 alive and 72 dead. Of which in the young adults, 104 were male, and 40 were female, and a similar ratio was present in the older adults 112 were male, and 32 were female. These persons were presented across two conditions, half of the participants viewed these famous individuals as faces, and the other participants viewed their written names.

2.2.2.1. Stimulus Presentation

For both young and older adults, for the famous faces condition, the selected images were presented as 13.5 x 12 cm on the centre of the screen. Head and shoulder shots were used (see Figure 1), where the individual is facing towards and making eye contact with the camera, to ensure uniformity between images. All photos were presented in black and white for consistency across time periods, and care was taken to control for distracting backgrounds and items such as hats or sporting accessories that could help identify the celebrities.

Figure 1 Example Image Presented to Participants. Image is a Head and Shoulder Shot with Eyes Facing Towards the Camera, and Presented in Black and White

Images for the famous persons were taken from the allocated time period, which corresponded to their date of death or peak of fame. This was to ensure a level of control and consistency, as appearances change over time, and individuals may have careers spanning lifetimes and therefore multiple peaks of fame.

Converting images to black and white contrast can cause significant differences in luminance which can affect reaction time (Teichner, 1954; MacLeod & Alderman, 1961). However, we found no significant difference in luminance between the dead or alive images, either for young (t (142) = -0.360, p = .7) nor for the older adults (t (142) = 1.67, p =.09). Nor between the sets used as ‘old’ or ‘new’ within the episodic recognition task for both the young (t (142) = -0.200, p = .8) and older adults t (142) = -.042, p = .97). So, in this case, luminance should not have affected task performance.

For the name condition, the written names were presented in Courier New font and 48pt type case. As the famous names were taken from the recognition pilot, there was some variation in word length (4-25 letters, *M* = 11.55, *SD* = 3.02 for young adults and 4– 25 letters, *M* = 11.69, *SD* = 3.08 for older adults). Word length can affect reading speed, and therefore task reaction time. However, there was no significant difference between word length of the famous names between the dead or alive names (t (142) = .566, p = .572 for the young adults, and t (142) = .027, p = .98 for the older adults), nor between the "old" or "new" conditions in the recognition task (t (142) = .785, p = .434 for the young adults, and t (142) = .566, p = .57 for the older adults). Therefore, word length should also not have an impact on task performance.

2.2.3. Experimental Tasks

All participants completed two computer-based tasks presented in E-Prime 2.0 (Psychology Software Tools, Pittsburgh, PA), presented on a 24-inch monitor. Participants were seated at a computer desk, in front of a computer screen approximately 60cm distance from their eyes.

2.2.3.1. Dead or Alive (Semantic) Task

The first task was an objective semantic task based on the dead or alive paradigm (Kapur et al., 1989). In this task participants viewed 72 stimuli of famous individuals, of which half were dead and half were alive and on which they were asked to make a dead or alive judgement. They first viewed written instructions explaining that they would be making a dead or alive judgement for each celebrity. They were instructed they would first see a fixation cross '+' on screen for one second, that they should focus on this and prepare for the stimuli to appear. This was presented in Courier New font and 36pt typeface. Following this, they were presented with a famous person stimulus, and were asked to press '1' on the keypad if they thought the individual was dead or '2' on the keypad if they thought the individual was alive. They had up to 4 seconds to decide; once the participant indicated their response, the procedure moved onto the next trial. Faces were presented in the centre and measured 13.5 x 12 cm; names were displayed in Courier New font and 46pt typeface. The words '*1 = DEAD'* were presented in the bottom left-hand corner, and '*2 = ALIVE'* were presented in the bottom right-hand corner. Following this, another fixation cross was presented for 1 second, and the procedure would repeat. The task took 6 minutes in total to complete.

2.2.3.2. Recognition Memory (Episodic) Task

In this task, participants were presented with the same stimuli from the dead or alive task ('old'), plus an equal number of unseen stimuli (new) and were asked to make an old or new judgement. They were told that they would again see a fixation cross '+' on screen for one second. This was presented in Courier New font and 36pt typeface. Following this, the stimuli appeared in the centre of the screen. When the stimuli were on screen they were instructed to press '1' on the keypad if they believe the stimuli was 'old'; that it had appeared in the previous task, or to press '2' on the keypad if they believe the stimuli were 'new'; that it had not appeared in the previous task and was novel to the experiment. They had up to 4 seconds to do this; once the participant indicated their response, the procedure moved onto the next screen. Faces were presented in the centre and measured 13.5cm x 12 cm, and names were presented in Courier New font and 46pt typeface. The words '*1 = OLD*' were presented in the bottom left-hand corner and ‘*2 = NEW*’ in the bottom right-hand corner. Following this judgment, they were instructed that they would be asked to make a confidence rating on their old-new decision, where they could press keys ‘1’,’2’, or ‘3’ to indicate their confidence level. ‘*How confident are you in that decision?*’ was presented at the top of the screen, with ‘*1 = Highly Confident*’ written directly below, followed by ‘*2 = somewhat confident’* and ‘*3 = not at all confident’*. This text was presented in Courier New font and 24pt typeface and aligned to the centre of the screen. They had up to 4 seconds to do this. Following this decision, a fixation cross was shown on screen for 1 second and the procedure repeated. This task took a maximum of twenty minutes to complete.

2.2.3.3. Celebrity Questionnaire

After completing both the semantic and episodic tasks, participants were asked to complete an in-depth questionnaire about the famous person stimuli presented to them within both tasks. This questionnaire was presented using Qualtrics (Qualtrics, Provo, UT) a web-based survey tool capable of collecting quantitative and qualitative data. The questionnaire asked participants a series of questions that were repeated for each famous person stimuli presented in the previous tasks. Participants were shown an example celebrity with these questions and given example responses, prior to completing the questionnaire.

For each famous person stimuli, participants were asked firstly ‘*Do you recognise this famous person?’* i.e., did they have any prior knowledge of this individual before the testing session? If they selected yes, they continued onto the next question, if they selected no to this question, the survey skipped all other questions for this stimulus and went onto the next celebrity.

The next question asked a judgement of familiarity for the famous person stimuli on a Likert scale from 0-4 where one is '*you rarely see or hear about this famous person*', and four is '*you see or hear about this famous person daily*'. Following this, they then rated their emotional salience for the stimuli on a scale of 0-4 where 0 equated to no emotional response or opinions, and 4 was a strong emotional response or opinion. Both rating systems were taken from Renoult et al., (2015).

The next few questions asked for factual knowledge relating to the famous person. Participants were asked to answer if they knew, the famous person; name (solely for the face condition), age, occupation, nationality and to detail what the person is famous for (i.e., naming a song, sport, film or achievement etc.). These responses were marked as correct or incorrect to create a score out of five for the name condition and six for the face condition. This provided an objective factual knowledge score. For the famous dead individuals, they were also asked factual knowledge relating to their death, i.e., cause, date and any specific details. This was marked correct or incorrect to create a score out of 3 for both stimuli modalities, which provided an additional objective factual knowledge score consistent with the dead or alive paradigm (Kapur et al., 1989).

Crucially, within the final part of the questionnaire participants were asked '*Do you have a personal event memory related to the person pictured? For example, a particular episode in which you watched, listened to or heard about the famous person, or if reading the person's name triggers some other specific memory, e.g., recalling a time, you sang along to their album in the car*'. This collected AS, taken from the original paradigm from Westmacott & Moscovitch (2003). As with the first recognition question, if participants gave a ‘no’ response here, the survey skipped the remaining questions and proceeded to the next stimuli. If they stated that they did have a memory, they were then asked to disclose; the details of the memory (if they were happy to), the year the memory occurred; ratings of vividness (0-4 Likert scale, not at all vivid to very vivid) and ratings of emotional response for the memory (very unhappy, somewhat unhappy, indifferent, somewhat happy or very happy).

Participants were asked to work through these questions for each of the 144 stimuli presented in the experimental tasks. At the end of the celebrity questionnaire, demographic information was collected for each participant, including gender, age, and education. They were also asked some self-report questions about their memory, specifically whether they believed they had a memory problem (yes, sometimes, no) and how they thought their memory was for faces and names (poor to very good, on a 5-point Likert scale). The demographic element also asked participants to complete questions for the Pittsburgh Sleep Quality Inventory (Buysse, Reynolds, Monk, Berman & Kupfer, 1989) and the PHQ-9 (Kroenke, Spitzer & Williams, 2001) mood questionnaire, which can both correlate with memory performance (Miyata et al., 2013; Kizilbash & Vanderploeg, 2002).

The time taken to complete the survey varied between participants due to the individual variance in number of famous persons known, and number of associated memories present, but on average the young adults completed in 60-90 minutes and the older adults in 120 minutes.

2.2.4. Procedure

Young adult participants responded to an advert on the SONA participation system (Appendix B), and older adult participants responded to an email advertisement from the School of Psychology's paid participant panel (Appendix C). They were informed the study was examining how personal significance would affect judgements and that they would be completing three computer-based tasks, making factual and personal judgements on a series of famous persons. Upon attending the lab, they were provided with an information sheet (Appendix D) and given the opportunity to ask any questions prior to giving their informed consent.

Participants were seated at a computer desk, in front of a computer screen approximately 60cm distance from their eyes. They worked through the dead-or-alive semantic judgement task followed by the old-new episodic recognition task on the computer. Following this they were then shown an example event questionnaire of the questions they would be asked and example responses (Appendix E). Participants were asked to work through the questions at their own pace. The older adult participants were given the opportunity to complete the questionnaire at home to limit fatigue from lengthy lab sessions. They were instructed to complete within 24 hours of leaving the lab. Prior to leaving the lab, all participants were thanked for their time, and given a verbal and written debrief (Appendix F) detailing the aims of the investigation to examine how the presence of any autobiographical memories for stimuli disclosed in the event questionnaire, would affect performance in the earlier semantic and episodic behavioural tasks.

2.3. Results

Reaction times and accuracy were collected for each stimulus from both the semantic and episodic tasks, and confidence judgements were taken from the episodic task, these were then linked to stimuli responses from the celebrity questionnaire. Participants' celebrity questionnaire responses were used to evaluate prior knowledge (yes or no) of the celebrities, as well as familiarity (0-4), emotional salience (0-4), factual knowledge (marked out of 5 for the name condition, and out of 6 for the face condition) and whether there was an associated episodic memory present (yes or no), and the details surrounding the memory, for each individual stimuli (see section 2.2.4 for questionnaire details). Episodic confidence, familiarity, emotional valence, and factual knowledge scores were then converted to percentages for ease of comparison.

We found no correlation between participants' sleep quality (PSQI; $M = 6.02$, $SD = 3.08$) nor their depression score (PHQ-9; $M = 4.81$, $SD = 5.29$) and their memory performance within the episodic task ($M = 84.32$, $SD = 7.60$), $r(90) = -.15$, $p = .15$ and $r(90) = -.12$, $p = .25$, respectively, so these were not included as co-variates in the following analyses.

2.3.1. Modality and Age Effects on Task Performance

Eighty per cent of young participants reported that they believed they had a better memory for faces over names, compared to just ten per cent who believed their memory for names was better and ten per cent who believed their memory for faces and names did not differ. Similarly, sixty-nine per cent of older adults' participants reported that they had a better memory for faces over names, compared to eight per cent who preferred names and twenty-two per cent that felt their memory for faces and names did not differ.

Participants were asked to rate their memory for faces or names, depending on the experimental modality they viewed, on a Likert scale 0-4 (see section 2.2.4). In line with their self-report, young adult participants rated their memory for faces on average as 2.96 (*SD* = .92) which was significantly higher than their ratings for names of 2.40 (*SD* = 1.41), *t (*49) = 2.05, *p* =.046. Interestingly, there was no difference within the older adults for their memory ratings of faces 1.90 (*SD* =.97) and the memory ratings for names 2.17 (*SD* = .64), *t* (35) = -1.01, *p* =.32.

To examine the effects of modality on task performance, we ran a ~~multivariate ANOVA~~ series of univariate ANOVAs to examine the impact of the modality of stimuli presented, and age group of the participant on the task variables; semantic accuracy, semantic reaction time, episodic accuracy, episodic confidence and episodic reaction time.

We observed no significant effect of modality on participants' semantic accuracy, *F* (1, 87) = .127, *p* = .72, semantic reaction time *F* (1, 87) = .015, *p* = .90, episodic accuracy *F*(1, 87) = 1.47, *p* =.23, episodic reaction time *F*(1, 87) = 2.58, *p* =.11 nor on their episodic confidence *F*(1, 87) = .015, *p* = .90.

There was a significant effect of age on participants semantic accuracy *F* (1, 87) = 10.98, *p* = .001, whereby the younger adults were significantly more accurate within this task (*M* = 74.76, *SD* = 10.65) than the older adults (*M* = 67.67, *SD* = 9.39). No age effect was observed on any of the other task variables; semantic reaction time *F* (1, 87) = 2.583, *p* = .112; episodic accuracy *F*(1, 87) = 2.53, *p* = .12; episodic reaction time *F*(1, 87) = .189, *p* = .67 and episodic confidence *F*(1, 87) = 2.32, *p* = .13.

There was no significant interaction between age and modality for any of the task variables; semantic accuracy *F* (1, 87) = 2.27, *p* =.14; semantic reaction time *F*(1, 87) = 6.50, *p* =.13; episodic accuracy *F*(1, 87) = 1.54, *p* =.22; episodic reaction time *F*(1, 87) = 29.58, *p* = .81 and episodic confidence *F* (1, 87) = 4.12, *p* = .054

~~The ANOVA found a significant effect of age on task variables, Wilks' Lambda = .01, *F* (5, 83) = 4296.09, *p* <.001. Tests of between-subjects effects showed this effect of age only significantly affected the semantic accuracy variable *F* (3,87) = 10.98, *p* = .001. Whereby the young adults were significantly more accurate (*M* = 74.76, *SD* = 10.65) than the older adults (*M* = 67.67, *SD* = 9.39).~~

~~There was no main effect of modality, Wilks' Lambda = .11, F (7,81) = 1.28, *p* = .27 on the task variables, but a main interaction was present between modality and age group of participants, Wilks' Lambda = 1.25, *F* (7,81) = 14.41, *p* <.001. This interaction reached the significance threshold for; semantic reaction time (*F* (1,87) = 6.50, *p* = .013); episodic confidence (*F* (1,87) = 4.19, *p* = .004) and episodic reaction time (*F* (1,87) = 29.57, *p* <.001). Independent measures t-test revealed young adult participants were significantly more accurate within the episodic task when the participants viewed famous faces (*M* = 87.34, *SD* = 6.93) compared to the participants that viewed names (*M* = 83.47, *SD* = 6.55), *t* (49) = 2.05, *p* = .046. They were also faster at responding to the face stimuli within the episodic memory task (*M* = 1347.19, *SD* = 242.65), than the participants that viewed the name stimuli (*M* = 1720.57, *SD* = 192.42), *t* (49) = -6.07, *p* <.001.~~

~~Whereas the reverse was true for older adults, the participants that viewed the name stimuli (*M* = 1455.33, *SD* = 251.34) were faster at responding to stimuli compared to participants that viewed face stimuli (*M* = 1658.56, *SD* = 317.80) in the episodic~~

~~task. This also approached significance within the semantic task (name; *M* = 1501.87, *SD* = 319.83: face; *M* = 1689.41, *SD* = 284.95: *t (*38) = -1.960 *p* = .057).~~

2.3.2. Impact of Prior Knowledge on Associated Task Performance

Participants rated each stimulus for if they recognised, or had prior knowledge of, the face or name before completing the experiment. Data from the Final Celebrity Questionnaire revealed no significant difference in the number of prior knowledge responses to stimuli between young adults (*M* = 58.13, *SD* = 18.02) and older adults (*M* = 53.69, *SD* = 17.51), *t (*89) = 1.18, *p* = .24.

There was also no significant effect of Modality on the number of prior knowledge responses *F*(1, 87) = .51, *p* = .48 between those participants that viewed face stimuli (*M* = 54.01, *SD* = 16.3) and those that viewed names (*M* = 58.39, *SD* = 19.21).

However a significant interaction was observed for modality of the stimuli viewed and age of the participant on the number of prior knowledge responses given, *F*(1, 87) = 28.35, *p* <.001. Examining the means, the younger adult participants that viewed names provided a greater number of prior knowledge responses (*M* = 68.21, *SD* = 19.65) than those that viewed faces (*M* = 48.44, *SD* = 8.89), whereas the reverse was the case for the older adults, those that viewed faces (*M* = 61.24, *SD* = 20.68) provided a greater number of prior knowledge responses than those that viewed names (*M* = 46.13, *SD* = 9.02).

~~A univariate ANOVA on the presence of prior knowledge revealed no significant effect of modality (*F* (1, 87) = .51, *p* =.48), however it did reveal a significant interaction between modality of the stimuli presented and age group of the participant~~

~~(F (1, 87) = 28.35, p <.001). Within the young participants those that viewed famous names reported more prior knowledge responses for the stimuli (M = 68.21, SD = 19.65) compared to those that viewed famous faces (M = 48.44, SD = 8.90), t (49) = -4.66, p <.001. Whereas the reverse was true for the older adults; participants who viewed famous faces gave more prior knowledge responses to stimuli (M = 61.24, SD = 20.68) than those that viewed famous names (M = 46.13, SD = 9.02), t (38) = 2.99, p =.006.~~

Average scores for accuracy, reaction times and confidence ratings were calculated for stimuli across both tasks, that participants had prior knowledge for, and for those that were unknown to the participant. A repeated measures ANOVA was conducted, examining the effect of prior knowledge for the stimuli on task performance. Means for these variables are displayed in Figure 2 and Figure 3.

It is clear from Figure 2 that prior knowledge of the stimuli boosted participants performance, in that participants were more accurate within both the semantic and episodic tasks for stimuli they had prior knowledge of compared to the stimuli they did not know before the experiment.

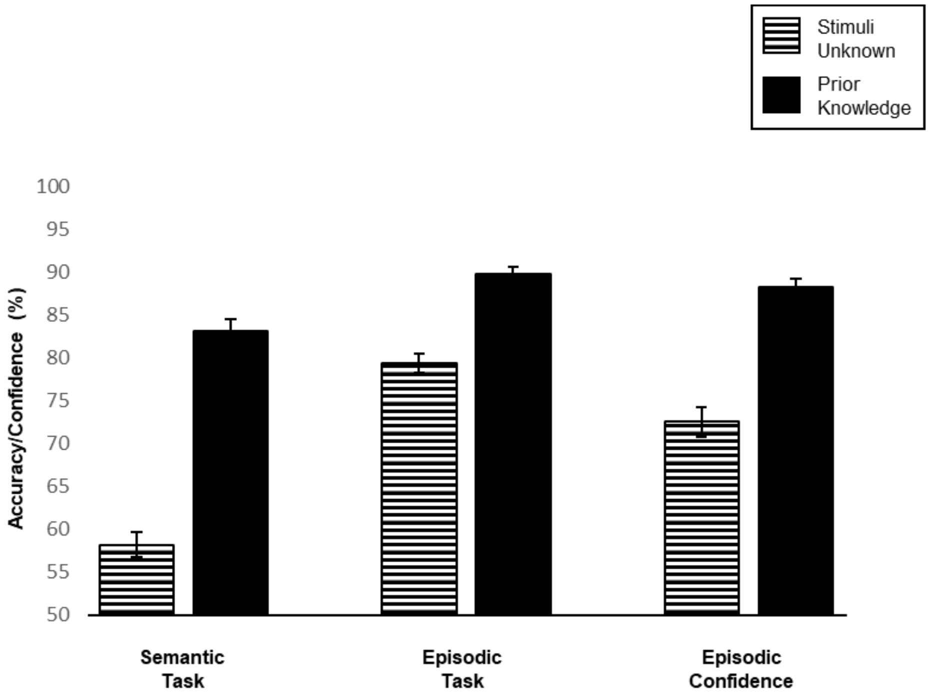

Figure 2 Mean Accuracy and Confidence within the Semantic and Episodic Task for the Stimuli Unknown to the Participant and those they had Prior Knowledge of.

This pattern of prior knowledge improvement was also present within the reaction time variables, as presented in Figure 3. Participants were faster at responding to the stimuli they had prior knowledge of, compared to those that were unknown to them, across both the semantic and episodic tasks.

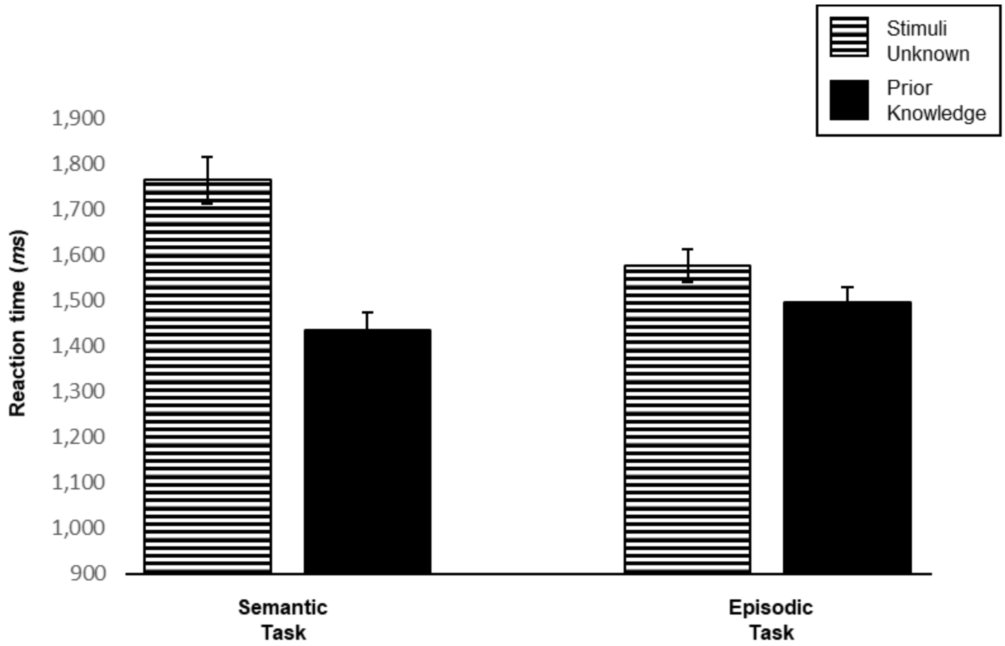

Figure 3 Mean Reaction Time within the Semantic and Episodic Task for the Stimuli Unknown to the Participant and those they had Prior Knowledge of.

A series of repeated measures ANOVAs were conducted, examining the effect of prior knowledge of the stimuli on semantic and episodic task performance. ~~A significant main effect of prior knowledge was found on these task variables, Wilks' Lambda = .17, *F* (5,81) = 77.17, *p* <.001. Univariate analysis indicated this reached significance for all variables; semantic accuracy (*F* (1,85) =219.50, *p* <.001), semantic reaction time (*F* (1,85) =60.41, *p* <.001), episodic accuracy (*F* (1,85) =119.99, *p* <.001), episodic confidence (*F* (1,85) = 164.09, *p* <.001) and episodic reaction time (*F* (1,85) =25.22, *p* <.001).~~

A significant effect of prior knowledge was found for sematic accuracy $F(1, 86) = 211.34$, $p < .001$; Semantic Reaction Time – $F(1, 86) = 60.41$, $p < .001$; Episodic Accuracy – $F(1, 86) = 115.92$, $p < .001$; Episodic Reaction Time – $F(1, 86) = 26.83$, $p < .001$ and Episodic Confidence – $F(1, 86) = 164.43$, $p < .001$.

Having prior knowledge for the stimuli therefore resulted in significantly superior accuracy, greater confidence and faster reaction time across both tasks compared to those they had no knowledge of.

2.3.2.1. Interaction of Prior Knowledge and Age on Task Performance

A significant interaction was also present, between age group of the participant and prior knowledge of the stimuli, ~~Wilks' Lambda = .511, *F* (5,81) = 15.49, *p* <.001. Univariate analysis found this interaction to be significant for all task variables; semantic accuracy (*F* (1,85) =12.21, *p* =.001), semantic reaction time (*F* (1,85) =8.81, *p* =.004), episodic accuracy (*F* (1,85) =48.44, *p* <.001), episodic confidence (*F* (1,85) =53.62, *p* <.001) and episodic reaction time (*F* (1,85) =15.70, *p* <.001).~~ within participants semantic accuracy $F(1, 86) = 8.83$, $p = .004$; episodic accuracy $F(1, 86) = 50.97$, $p < .001$, episodic reaction time $F\ (1, 86) = 14.96$, $p < .001$ and episodic confidence $F\ (1, 86) = 56.09$, $p < .001$. No effect of age was observed within semantic reaction time *F* (1, 86) - .24, $p = .63$.

To examine the effect of age on the impact of prior knowledge for a stimulus, mean differences were calculated for the participants between their performance on the stimuli they had prior knowledge of, and those unknown to them. These calculated mean differences for task accuracy and confidence are displayed in Figure 4, and those for reaction times are displayed in Figure 5.

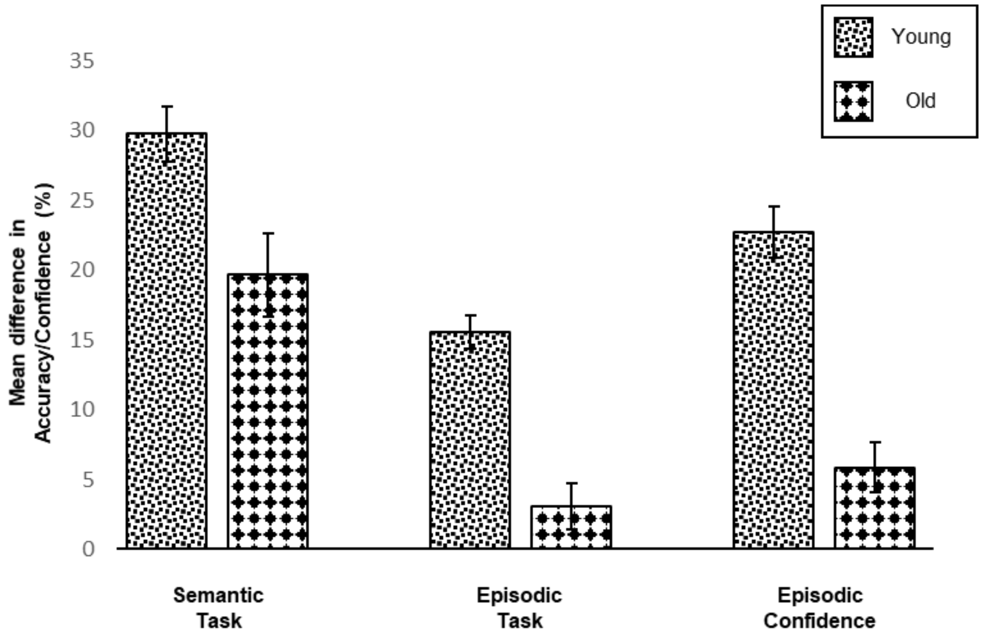

Figure 4 Mean Difference in Task Accuracy and Confidence Between Stimuli Participants had Prior Knowledge of and those that were Unknown to the Participant, for Young and Older Adults.

It is clear for Figure 4 that the young adults show the greatest benefit from the association of prior knowledge with a stimulus, observable by the largest mean difference in performance. Young adults also show the greatest improvement in task accuracy, and task confidence. They also show the larger differences in reaction times for both tasks (Figure 5).

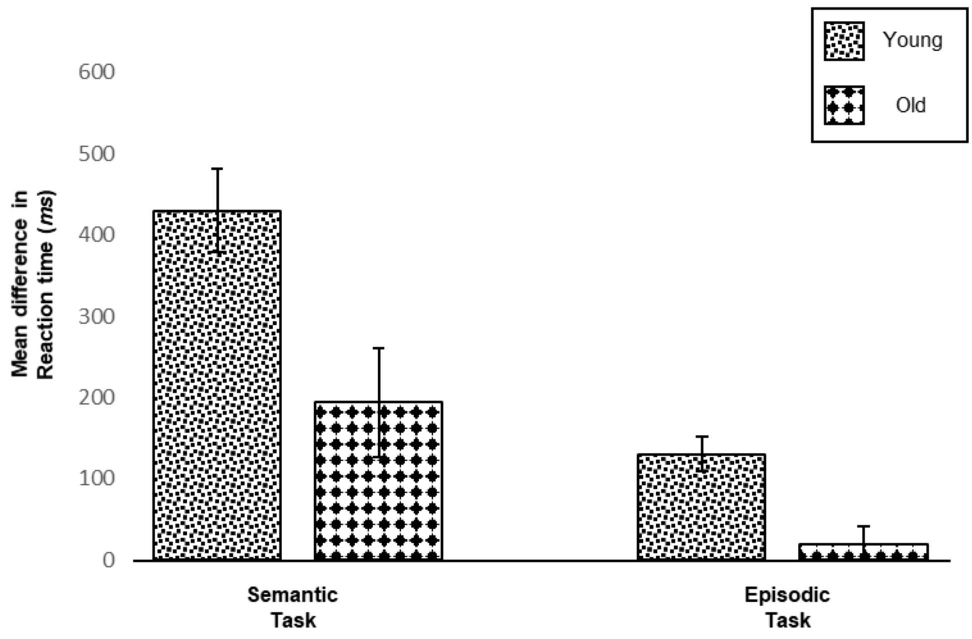

Figure 5 Mean Difference in Task Reaction Time Between Stimuli Participants had Prior Knowledge of and those Unknown to them, for Young and Older Adults.

Paired samples t-tests found these age-related variances in mean difference significant for; semantic accuracy (t (88) = 2.92, p =.004), episodic accuracy (t (88) =6.24, p <.001), episodic confidence (t (88) =6.49, p <.001) and episodic reaction time (t (88) =2.83, p = .006). Indicating that the task enhancement effect observed when the stimuli are associated with prior knowledge is significantly greater within the young adults than the older adults.

2.3.2.2. Interaction Between Prior Knowledge, Age and Modality

A significant three-way interaction was present between prior knowledge for the stimuli, age group of the participant and the modality of the stimuli viewed, within participants episodic accuracy F (1, 86) = 25.47, p <.001; episodic reaction time F (1, 86) = 11.27, p = .001 and episodic confidence F(1, 86) = 31.05, p <.001. This interaction did not reach significance for participants semantic accuracy *F* (1, 86) = 3.402, *p* = .07 or semantic reaction time *F*(1, 86) = 7.75, *p* = .07.

~~Wilks' Lambda = .65, *F* (5,81) =8.61, *p* <.001. Univariate analysis revealed this three-way interaction significantly affected performance within participants' semantic accuracy (*F* (1,85) =5.36, *p* = .023), semantic reaction time (*F* (1,85) =7.75, *p* = .007), episodic accuracy (*F* (1,85) =23.68, *p* <.001), episodic confidence (*F* (1,85) =29.40, *p* <.001) and episodic reaction time (*F* (1,85) =11.93, *p* = 001). Again, mean difference in task variables were calculated between stimuli participants had prior knowledge of and those unknown to them,~~

these are shown in Figure 6 and Figure 7 here.

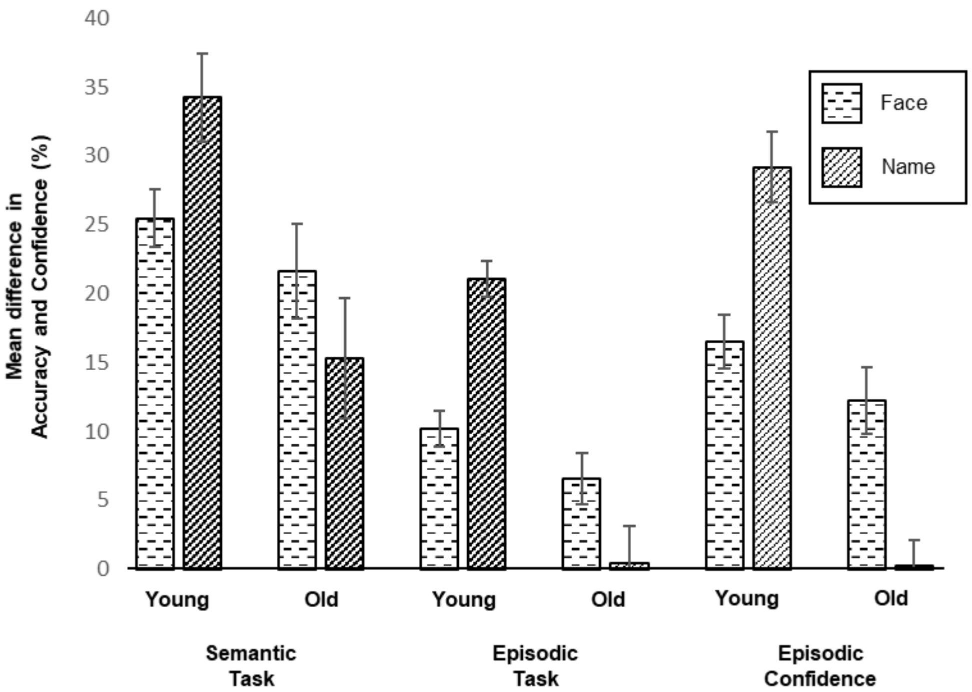

Figure 6 Mean Difference in Task Accuracy and Confidence between Stimuli Participants had Prior Knowledge of and those Unknown to the Participant, for Young and Older Adults across Modality

It appears within the young adults that participants that viewed the name stimuli had the greatest effect of prior knowledge on task performance (Figure 6), observable by the largest mean difference for semantic and episodic accuracy and episodic confidence. Within the older adults the largest mean difference falls within the participants that viewed famous faces within both task accuracy and confidence.

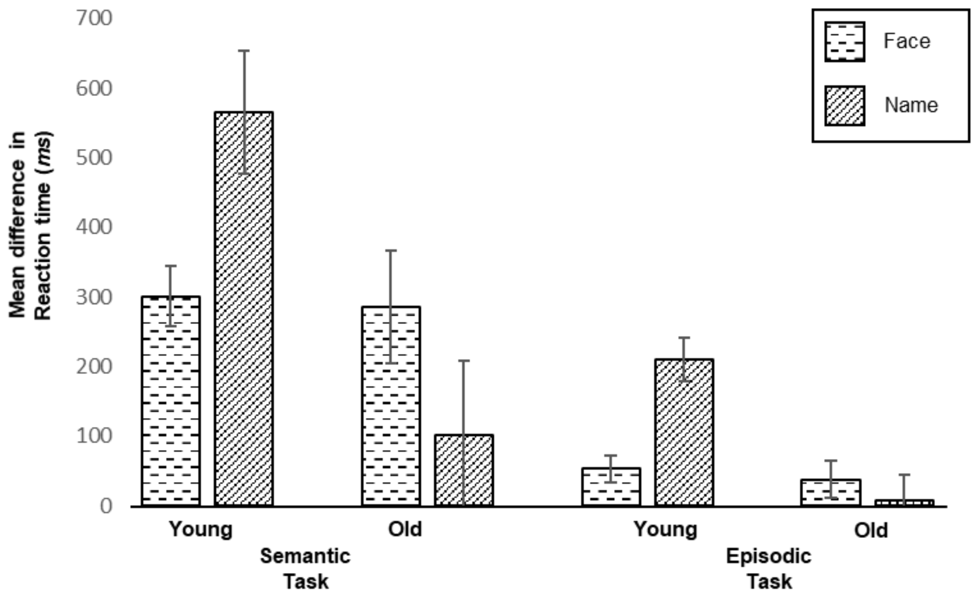

Figure 7 Mean Difference in Reaction Time between Stimuli they had Prior Knowledge of and those Unknown to the Participant, for Young and Older Adults across Modality

The same pattern is observed within the young adults for the reaction time variables (Figure 7), where in each case the largest mean difference in task performance due to the presence of prior knowledge is within the participants that viewed famous names, whereas within the older adults' modality effects are more mixed.

Within the young adults, independent measures t-tests revealed significant modality variance between the prior knowledge mean difference, for the participants that viewed the face stimuli and for the participants that viewed the name stimuli for; semantic accuracy (t (49) = -2.28, *p* =.028), semantic reaction time (*t (*49) =-2.68, *p* = .011), episodic accuracy (*t (*49) = -5.99, *p* <.001), episodic confidence (*t (*49) = -3.96, *p* <.001) and episodic reaction time (*t (*49) = -4.26, *p* <.001). In each case, observable from Figure 6 and Figure 7, participants that viewed the name stimuli showed the greatest improvement in performance for having prior knowledge (increase in accuracy and confidence, decrease in reaction time) than the participants that viewed the face stimuli.

Within the older adults, independent measures t-tests revealed significant modality differences within episodic accuracy (t (37) = 2.09, *p* = .043) and episodic confidence (*t* (37) = 4.13, *p* <.001). Contradictory to the young sample, the participants that viewed faces showed the greatest improvement relating to the association of prior knowledge with a stimulus, compared to the participants that viewed names.

Within the face stimuli, paired samples revealed no significant difference between the young and older adults for the mean improvement difference of prior knowledge for any of the task variables. Whereas, within the name stimuli, young adults consistently showed a larger improvement relating to prior knowledge across semantic accuracy (*t (*43) = 2.92, *p* =.006), semantic reaction time (*t (*42) = 3.37, *p* = .002), episodic accuracy (*t (*43) = 7.75, *p* <.001), episodic confidence (*t (*43) = 9.40, *p* <.001) and episodic reaction time (*t (*43) = 4.36, *p* <.001). This means that the effect of prior knowledge is greatest for face stimuli for the older adults, and they do not differ from young adults within this modality. Whereas the young adults show the greatest benefit of prior knowledge for the name stimuli and have a significant age-related performance advantage within these stimuli.

2.3.3. Level of Associated Knowledge on Task Performance

In addition to whether the participant knew the stimuli, it was also of interest to examine whether the level of associated knowledge would vary their task performance. Participants were asked factual knowledge questions for each stimulus, and their percentage accuracy for these questions was recorded.

Data from the Final Celebrity Questionnaire revealed a significant difference between young adults (M = 77.23, SD = 9.22) and older adults (M = 82.51, SD = 8.07) in the percentage accuracy for their associated factual knowledge, t (89) = -2.86, p = .005. Where older adults had a greater level of knowledge for the stimuli.

A univariate ANOVA on factual knowledge revealed a significant effect of modality (F (1, 87) = 5.77, p =.018). Whereby faces were associated with a significantly greater level of factual knowledge (M = 81.87, SD = 77.17) than names (M = 77.17, SD = 7.79).

There was also a significant interaction present between modality of the stimuli and age group of the participant on the level of associated factual knowledge, F (1, 87) = 13.38, p <.001. Within the young participants, those that viewed famous faces reported a higher level of factual knowledge of the stimuli (M = 82.19, SD = 9.95) compared to those that viewed famous names (M = 72.07, SD = 4.41), t (49) = 4.73, p <.001. Whereas within the older adults no significant difference in factual knowledge between faces (M = 81.46, SD = 9.63) and names (M = 83.56, SD = 6.21) was present, t (38) = -.82, p = .42.

A median split was used to create stimuli participants had high associated factual knowledge for (high-fact; score greater than 80%), and those they had low associated factual knowledge for (low-fact; score less than 79%). Average scores for accuracy, reaction times and confidence ratings were calculated for stimuli that participants had low-fact, and high-fact. A repeated measures ANOVA was conducted, examining the impact of knowledge on task performance. Means for these variables are displayed in Figure 8 and Figure 9.

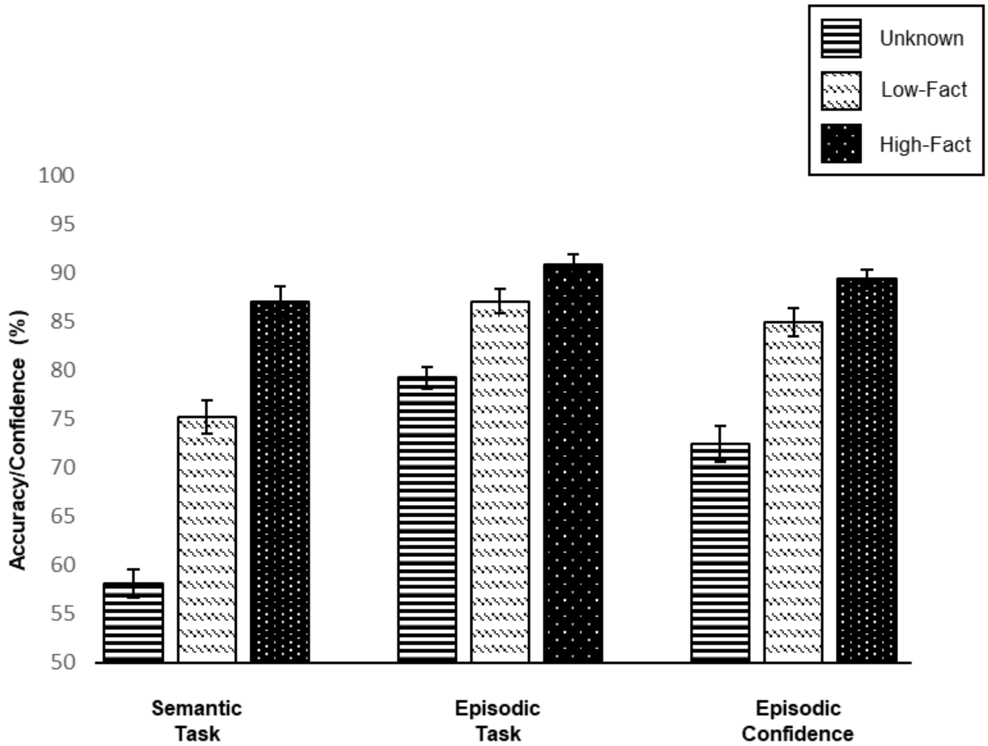

Figure 8 Mean Accuracy and Confidence Ratings for Stimuli Unknown to the Participant, Stimuli with Low Associated Fact and Stimuli with High Associated Fact within the Semantic and Episodic Tasks

A clear relationship between level of knowledge for the stimuli and associated task performance is observed within Figure 8. Both associated low-fact and high-fact for stimuli resulted in superior accuracy and confidence compared to stimuli unknown to the participant, and stimuli associated with high-fact were associated with the greatest level of accuracy in both semantic and episodic tasks and the highest level of task confidence within the episodic task.

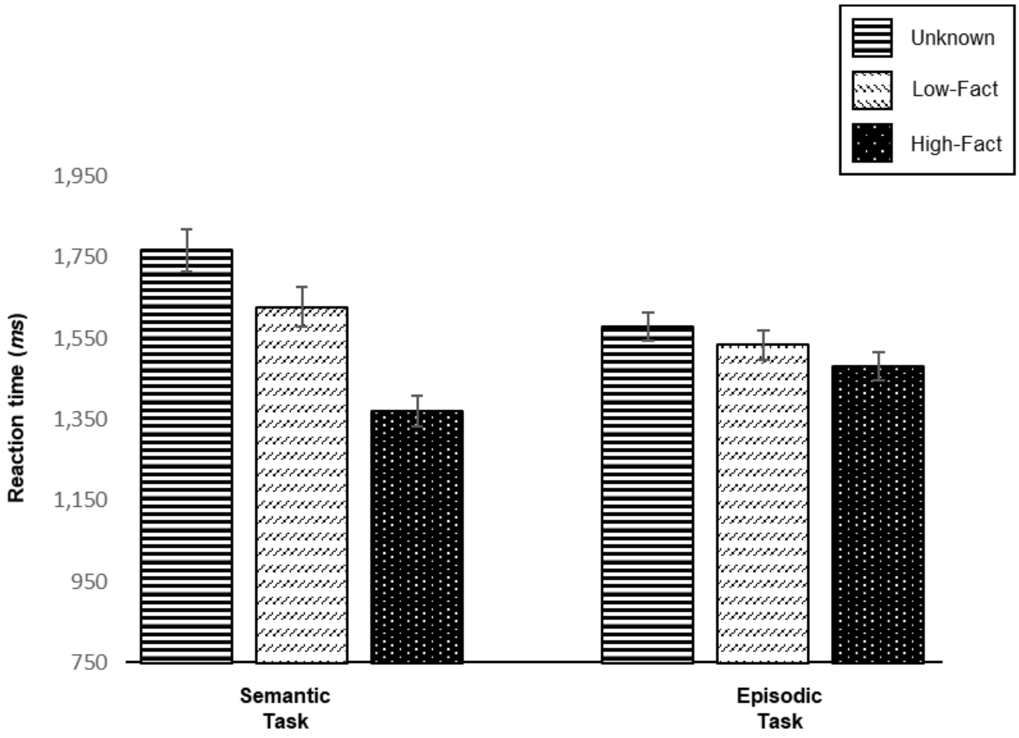

Figure 9 Mean Task Reaction Time for Stimuli Unknown to the Participant Alongside those Stimuli Associated with Low Fact and High Fact for the Semantic and Episodic Tasks.

A similar pattern is observed within the reaction time variables in Figure 9, wherein the stimuli associated with the greatest level of knowledge has the fastest reaction time, whereas participants were slowest to respond to stimuli with no prior knowledge.

A repeated measures ANOVA was conducted, examining level of knowledge for the stimuli on semantic and episodic task performance. A significant main effect of level of knowledge was for semantic accuracy F (1, 85) = 38.04, p <.001; semantic reaction time F (1, 85) = 60.14, p <.001; episodic accuracy F (1, 87) = 11.58, p <.001, episodic reaction time F (1, 87) = 6.93, p =.01 and episodic confidence F (1, 87) = 13.08, p = .001.

~~Wilks' Lambda = .41, *F* (5,81) = 23.23, *p* <.001. Univariate analysis indicated this reached significance for all variables; semantic accuracy (*F* (1,85) =36.00, *p* <.001), semantic reaction time (*F* (1,85) =60.14, *p* <.001), episodic accuracy (*F* (1,85) =12.04, *p* <.001), episodic confidence (*F* (1,85) = 13.17, *p* <.001) and episodic reaction time (*F* (1,85) =6.42, *p* = .01).~~

Indicating that having a greater level of associated knowledge for the stimuli resulted in superior accuracy, greater confidence, and faster reaction time for these stimuli across both tasks compared to those they had less knowledge of.

There was no interaction between age group of the participant and level of knowledge on any of the task performance variables; semantic accuracy *F* (1, 86) = .12, *p* = .73; Semantic reaction time *F* (1, 86) = .43, *p* = .52; Episodic Accuracy *F* (1, 87) = 1.45, *p* = .23; Episodic reaction time *F* (1, 87) = .22, *p* = .64 or Episodic Confidence *F* (1, 87) = 3.70, *p* = .36. ~~Wilks Lambda = .962, *F* (5, 81) = .64, *p* = .67. Nor between the modality of the stimuli and the level of associated knowledge, Wilks Lambda = .88, *F* (5, 81) = 2.25, *p* = .06.~~

There was also no three-way interaction present between age group of the participant, modality of the stimuli and level of knowledge for the stimuli on participants' task performance; ~~Wilks' Lambda = .99, *F* (5, 81) = .25, *p* = .94~~. Semantic accuracy *F* (1, 85) = .001, *p* = .98; semantic reaction time *F* (1, 85) = 1.12, *p* = .29, episodic accuracy *F* (1, 87) = .223, *p* = .638; episodic reaction time *F* (1, 87) = .02, *p* = .90 and episodic confidence *F* (1, 87) = .150, *p* = .70.

Indicating that the impact of level of knowledge for the stimuli was not influenced by subject age or stimuli modality.

2.3.4. The Effect of Autobiographical Significance on Associated Task Performance

Participants were asked to disclose if they had an associated memory or not for each stimulus (see section 2.4). Interestingly there was no significant difference between the young adults (*M* = 27.03, *SD* = 16.99) and older adults (*M* = 31.35, *SD* = 17.30) in the percentage of associated memories for stimuli (t (89) = -1.20, p = .24).

A univariate ANOVA on the presence of AS for the stimuli found no significant effect of modality on the prevalence of associated memories for the stimuli (F (1, 87) = .85, p = .36), but there was a significant interaction between modality of the stimuli viewed and age group of the participant on the level of associated memories for stimuli (F (1, 87) = 18.10, p <.001).

Within the young adults, a significant difference in the proportion of associated memories was found between those who viewed the face stimuli (*M* = 35.39, *SD* = 15.26) and those that viewed the name stimuli (*M* = 18.33, *SD* = 14.29; (t (49) = 4.12, p <.001), with the participants who viewed the face stimuli reporting more memories than those who viewed names. Whereas the opposite effect is observed within the older adults with the participants who viewed names (*M* = 36.85, *SD* = 18.63) reporting a greater number of associated memories than those that viewed faces (*M* = 25.86, *SD* = 14.26), t (3561) = 3.27, p = .001.

Behavioural averages were calculated for accuracy, reaction time and confidence ratings for the semantic and the episodic tasks, for stimuli that participants had produced an associated memory for (AS), and those that they had prior knowledge of but had no associated memory (no-AS).

Means for task accuracy and confidence for AS and no-AS stimuli are presented in Figure 10. Participants were most accurate for the stimuli that were AS, compared to the stimuli that they had prior knowledge for but no associated memory.

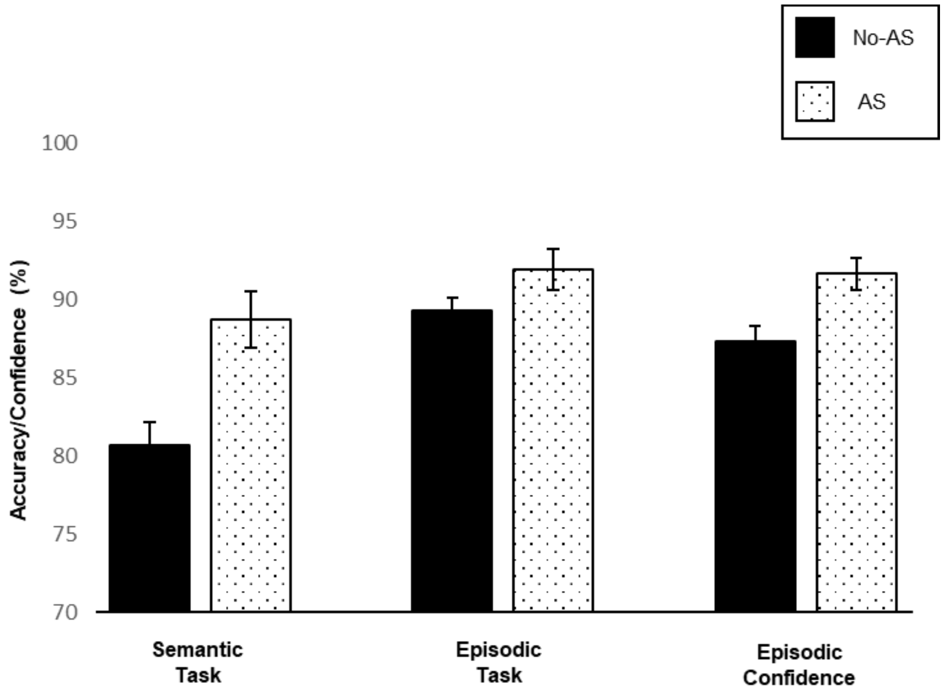

Figure 10 Mean Accuracy and Confidence Levels for the Stimuli Associated with AS and those Associated with Prior Knowledge but No-AS.

The same pattern of task improvement for stimuli associated with AS was present in the mean reaction time variables within Figure 11. Participants were faster at responding to AS stimuli compared to the stimuli with no-AS.

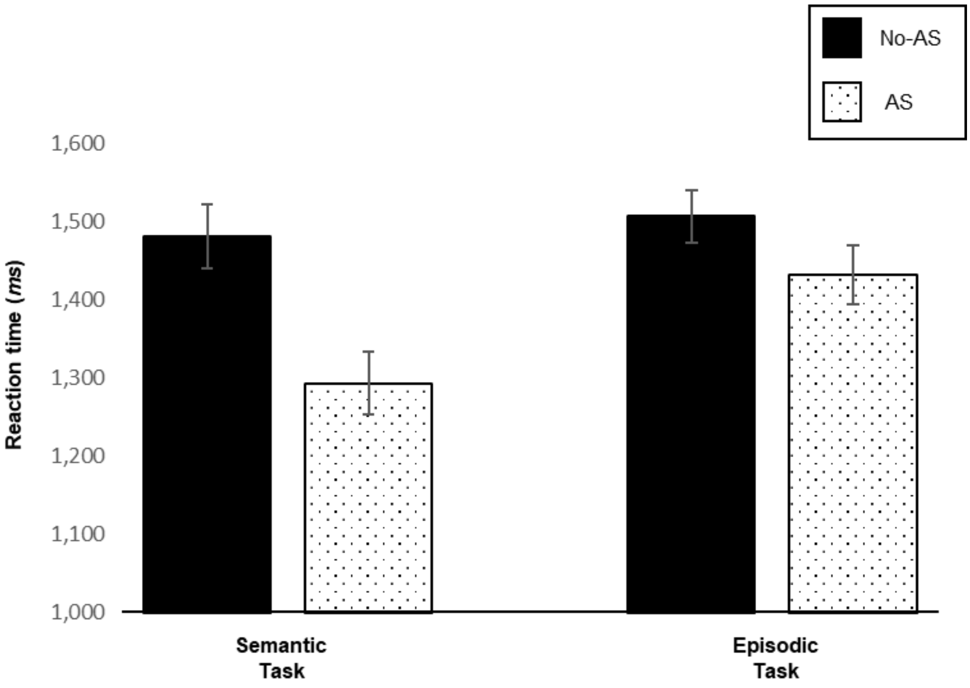

Figure 11 Mean Reaction Time for the Semantic and Episodic Tasks for Stimuli Associated with AS and for Stimuli Associated with Prior Knowledge but No-AS.

A repeated measures ANOVA examining the effect of AS, modality and age group on task performance revealed; ~~a significant main effect of AS, Wilks' Lambda = .51, *F* (5,79) = 15.02, *p* <.001. Univariate analysis found AS had a significant effect on participants'; semantic accuracy (*F (*1,83) = 27.38, *p* <.001), semantic reaction time (*F (*1, 83) = 45.22, *p* <.001), episodic accuracy (*F (*1, 83) = 5.03, *p* = .028), episodic confidence (*F (*1,83) = 24.42, *p* <.001) and episodic reaction time (*F (*1, 83) = 11.51, *p* = .001).~~ a significant effect of AS on participants' semantic accuracy – *F* (1, 85) = 19.40, *p* <.001; semantic reaction time *F* (1, 84) = 45.63, *p* <.001; episodic accuracy *F*(1, 87) = 1.31, *p* = .03, episodic reaction time *F* (1, 86) = 12.80, *p* = .001 and episodic confidence *F* (1, 86) = 6.54, *p* = .012.

From Figure 10 and 11, it is apparent that the association of AS results in superior performance for those stimuli. Specifically, participants perform with greater level of accuracy in both the semantic and episodic task, and have a higher level of confidence within the episodic task for the stimuli they have associated AS for, compared to the stimuli they have prior knowledge of, but no associated AS. They also demonstrated a faster reaction time to these AS stimuli compared to the stimuli they had no-AS for.

2.3.4.1. Effect of Age on Autobiographical Significance

A significant interaction was found between age of participant and AS on semantic accuracy F (1, 85) = 6.46, p = .013, episodic accuracy F(1, 87) = 4.99, p = .03 and episodic confidence F (1, 86) = 6.88, p = .01. No significant effect of age and AS was found for participants semantic reaction time F (1, 84) = .006, p = .94 nor their episodic reaction time F (1, 86) = .041, p = .84.

Wilks' Lambda = .87, F (5,79) = 2.46, p =.040. Univariate analysis revealed age and AS had a significant effect on semantic accuracy (F (1,83) = 8.03, p = .006), and both episodic accuracy (F (1,83) = 3.88, p = .052) and episodic confidence (F (1, 83) = 3.40, p = .069) approached the significance threshold. To examine the effect of AS, mean differences were calculated for accuracy and confidence for stimuli associated with AS and those with prior knowledge but no-AS. Mean differences for accuracy and confidence are displayed in Figure 12, these reveal a great effect of AS within the young compared to the older adults.

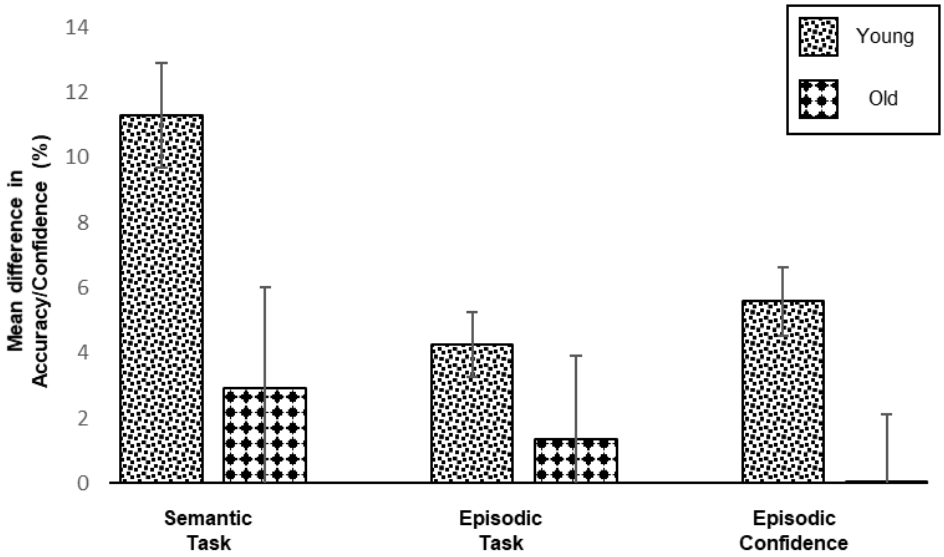

Figure 12 Mean Difference in Accuracy and Confidence Between Stimuli Associated with AS and Those Associated with Prior Knowledge but No-AS, Across Young and Older Adults

Independent measures t-tests found these differences to be significant for semantic accuracy (*t (*87) = 2.39, *p* = .020), episodic accuracy (*t (*89) = 2.06, *p* = .045) and episodic confidence (t *(*89) = 2.44, *p* = .018). In each case young adults showed the greatest task performance benefit of associated AS.

2.3.4.2. Interaction of Modality, Age and Autobiographical Significance

A significant three-way interaction was present between AS, the modality of the stimuli presented and the age group of the participant on task performance, for participants' semantic reaction time *F* (1, 84) = 11.56, *p* = 001 and episodic reaction time *F* (1, 86) = 4.54, *p* = .04. This interaction did not reach significance for participants' episodic accuracy *F* (1, 87) = .97, *p* = .33; semantic accuracy *F* (1, 85) = 1.83, *p* = .18, and episodic confidence *F* (1, 87) = 1.95, *p* = .17. ~~Wilks' Lambda = .86,~~

F (5, 79) = 2.68, p = .03. Univariate analysis showed this interaction was significant for semantic reaction time (F (1,83) = 10.91, p = .001) and that this approached significance within participants' episodic reaction time (F (1,83) = 3.62, p = .06.

Mean differences for these variables are displayed in Figure 13.

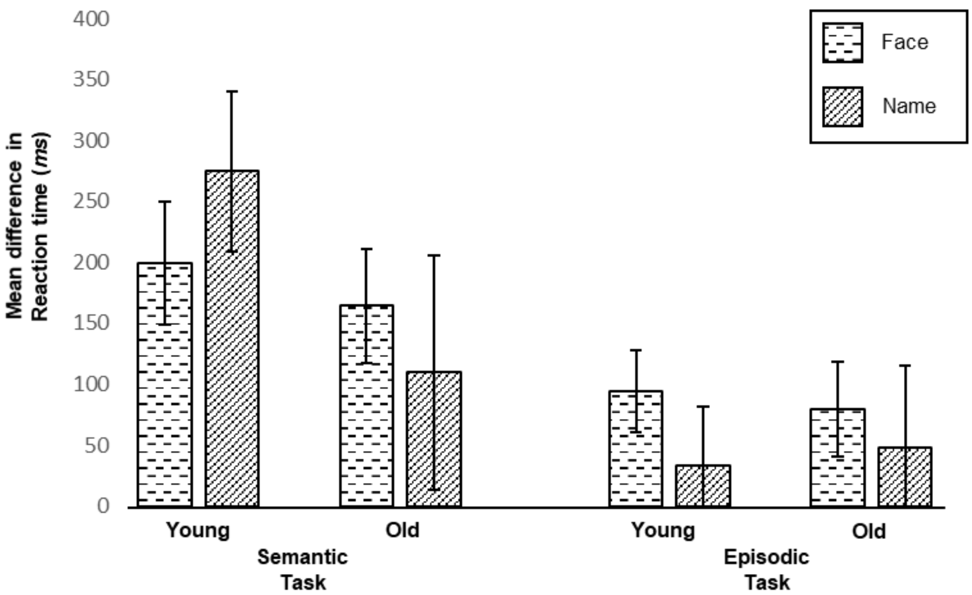

Figure 13 AS Effect on Task Reaction Time as Measured by the Mean Difference in Performance Between the Stimuli Associated with AS and Those Associated with Only Prior Knowledge Across Age and Stimuli Modality.

Clear modality and age-related variance are present within the two reaction time variables. Within the young adults it appears participants who viewed the name stimuli had the greatest benefit of AS within the semantic reaction time, compared to those that viewed faces. Whereas those that viewed the face stimuli had the greater advantage of AS within the episodic reaction time than those that viewed names, although independent t-tests showed these to not reach the significance threshold (t (49) = -1.42, p = .16 and t (49) = -1.96, p - .06, respectively).

Within the older adults, those that viewed faces seemed to show the greater effect of AS within semantic and episodic reaction time, compared to those that viewed names, this reached significance within semantic reaction time (t (35) = 2.89, p = .007), but did not reach significance within the episodic reaction time (t (37) = 1.33, p = .19).

Within the participants that viewed faces, we observe significant effects of age within semantic reaction time, whereby the young adults show the greatest effect of AS (t (42) = -2.24, p =.035). However, no significant effect of age group was found within the episodic reaction time task (t (44) = -1.37, p = .18).

For those that viewed names, again the young adults had a significantly greater effect of AS than the older adults within the semantic reaction time (t (42) = 2.34, p = .024), and no significant difference was found within episodic reaction time (t (42) = 1.51, p = .14).

In summary, it appears the young adults show a modality difference within AS whereby those that viewed names showed greater AS benefit within semantic reaction time, whereas those that viewed faces showed greater AS benefit within episodic reaction time. Within the older adults across both tasks, participants that viewed famous faces showed the greatest AS enhancement effect. There were age effects across both modalities within semantic reaction time, where the greatest boost in performance from AS was observed in the young adults, but no age-effects were present within episodic reaction time.

2.3.5. Familiarity, Factual Knowledge and Emotional Salience for the Stimuli

It was also of interest to examine the effect of AS on the variables drawn from the celebrity questionnaire; stimuli familiarity, associated factual knowledge and emotional salience of the stimuli. A repeated measures ANOVA examining stimuli associated with AS and those associated with no-AS found a significance effect of AS on participants' familiarity ratings F (1, 87) = 270.51, p <.001, factual knowledge scores F (1, 87) = 154.34, p <.01 and emotional salience ratings F(1, 87) = 314.17, p <.001for the stimuli. on these variables Wilks' Lambda = .20, F (3,85) = 116.03, p <.001. Univariate analysis showed significance for familiarity of the stimuli (F (1, 87) = 270.51, p <.001), associated factual knowledge (F (1,87) = 154.34, p <.001) and level of associated emotional salience (F (1,87) = 314.17, p <.001).

Means for these variables are displayed in Figure 14, stimuli associated with AS were higher in familiarity, emotional salience, and factual knowledge.

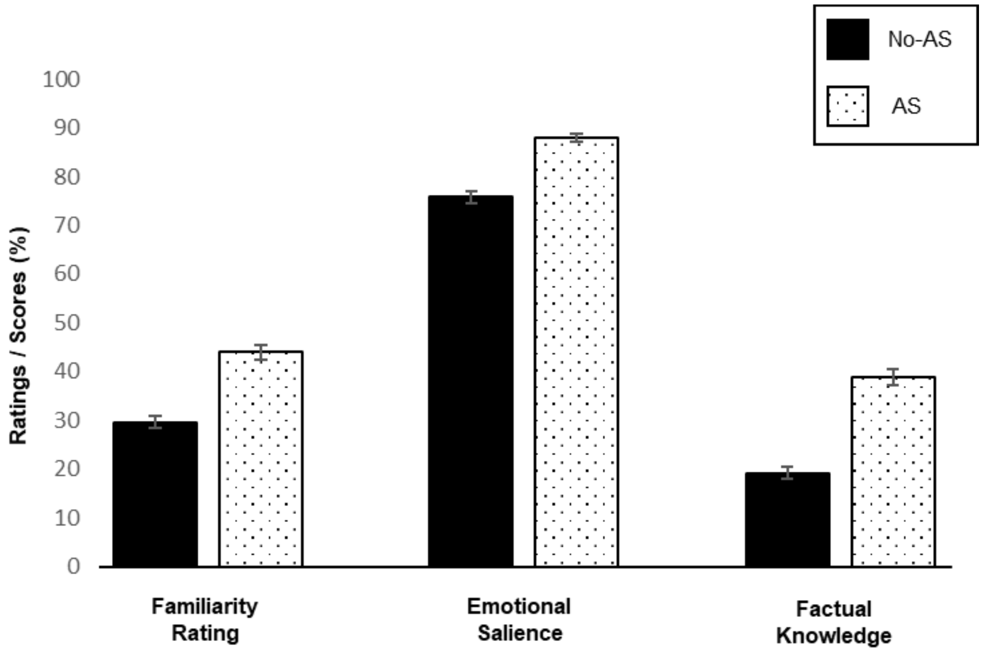

Figure 14 Mean Familiarity and Emotional Salience Ratings, and Percentage Factual Knowledge Accuracy for the Stimuli Participants had Associated AS for, and for those they had Prior Knowledge for but No-AS.

Interestingly, there was no interaction between AS and the age group of the participant, for familiarity *F* (1, 87) = 2.32, *p* = .13, factual knowledge *F* (1, 87) = .81, *p* = .37 and emotional salience *F* (1, 87) = .68, *p* = .41. ~~there was no interaction between AS and age group of the participant (*F* (3,85) = .80, *p* = .50). However, there was a significant interaction between AS and modality on these variables, Wilks' Lambda - .87, *F* (3,85) = 4.11, *p* = .01. Univariate analysis found significance for factual knowledge (*F* (1,87) = 7.49, *p* = .008).~~

However, there was a significant interaction between AS and modality of the stimuli on factual knowledge *F* (1, 87) = 7.49, *p* = .01. The mean difference was calculated for factual knowledge between stimuli associated with AS and stimuli associated with prior knowledge but no-AS. Participants that viewed face stimuli had a significantly greater mean difference in factual knowledge (*M* = 14.92, *SD* = 8.14), compared to the participants that viewed name stimuli (*M* = 9.45, *SD* = 0.13).

No three-way interaction was present between AS, age group and modality of the stimuli ~~(*F* (3,85) = 1.47, *p* = .23).~~on familiarity *F* (1, 87) = .40, *p* = .53, factual knowledge *F* (1, 87) = .08, *p* = .78 and emotional salience *F* (1, 87) = 3.49, *p* = .07.

Due to the relations between AS and stimulus familiarity, factual knowledge and emotional salience described above, we investigated whether the observed AS task enhancement effects would still be observed when controlling for these concurring variables. This was done at the individual participant level. It was not possible to control for the three variables simultaneously, so we controlled for emotional salience separately.

2.3.5.1. Controlling for Factual Knowledge and Familiarity within Autobiographical Significance

Within each participant we removed stimuli outliers high or low in familiarity and factual knowledge until there was no significant difference in familiarity and factual knowledge between stimuli associated with AS and those associated with prior knowledge but no-AS, as measured by an independent t-test within-subjects for each participant. The *p* values for familiarity and factual knowledge ranged from 0.09 to 0.97 (*M* = .40, *SD* =.25) between the stimuli with and without AS. Participant means for factual knowledge and familiarity before and after control can be viewed in Appendix G.

Using this controlled stimuli set we calculated averages for task accuracy, confidence and reaction times for stimuli associated with AS and those associated with prior knowledge but no-AS. Means for these task variables are displayed in Figure 15 and Figure 16, as with the 'uncontrolled' stimuli, we still observe the same benefit of AS in the form of increased task accuracy and increased task confidence for the stimuli associated with AS compared to the stimuli associated with no-AS, although this is a markedly smaller difference to that observed prior to the controlling for familiarity and factual knowledge.

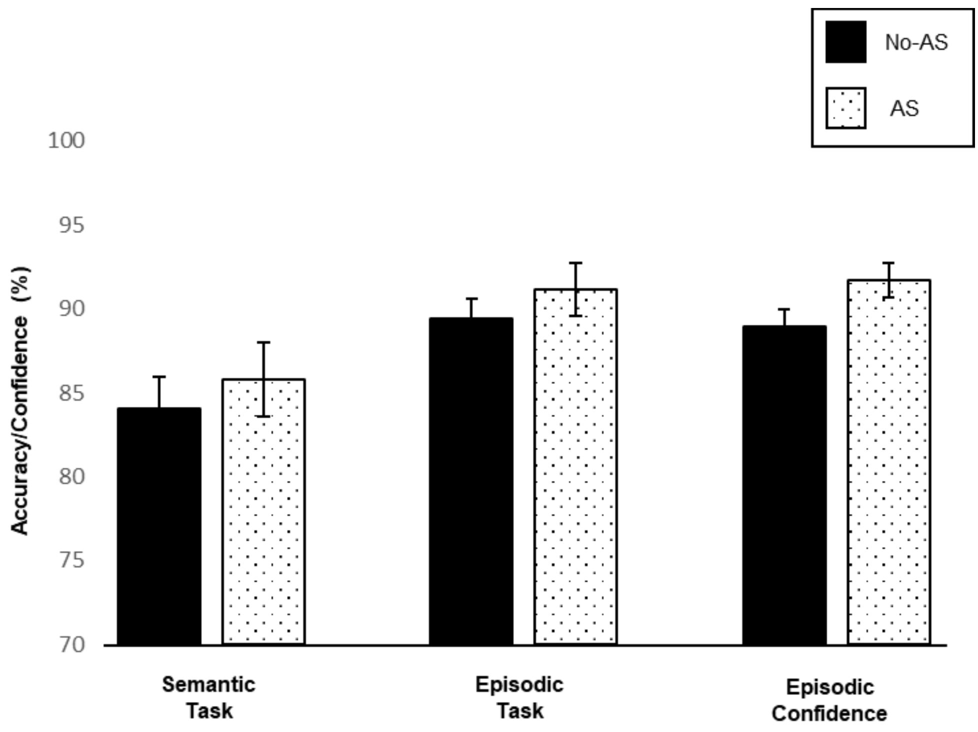

Figure 15 Mean Accuracy and Confidence Scores for the Stimuli with AS and the Stimuli with Prior Knowledge but No-AS After Familiarity and Factual Knowledge had been Controlled at the Participant Level.

Within the reaction time variables within Figure 16, minimal difference is observed between the stimuli associated with AS and stimuli associated with prior knowledge but no-AS. Although there is a slight trend towards faster reaction times for the former.

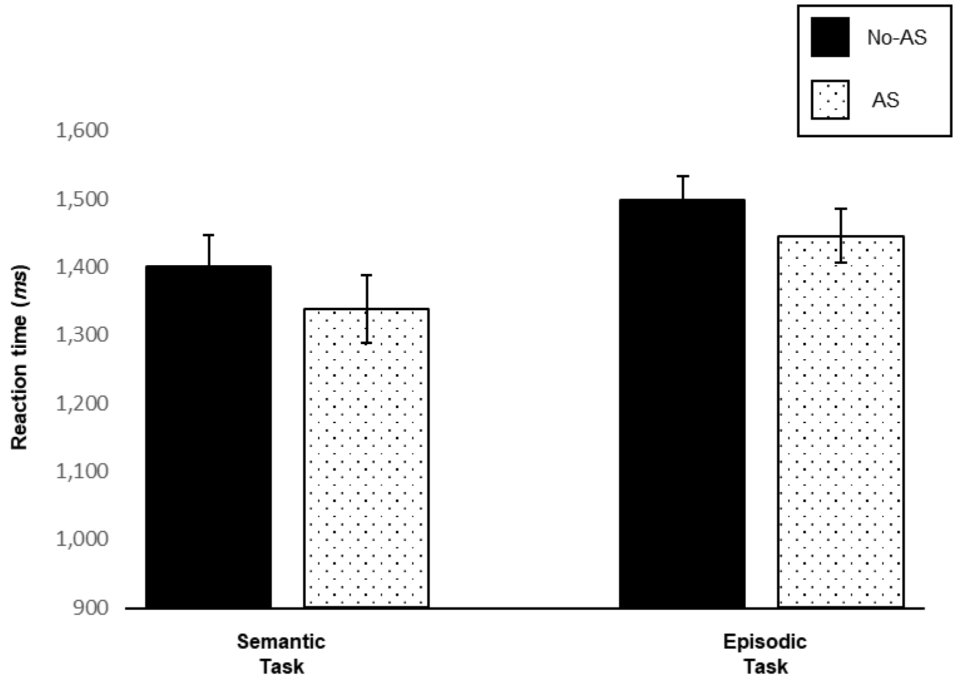

Figure 16 Mean Reaction Times for the Stimuli Associated with AS and those with Prior Knowledge but No-AS after Factual Knowledge and Familiarity had been Controlled at the Participant Level.

A repeated measures ANOVA examining the effect of AS within these factual knowledges and familiarity-controlled stimuli still shows a significant main effect of AS, on semantic reaction time F (1, 74) = 7.24, p = .009 and episodic confidence F(1, 77) = 3.88, p = .05. ~~Wilks' Lambda = .84, F (5, 71) = 2.65, p = .03. Univariate analysis reveals this to be significant for episodic confidence (F (1, 75) = 10.05, p = .002), episodic reaction time (F (1,75) = 4.11, p = .046) and approached significance within the semantic reaction time (F (1, 75) = 3.92, p = .051).~~

Examination of the means in Figure 15 revealed participants were significantly more confident for the stimuli associated with AS than those with prior knowledge but no-

AS. Participants were also significant faster for the AS stimuli, compared to the stimuli associated with no-AS during the semantic task (Figure 16).

The interaction between AS and age group was not significant for any of the task variables; semantic accuracy *F* (1, 75) - .70, *p* = .41; semantic reaction time *F* (1, 74) = 4.00, *p* = .06; episodic accuracy *F* (1, 77) = 3.89, *p* = .06; episodic reaction time *F* (1, 77) = .14, *p* = .71 or episodic confidence *F* (1, 77) – 2.31, *p* = .13.

~~of the participant approached significance (*F* (5,71) = 2.25, *p* = .06), but univariate analysis did not reach significance for any of the task variables.~~ There was also no significant main effect of modality on any of the task variables; semantic *F* (1, 75) = 1.15, *p* = .29; semantic reaction time *F* (1, 74) = .05, *p* = .17; episodic accuracy *F* (1, 77) = .31, *p* = .58; episodic reaction time *F* (1, 77) = .004, *p* = .95 or episodic confidence *F* (1, 77) = .007, *p* = .94., nor a three-way interaction between AS, age group and modality on the task variables; semantic accuracy *F* (1, 75) = 7.83, *p* = .07; semantic reaction time *F* (1, 74) = 17.44, *p* =.12; episodic accuracy *F*(1, 77) = .01, *p* = .92; episodic reaction time *F*(1, 77) = 3.43, *p* = .07. and episodic confidence *F* (1, 77) = .001, *p* = .98.

Indicating the effect of AS did not significantly differ between the age groups, or the modality of the stimuli viewed, after factual knowledge and familiarity had been controlled.

To examine the effect of controlling for familiarity and factual knowledge at the stimuli level on the AS task enhancement effect, mean differences were calculated for performance between the stimuli associated with AS and those associated with no-AS. These mean differences were contrasted between the set controlled for familiarity and factual knowledge, and the uncontrolled set.

Paired samples t-tests revealed only the semantic reaction time variable significantly differed between these two sets (t (77) = 2.86, p = .006). The uncontrolled stimuli set had the larger mean difference (M = 195.67, SD = 257.98) compared to the factual knowledge and familiarity-controlled set (M = 61.98, SD = 301.91), indicating controlling for these variables reduced the effect of AS only within this variable. Overall, this suggests that factual knowledge and familiarity have some impact, but they are not essential to the observed AS effect on task performance.

2.3.5.2. Controlling for Emotional Salience within Autobiographical Significance

As with factual knowledge and familiarity, we also controlled for emotional salience at the individual level. Outliers high and low in emotional salience were removed until an independent measures t-test revealed no significant difference in emotional salience between stimuli associated with AS and those associated only with prior knowledge. The p values ranged from 0.06 to 0.95 (M = .33, SD =.24) between the stimuli with and without AS, Participant means for emotional salience before and after control can be viewed in Appendix H.

A repeated measures ANOVA examining the effect of AS within these stimuli controlled for emotional salience at the participant level revealed a significant effect of AS on the task variables Semantic RT – F(1, 76) = 15.62, p <.001 and Episodic RT – F (1, 78) = 5.55, p = .02 but this did not significantly effect participants' Semantic Accuracy – F (1, 77) = ,17, p = .68; Episodic Accuracy – F(1, 78) = .84, p = .36 or Episodic Confidence – F (1, 78) = .47, p = *.50*

~~Wilks' Lambda = .79, *F* (5, 72) = 3.87, *p* = .004. Univariate analysis found significance for; semantic reaction time (*F* (1, 76) = 15.62, *p* <.001) and episodic reaction time (*F* (1, 76) = 5.32, *p* = .024).~~

Means for these variables are displayed in Figure 17. After controlling for emotional salience at the stimuli level, participants were still faster at responding to the stimuli associated with AS, compared to the stimuli they had prior knowledge of but no-AS.

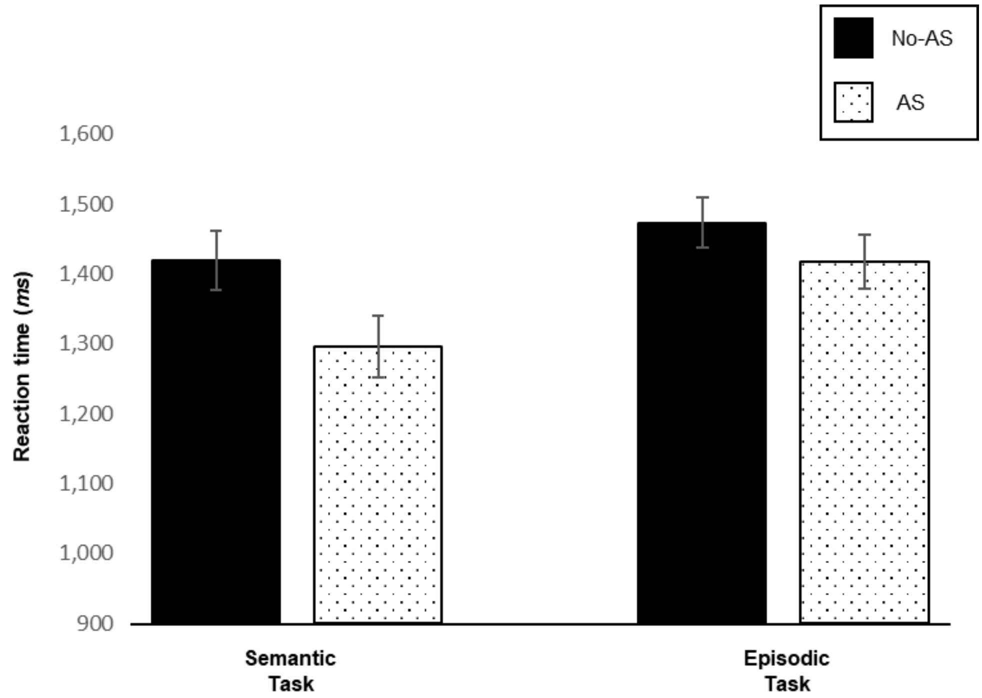

Figure 17 Mean Reaction Time within the Semantic and Episodic Task for Stimuli that is Associated with AS and those that are Associated with Prior Knowledge but No-AS, After Emotional Salience had been Controlled at the Participant Level.

To examine the effect of emotional salience on the AS effect, mean difference in performance was calculated between stimuli associated with AS and stimuli associated with prior knowledge by no-AS. We then contrasted the AS effect within the data set controlled for emotional salience, and the uncontrolled data set. There was a significant difference between the 'uncontrolled' set (*M* = 178.63, *SD* =

277.28) and the emotional salience controlled (*M* = 123.17, *SD* = 300.11), for the size of the AS effect *t (*79) = 3.62, *p* = .001, only within the semantic reaction time variable. Indicating that controlling for emotional salience reduced the effect of AS only within this variable.

No significant interaction between age of the participant and AS on task performance was observed when emotional salience is controlled; Semantic Accuracy *F* (1, 77) = = .09, *p* = .77; Semantic reaction time *F* (1, 76) = .08, *p* = .78; Episodic Accuracy *F*(1, 78) = 6.89, *p* =.01; Episodic reaction time *F* (1, 78) = .06, *p* = *.81* and Episodic Confidence *F* (1, 78) = .63, *p* = .43.

Nor was there a modality interaction for semantic accuracy *F* (1, 77) = 1.37, *p* = .25; semantic reaction time F(1, 76) = 6.08, *p* = .02; episodic accuracy *F*(1, 78) = .00, *p* = 98; episodic reaction time *F* (1, 78) = .29, *p* = .59; Episodic RT x Age x Modality – *F* (1, 78) = 1.56, *p* = .22 and episodic confidence *F* (1, 78) = 1.02, *p* = .32.

~~, nor was there a modality interaction.~~ Overall, this indicates that emotional salience had some impact on AS, but it is not essential.

2.3.6. Exploring the Associated Memories within Autobiographical Significance

Participants were asked to disclose any memories associated with the stimuli within the final celebrity questionnaire. This provided the opportunity to look at elements of the memories that may affect the observed AS enhancement effect in young and older adults.

2.3.6.1. Impact of Memory type on AS

Disclosed memories were coded for type of memory according to the personal semantic memory classification system developed by Renoult et al., (2012). Unique events were classed as memories that referred to a specific time or place (e.g., 'His song was playing the first time I drove my car alone after passing my driving test'). Repeated events were considered memories that had common elements taken from multiple episodes (e.g., 'I watch The Voice every week and he's one of the judges'). Memories were classified as autobiographical facts if they did not relate to a single episode but were instead personalised factual knowledge about their life (e.g., 'He looks like someone I used to work with').

In both young and older adults, the largest proportion of memories were coded as unique events with around two-thirds of disclosed memories falling into this category. Repeated events were reported in approximately one-third of cases and the fewest reported memories were considered autobiographical fact (*table 1*).

We observed no significant interaction between the frequency of reported memory types and the age group of the participant $X^3(4) = 4.95, p = .29$, however there was an interaction between the modality of the stimuli presented and the frequency of reported memory types X^3 (4) = 12.18, p = .026. Examining the frequencies in Table x, it appears that a greater portion of repeated events were reported by participants that viewed the name stimuli, whereas those that viewed faces reported a greater proportion of unique events.

Table 1 Proportion of Memories Reported by Type of Stimuli Viewed Across Modality of Stimuli Presented

	Face		Name		Total	
Memory Type	*M*	*SD*	*M*	*SD*	*M*	*SD*
Unique Events	66.69	19.22	62.04	19.11	64.39	19.2
Repeated Events	30.18	16.95	34.39	14.71	32.21	15.96
Autobiographical Fact	11.14	8.19	9.97	5.45	10.46	6.65

To examine the impact of memory type on task performance averages for accuracy, reaction times and confidence ratings were calculated for stimuli that participants had produced unique events for, and those they had disclosed repeated events for. Autobiographical facts were not included within this analysis as only 36 subjects out of 91 reported these, and this equated to 4.8% of all reported memories. Mean differences were calculated between the stimuli associated with either a unique or a repeated event, and the stimuli that was associated with prior knowledge but no-AS to determine if the type of associated memory would impact the benefits of AS on task performances.

A repeated measures ANOVA examining the effect of memory type of AS on task performance revealed no significant effect on semantic accuracy F (1, 68) = .67, p = .42; semantic reaction time F (1, 64) = .04, p = .84; episodic accuracy F (1, 81) = .22, p = .64; episodic reaction time F (1, 80) = .81, p = .37 and episodic confidence F (1, 81) = 1.32, p = .25;

Wilks' Lambda = .99, *F* (5,60) = .13, *p* = .99. There was also no significant interaction between memory type and age group of the participant on their semantic accuracy *F* (1, 68) = .002, *p* = .97; semantic reaction time *F* (1, 64) = 1.30, *p* = .26; episodic accuracy *F* (1, 81) = .82, *p* = .37; episodic reaction time *F* (1, 80) = .57, *p* = .45; and episodic confidence *F*(1, 81) – 2.08, *p* = .15. Nor a significant three-way interaction between memory type, age group of the participant and modality of the stimuli on participants' semantic accuracy *F* (1, 68) = 1.11, *p* = .30; semantic reaction time *F*(1, 64) = .30, *p* = .58; episodic accuracy *F* (1, 81) = .86, *p* = .36; episodic reaction time *F* (1, 80) = .87, *p* = .35 and episodic confidence – *F*(1, 81) = .001; *p* = .98.

There was a significant interaction between type of memory and the modality of the stimuli presented to participants on their semantic reaction time *F* (1, 64) = 4.96, *p* = .03, but there was no significant effect of this interaction on semantic accuracy *F* (1, 68) = .47, *p* = .50; episodic accuracy *F* (1, 81) = .26, *p* = .61; episodic reaction time *F* (1, 80) = .82, *p* = .37 and episodic confidence *F* (1, 81) = 2.77, *p* = .1. (*F* (5,60) = 3.77, *p* = .005), univariate analysis revealed this interaction significantly affected participants semantic reaction time (*F* (1, 64) = 4.96, *p* = .029) and their confidence within the episodic task (*F* (1,64) = 10.72, *p* = .002).

Independent measures t-tests revealed a significant effect of modality within the semantic reaction time for unique events (*t*, 84) = 2.07, *p* = .041), participants that viewed the face stimuli show the greater AS difference in performance (*M* = 250.93, *SD* = 264.21) than those that viewed the name stimuli (*M* = 121.17, *SD* = 314.98). The same pattern was observed within episodic confidence for unique events (*t (*87) = 2.128, *p* = .036), again participants that viewed the face stimuli (*M* = 6.19, *SD* = 7.31) had a significantly greater effect of AS than those that viewed the name stimuli (*M* = 2.24, *SD* = 10.01).

Within participants that viewed the face stimuli, paired samples t-test reveal a significant difference between the mean difference for unique events (*M* = 248.36, *SD* = 255.07) and repeated events (*M* = 140.60, *SD* = 335.45) within the semantic reaction time (t (33) = 2.23, p =.032). Indicating that for faces, performance was most enhanced by the association of unique events.

Within the participants that viewed the name stimuli, we find a significant difference within episodic confidence, the effect of AS was significantly greater for repeated events (*M* = 5.37, *SD* = 10.53) compared to unique events (*M* = 1.78, *SD* = 10.21; t (40) = -2.20, p = .034). Indicating that for names performance was most enhanced by the associated of repeated events.

Overall, within the semantic task, face stimuli had the greater benefit when unique events were associated, whereas for the name stimuli, the great benefit within episodic confidence came from the association of repeated events.

2.3.6.2. Effect of Date of Memory on AS

Participants were also asked to disclose the year of their associated memories if they could recall, this was to examine if the age at the time of the memory, or how many years ago the memory was from would affect the AS enhancement effect.

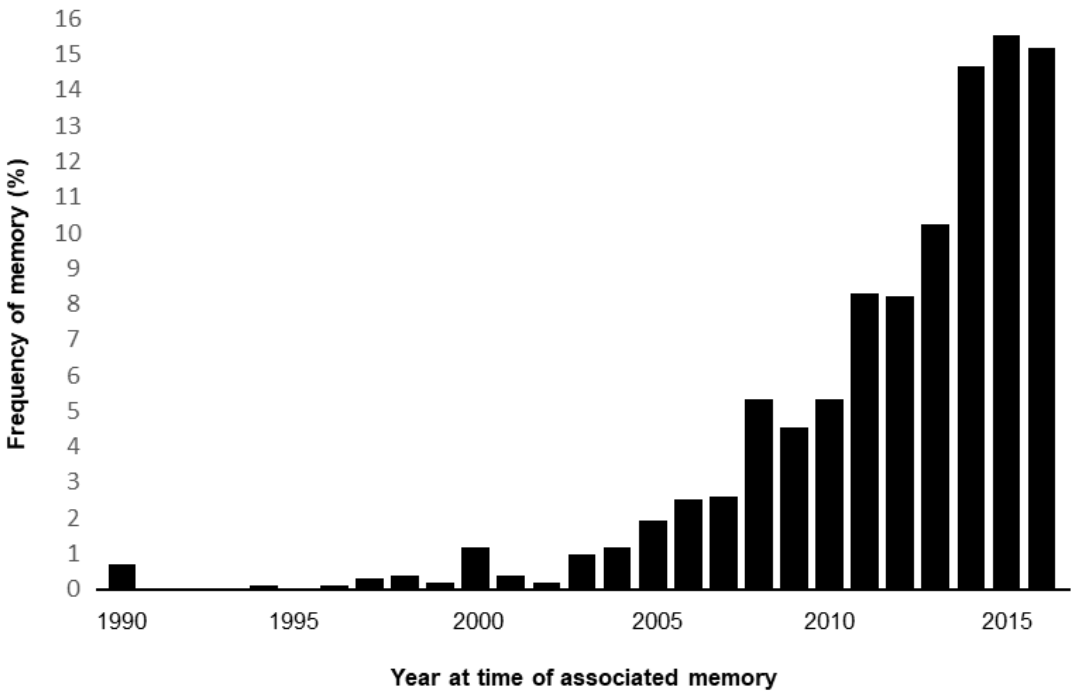

Figure 18 Frequency of Associated Memories by Year for the Young Adult Participants

In both the young (Figure 18) and older (Figure 19) adults, it appears that there is a clear peak in associated memories produced in the most recent five years. This recency period accounted for 53% of memories produced for the young adults, and 19.3% of memories produced for the older adults.

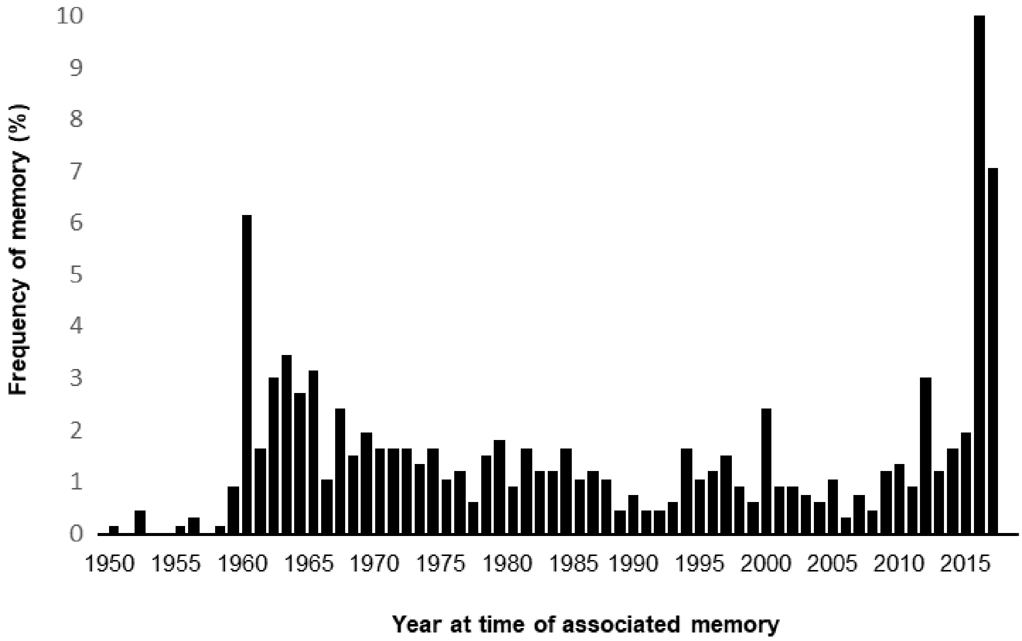

Figure 19 Frequency of Associated Memories by Year for the Older Adult Participants.

To examine if date of associated memory would impact performance we calculated scores for accuracy, reaction times and confidence ratings in semantic and episodic tasks for stimuli that participants had associated memories within the recency period (last five years), and for those they had produced memories for outside of this period. Mean differences were calculated between stimuli associated with either a recent or non-recent memory and the stimuli that was associated with prior knowledge but no-AS, to determine if the time of the associated memory would impact task performance.

A repeated measures ANOVA examining the effect of memory year on task performance, showed no main effect of the recency time period on semantic accuracy F (1, 63) = 6.55, p = .11; Semantic reaction time F (1, 59) = 1.34, p = .25; Episodic accuracy *F* (1, 73) = 1.44, *p* = .23; Episodic reaction *F*(1, 72) = 2.89, *p* = .09 and Episodic confidence – *F* (1, 73) = .80, *p* = .38. ~~Wilks' Lambda = .90, *F* (5, 53) = 1.15, *p* = .35.~~

There was also no interaction between this time period of memories and the age group of the participants on their semantic accuracy *F* (1, 63) = 7.05, *p* = .11; semantic reaction time *F* (1, 59) = 1.33, *p* = .25; episodic accuracy *F* (1, 73) = .024, *p* = .88; episodic reaction time *F* (1, 72) = 1.33, *p* = .25 and episodic confidence *F* (1, 73) = .15, *p* = .70. -Nor any interaction between the time period and the modality of the stimuli viewed on semantic accuracy *F* (1, 63) = 1.44, *p* = .24; semantic reaction time semantic *F* (1, 59) = 4.88, *p* = .03; episodic accuracy F (1, 73) = 5.59, *p* = .02; episodic reaction time *F* (1, 72) = 1.4, *p* = .24; or episodic confidence *F* (1, 73) = .18, *p* = *.68;* nor was any three-way interaction present between these factors and semantic accuracy *F* (1, 63) = 1.71, *p* = .20; semantic reaction time *F* (1, 59) = 2.38, *p* = .13; episodic accuracy *F* (1, 73) = .59, *p* = .44; episodic reaction time *F* (1, 72) = 3.92, *p* = .05 and episodic confidence *F* (1, 73) = 1.79, *p* = .19.

This indicates that the task enhancement effect observed for stimuli associated with AS was not modulated by how recent the associated memory was.

An earlier peak in frequency of memories is also present within the older adults, likely to be representative of a 'reminiscence bump' where adults recall more memories from their adolescence or early adulthood years (10-30 years; Munawar, Kuhn & Haque, 2018). Within the older adults, 35.6% of their associated memories fell within this period of their life, for the young adults, by nature of them still living within this period, this equated to 75.8% of their memories.

To examine if this reminiscence bump period influenced task performance, again mean differences were calculated between stimuli associated with a memory either within or outside the reminiscence bump period and the stimuli associated with prior knowledge but no-AS. A repeated measures ANOVA examining the reminiscence bump time period on task performance found no effect of this time period, on semantic accuracy F (1, 62) = 1.39, p = .24; semantic reaction time F(1, 61) = .73, p = .40; episodic accuracy F (1, 72) = .58, p = .45; episodic reaction time F(1, 71) = 1.95, p = .17 and episodic confidence F(1, 72) = .48, p = .49. There was also no significant interaction between the age group of the participant semantic accuracy F (1, 62) = 2.39, p = .13; semantic reaction time F (1, 61) = .06, p = .81; episodic accuracy F (1, 72) = .02, p = .89; episodic reaction time F (1, 71) = 3.44, p = .07 and episodic confidence F (1, 72) = .12, p = .74. Nor any interaction between the modality of the stimuli on semantic accuracy F(1, 62) = .36, p = .50; semantic reaction time F (1, 61) = 2.70, p = .11; episodic accuracy *F (1, 72) = .14*, p = .71; episodic reaction time F (1, 71) = .48, p = .50 and episodic confidence F (1, 72) = .42, p = .52.

There was also no three-way interaction on participants' semantic accuracy F (1, 62) = .22, p = .64; semantic reaction time F (1, 61) = .09, p = .76; episodic accuracy F (1, 72) = .98, p .33; episodic reaction time F (1, 71) = .19, p = .66 and episodic confidence F (1, 72) = 2.35, p = .13

This indicated that the task enhancement effect is not modulated by memories falling within this period. It is important to note, that this analysis may not accurately capture the reminiscence bump as our participants varied in age from 65-83 years and therefore would experience the traditional reminiscence bump at different time points, however analysis using the participants age at the time of memory was also completed which also resulted in the same non-significant findings for semantic accuracy (1, 28 = 1.25, *p* = .27; semantic reaction time *F* (1, 29) = 3.75, *p* = .06; episodic accuracy *F* (1, 34) = 1.12, *p* = 30; episodic reaction time *F* (1, 34) = .42, *p* = .52; and episodic confidence *F* (1, 34) = 1.50, *p* = .23

2.3.6.3. Impact of Vividness of Memory on AS

In addition to the type of memory, and the date of memory, participants were also asked to rate their memories in terms of vividness. Vividness ratings ranged from 0-4 (*M* = 2.81, *SD* = 1.13). There was no significant difference in vividness between the young adults (*M* = 2.78, *SD* = .71) and the older adults (*M* = 2.65, *SD* = .78), *t* (89) = .78, *p* = .44. Nor any significant difference between the modality viewed by participants, faces (*M* = 2.59, *SD* = .80) and names (*M* = 2.86, *SD* = .66), *t* (89) = -1.76, *p* = .08.

In order to see if the vividness rating would have an impact on the AS enhancement effect, we calculated task averages for accuracy, confidence and reaction time the memories rated with high vividness (3-4) and low vividness (0-2). Mean differences were calculated between the stimuli associated with either a memory with a high vividness or low-vividness rating, and the stimuli associated with prior knowledge but no-AS to determine if vividness of the associated memory would impact task performance.

A repeated measures ANOVA revealed a main effect of vividness on task ~~performance, Wilks' Lambda = .84, *F* (5, 55) = 2.18, *p* = .07~~, semantic reaction time *F* (1, 59) = 5.90, *p* = .02. Within this variable, memories associated with high vividness ratings had significantly greater mean difference in the AS effect (*M* = 219.77, *SD* = 514.56) compared to associated memories with low vividness ratings (*M* = 86.36, *SD*

= 620.35), $t(62) = 2.78$, $p = .007$. This indicates that greater levels of vividness lead to greater increases in performance, but only within this variable. There was no main effect of vividness on semantic accuracy $F(1, 64) = .08$, $p = .78$; episodic accuracy $F(1, 75) = .24$, $p = .62$; episodic reaction time $F(1, 74) = 4.98$, $p = .13$ and episodic confidence $F(1, 75) = .22$, $p = .64$;

We observed no main effect of age ~~($F(5, 55) = 1.24$, $p = .30$),~~ for participants' semantic accuracy $F(1, 64) = 1.66$, $p = .20$; semantic reaction time $F(1, 59) = 4.70$, $p = .23$; episodic accuracy $F(1, 75) = .04$, $p = .85$; episodic reaction time $F(1, 74) = .34$, $p = .56$ and episodic confidence $F(1, 75) = .09$, $p = .76$. No main effect of modality ~~($F(5, 55) = 1.15$, $p = .35$),~~ on semantic accuracy $F(1, 64) = 3.03$, $p = .09$; semantic reaction time $F(1, 59) = 4.32$, $p = .06$; episodic accuracy $F(1, 75) = .37$, $p = .54$; episodic reaction time $F(1, 74) = .45$, $p = .83$ and episodic confidence $F(1, 75) = 1.48$, $p = 23$. Nor any three-way interaction between vividness of AS, age and modality on the task variables ~~($F(5,55) = .66$, $p = .65$)~~ semantic accuracy $F(1, 64) = .14$, $p = .71$; semantic reaction time $F(1, 59) = .15$, $p = .7$; episodic accuracy $F(1, 75) = .18$, $p = .67$; episodic reaction time $F(1, 74) = 1.33$, $p = .25$ and episodic confidence $F(1, 75)= 3.42$, $p = .07$.

Indicating that the vividness of memories has some impact within AS but is not essential to the previously observed boost in task performance.

2.3.6.4. Impact of Memory Emotion on AS

Participants were also asked to indicate how they were feeling at the time of their memory (extremely unhappy, unhappy, indifferent, happy, extremely happy). To see what impact this had on task performance, we coded memories as either positive

(69.7%), negative (13%) or indifferent (17.3%). Mean differences were calculated between the stimuli associated with a positive, negative or indifferent emotional association, and the stimuli associated with prior knowledge but no-AS, to determine if the emotional salience of the associated memory would impact the benefits of AS on task performances.

A repeated measures ANOVA on emotion of memory, revealed no main effect on task performance, Wilk's Lambda = .80, *F* (10,146) = 1.66, *p* = .095 on semantic accuracy *F* (2, 42) = .52, *p* = .60; semantic reaction time *F*(2, 40) = 2.29, *p* = .11; episodic accuracy *F*(2, 57) = 1.26, *p* = .29; episodic reaction time *F* (2, 56) = 1.02, *p* = .37 or episodic confidence *F* (2, 57) = 4.31, *p = .12.* There were also no significant interactions present with modality of the stimuli (*F (*10,144) = .88, *p* = .55) on semantic accuracy *F* (2, 42) = .26, *p* = .77; semantic reaction time *F* (2, 40) = .59, *p* = .56; episodic accuracy *F* (2, 57) = 1.31, *p* = .28; episodic reaction time *F* (2, 56) = 2.43, *p* = .10 and episodic confidence *F* (2, 57) = 1.71, *p* = .19; Nor the age group of the participant on semantic accuracy *F* (2, 42) = 1.53, *p* = .23; semantic reaction time *F* (2, 40) = 2.54, *p* = .09; episodic accuracy *F* (2, 57) = .01, *p* = .99; episodic confidence *F* (2, 57) = .12, *p* = .89 and episodic reaction time *F* (2, 56) = 3.04, *p* = .06.

Indicating the emotion at the time of the memory does not affect AS.

2.3.7. Date of Stimuli

Previous investigations found prior knowledge and AS responses were more prevalent according to the time period of the stimuli presented. We examined this factor within this study, by grouping stimuli within each of the three time periods (2008-2011, 2012-

2015 and 2016) for the young adults and the twelve time periods (1961-65, 1966-70, 1970-75, 1976-80, 1981-85, 1986-90, 1991-95, 1996-00, 2001-05, 2006-10, 2011-15, 2016) for the older adults (see section 2.2.4). As the stimuli spanned only eight years within the young adults, the following analysis is focused only on the older adult participants.

Participants' responses for prior knowledge, familiarity ratings, emotional salience ratings, factual knowledge scores and association of memories for each stimulus were averaged, in order to compare the influence of time period on these variables.

Average level of prior knowledge for the stimuli across twelve time periods are displayed in Figure 20, and the proportion of associated memories for stimuli across the time periods are displayed in Figure 21 below.

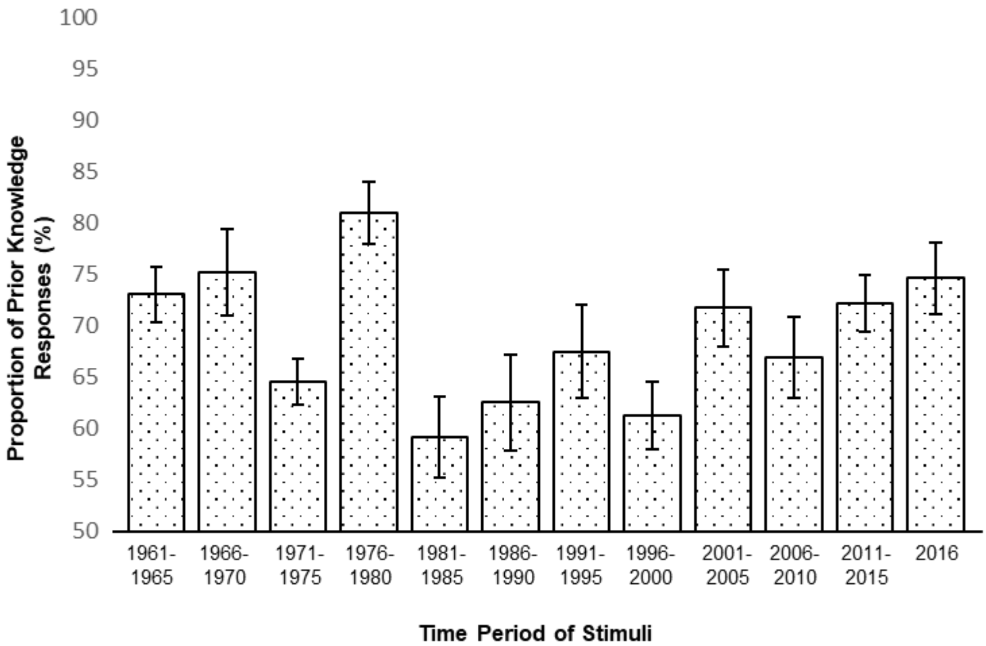

Figure 20 Percentage of Stimuli Associated with Prior Knowledge Responses Across Twelve Time Periods

There is considerable variation of both proportion of prior knowledge (Figure 20) and the proportion of associated memories (Figure 21) across the time periods. A repeated measures ANOVA examining the effect of time period of the stimuli found a significant effect on the proportion of associated prior knowledge, (F $(11, 396) = 14.87$, $p < .001$) and the proportion of associated memory (F $(11, 396) = 4.78$, $p < .001$). Loosely, it appears that the highest proportion of both prior knowledge and associated memory fell within the most dated time periods.

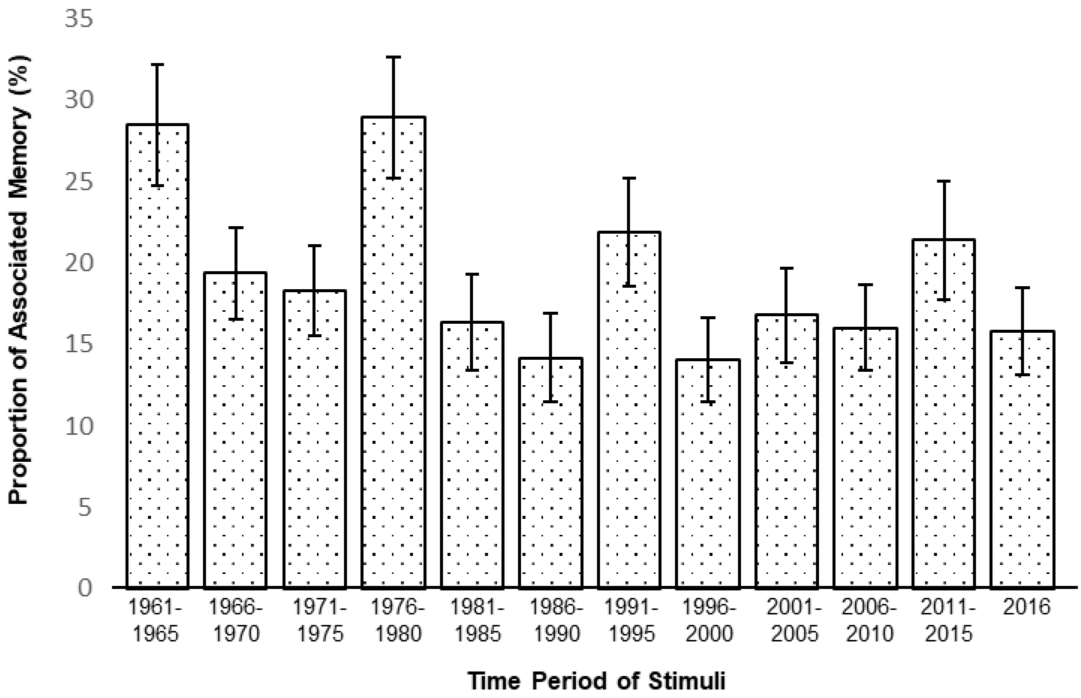

Figure 21 Percentage of Stimuli Associated with a Memory Across Twelve Time Periods

To examine the results more easily, the time periods were grouped and further averaged to display the four most dated periods 1961-1980, the four most recent time periods 2001-2016, and an intermediary period 1981-2000. Updated means for these grouped time periods for prior knowledge and associated memories are displayed in Figure 22 below.

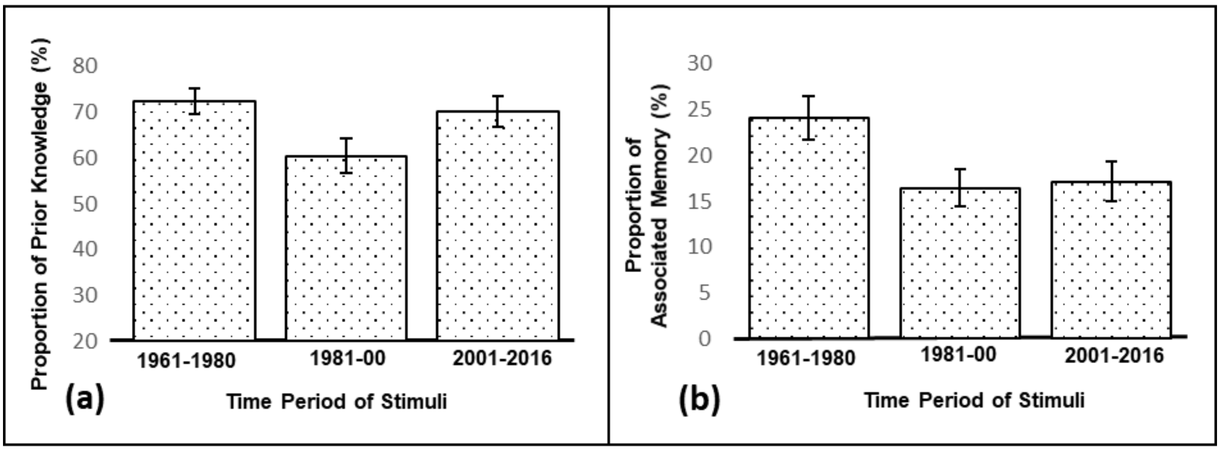

Figure 22 Percentage of Stimuli Associated with (a) Prior Knowledge Responses (b) Associated Memory Responses Across Three Averaged Time Periods.

It is clearer within Figure 22 that older adults had a high level of prior knowledge for the stimuli in the most dated and most recent time periods compared to the intermediary period. Consistently, paired samples t-tests found a significant difference between the proportion of associated prior knowledge for stimuli from 1961-1980 and the stimuli within 1981-2000 (t (39) = 7.16, p <.001), equally there was also a significantly greater proportion of prior knowledge in the most recent time period 2001-2016 compared to the intermediary (t (39) = -7.57, p <.001), but there was no difference in prior knowledge between the most dated and most recent time period (t (39) = 1.52, p = .137).

For associated memories it seems (Figure 22-b) there was a higher proportion for stimuli within the most dated time period 1961-1980 than either the intermediary

1981-2000 (*t (*39) = 4.68, *p* <.001) or most recent 2001-2016 time periods (*t (*39) = 4.59, *p*<.001). There was no difference observed between the most recent and intermediary time periods (*t* (39) = -.48, *p* = .64).

There was a significant interaction between time period and modality of the stimuli on the proportion of prior knowledge reported, *F* (2, 76) = 5.92, *p* = .005. Means for this variable split across modality and time period are displayed in Figure 23 below.

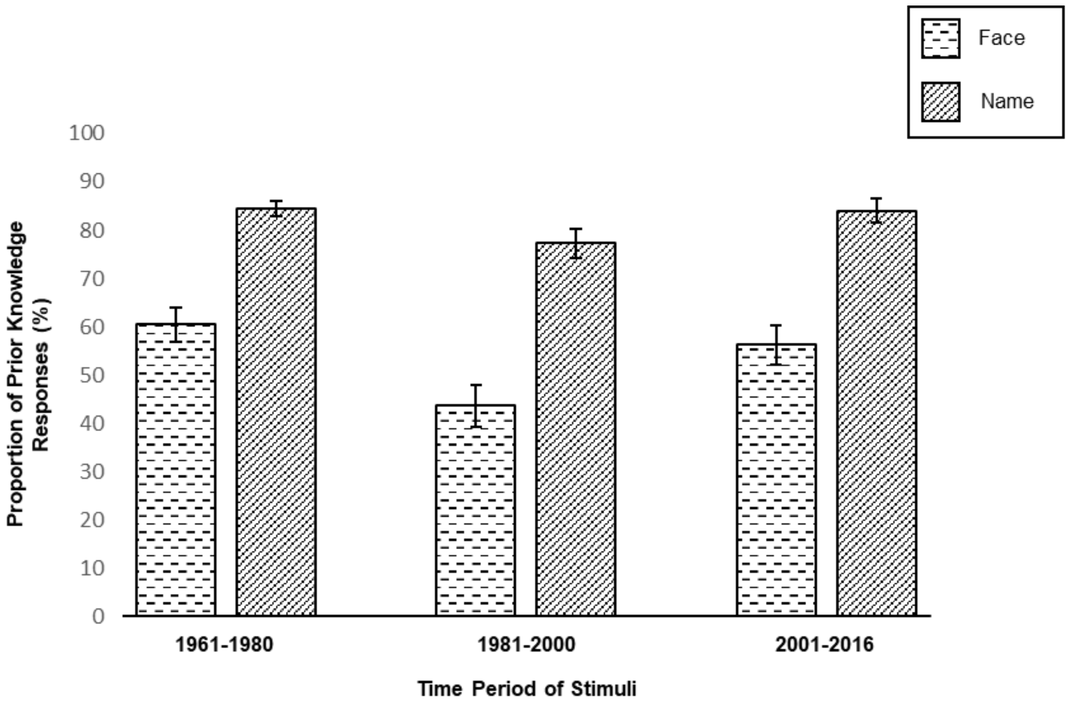

Figure 23 Proportion of Prior Knowledge by Modality Across Three Averaged Time Periods.

Paired samples t-tests showed that participants that viewed faces had a high proportion of prior knowledge for the stimuli in the dated time period compared to the intermediary (*t (*19) = 8.27*, p* <.001) and within the most recent time period compared to the intermediary (*t (*19) = -6.32*, p* <.001), and the same was observed for the name stimuli (*t (*39) = 3.22, *p* = .004, *t (*39) = -4.99*, p* <.001, respectively).

We also examined whether associated familiarity, factual knowledge or emotional salience would vary across time period, means for these variables are displayed in Figure 24 below.

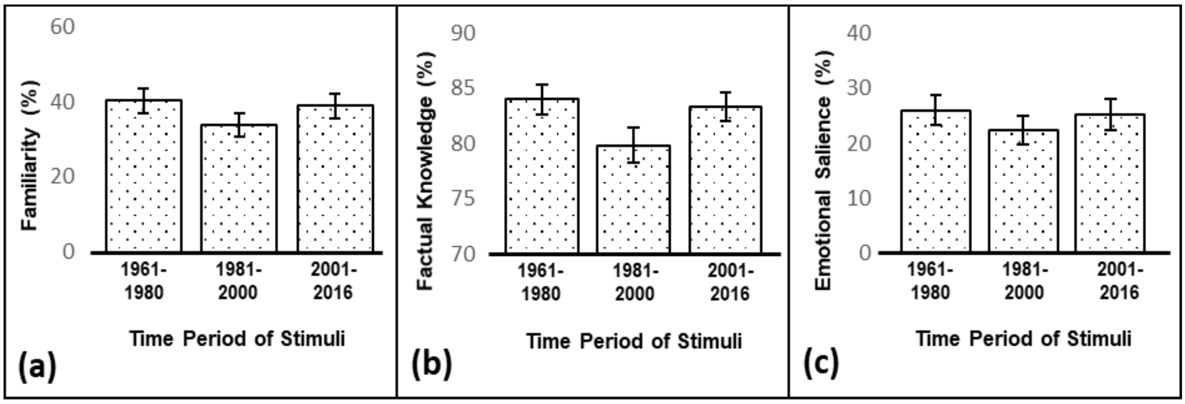

Figure 24 Percentage (a) Familiarity (b) Factual Knowledge (c) Emotional Salience Across Three Average Time Periods.

It appears that all three variables follow the same pattern as that observed within the proportion of prior knowledge, whereby participants had a high level of associated familiarity, factual knowledge and emotional salience for stimuli within the most dated and most recent time periods compared to the intermediary period (Figure 24). Paired samples t-tests supported the observance of this pattern, ratings significantly differed between stimuli within the most dated period 1961-80 and the intermediary period 1981-2000 for familiarity (t (39) = 5.74, p <.001), factual knowledge (t (39) = 4.24, p <.001) and emotional salience (t (39) = 3.29, p = .002), and also between the most recent time period 2001-2016 and the intermediary period for familiarity (t (39) - -3.80, p <.001), factual knowledge (t (39) = -3.08, p = .004) and emotional salience (t (39) = -2.66, p = .011).

There was no interaction between modality and time period of the stimuli on participants' familiarity ratings (*F (*2, 76) = .91, *p* = .39), factual knowledge scores (*F (*2, 76) = 3.09, *p* - .05) or emotional salience ratings (*F (*2, 76) = 98, *p* = .38).

2.3.7.1. Date of Stimuli on Task Performance

We are also able to examine the impact of time period on the semantic and episodic task performance for the stimuli. A repeated measures ANOVA found no significant effect of time period of the stimuli on semantic accuracy (*F (*2, 44) = .26, *p* = .77), semantic reaction time (*F (*2, 44) = .64, *p* = .53), episodic accuracy (*F (*2, 44) = .23, *p* = .80), episodic reaction time (*F (*2, 44) = .20, *p* = .82) and episodic confidence (*F (*2, 44) = .14, *p* = .62) indicating the time period of stimulus did not directly influence participants task performance.

2.3.7.2. Interaction between Date of Stimuli and Prior Knowledge

To examine if date of stimuli interacted with participants' prior knowledge on task performance, a repeated measures ANOVA was conducted. A significant interaction was found between time period of the stimuli and associated prior knowledge on participants' episodic reaction time (*F (*2, 44) = 3.16, *p* = .04) and confidence within the episodic task (*F (*2, 44) = 4.89, *p* = .02), a trend towards significance was also observed within participants' episodic accuracy (*F (*2, 44) = 2.78, *p* = .07). To better examine this interaction, the mean difference was calculated for participants' accuracy, confidence, and reaction time for stimuli unknown to the participant and those associated with prior knowledge for each of the three averaged time periods. These are displayed in Figure 25 below.

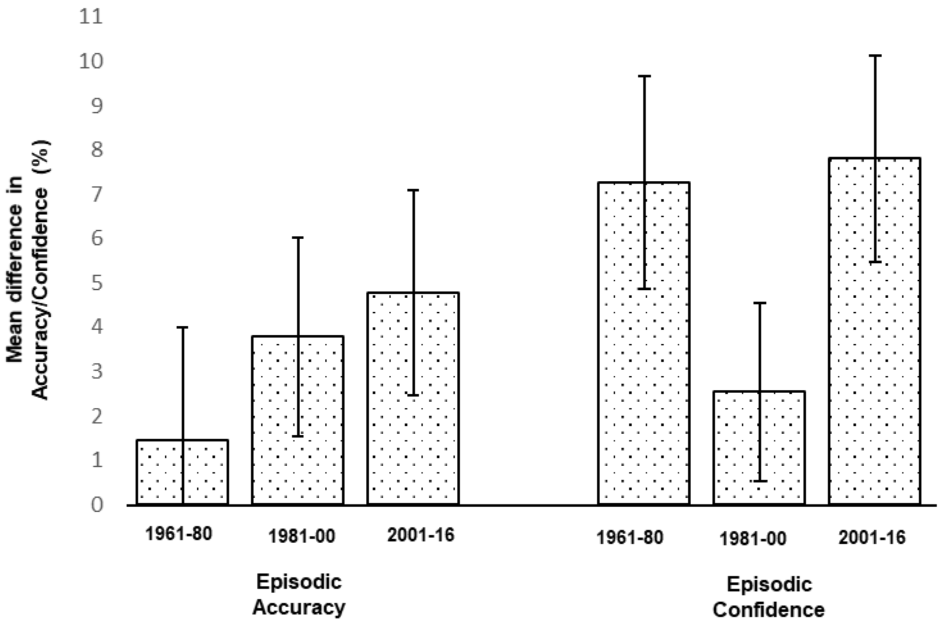

Figure 25 Mean Difference in Task Accuracy and Confidence Between Stimuli Unknown to the Participant and those Associated with Prior Knowledge across Three Averaged Time Periods.

It seems that the benefit of prior knowledge, as measured by mean difference, is greatest for the most dated and most recent stimuli for participants' episodic confidence (Figure 25), compared to the intermediary time period. Whereas within episodic accuracy and episodic reaction time (Figure 26) there is a linear increase in the benefit of prior knowledge where the stimuli from the most dated time periods show the lowest increase in performance, and the stimuli from the most recent time periods show the greatest increase in task performance from the association of prior knowledge .

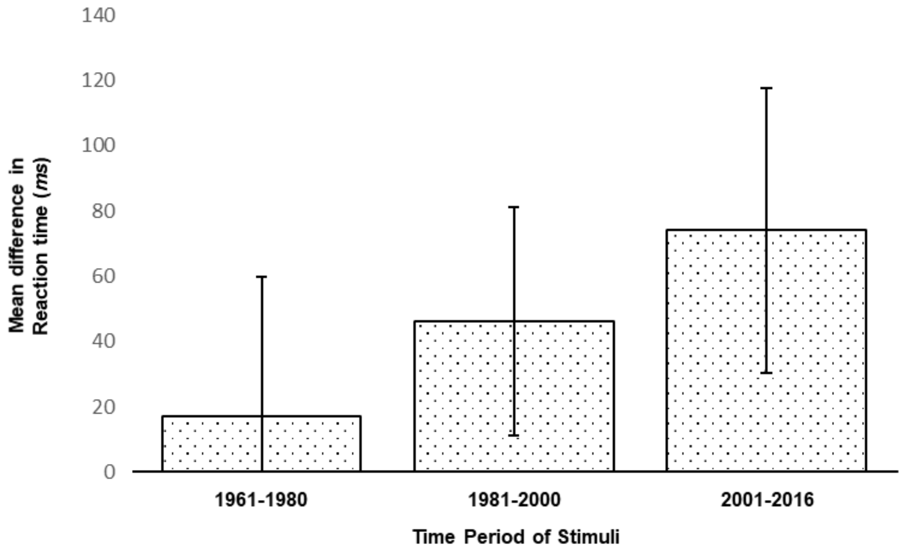

Figure 26 Mean Difference in Episodic `Reaction Time Between Stimuli Unknown to the Participant and those Associated with Prior Knowledge across Three Averaged Time Periods

Paired samples t-tests found participants' mean difference from prior knowledge was significantly greater within the episodic confidence variable for the most dated time period, compared to the intermediary time period (t (38) = 1.98, p = .05) and between the most recent and the intermediary time period (t (38) = -2.68, p = .011). Within the episodic reaction time, the prior knowledge mean difference was significantly larger within the most recent (2001-2016) time period compared to the intermediary (1981-2000) time period (t (36) = -2.20, p = .04. No significant differences were found for the mean difference in episodic accuracy between the three time periods (p >.05). Overall, indicating prior knowledge had the greatest benefit for stimuli within the most recent time period.

2.3.7.3. Interaction between Date of Stimuli and AS

To examine if date of stimuli interacted with participants' AS, a repeated measures ANOVA was conducted. A significant interaction was found between time period of the stimuli and AS on participants' episodic confidence (F (2, 44) = 5.48, p = .01). Participants' mean difference between stimuli associated with AS and stimuli associated with prior knowledge, but no-AS were calculated for stimuli within each of the three averaged time periods, these are shown in Figure 27 below.

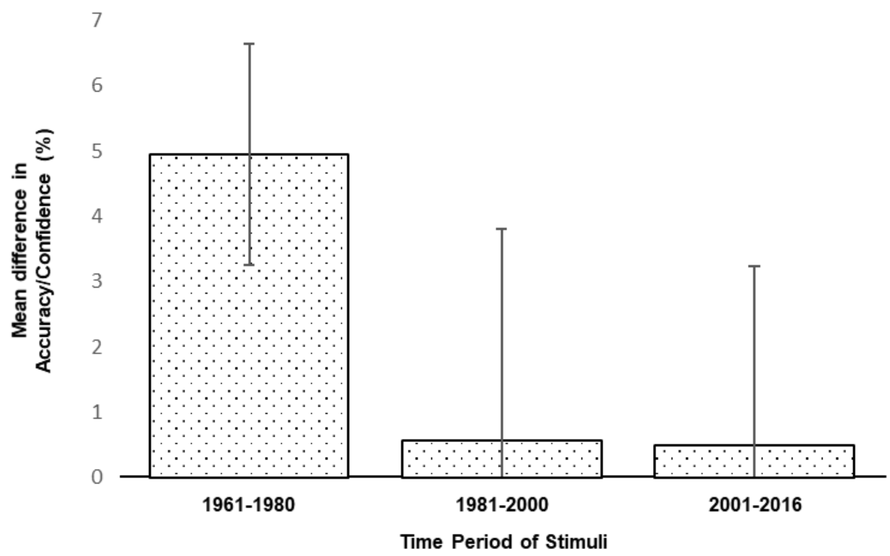

Figure 27 *Mean Difference in Episodic Confidence Between Stimuli Associated with AS and Stimuli Associated with Prior Knowledge but No-As, across Three Averaged Time Periods.*

It seems that the benefit of associated AS was greatest for the most dated stimuli, whereby participants had the greatest increase in confidence, although paired samples t-tests found no significant difference between any of the three time periods (p >.05). Overall indicating that benefit of AS was not modulated by time period of stimuli.

2.4. Discussion

In this experiment, participants encoded famous person stimuli with a semantic judgement task, following which their episodic memory was tested for these stimuli within an old-new recognition task. Their performance on these experimental tasks were later matched to their personal prior experience and ratings for these stimuli. We found participants showed enhanced task performance for stimuli they had prior knowledge of, and performance was further boosted when AS for the stimuli was present.

Previous research demonstrating the effect of prior knowledge on task performance, did not ask participants to disclose prior experience and instead prior knowledge was based on whether the participant was likely to have been exposed to the stimuli (Backman & Herlitz, 1990; Wahlin et al., 1993; Xie & Zhang, 2017). The present study thus offered the first opportunity to examine the impact of 'personalised' prior knowledge, which we found resulted in greater accuracy and confidence, and faster reaction times for these stimuli compared to those unknown to the participants across both the semantic and episodic experimental tasks. This benefit was also extended by how much prior knowledge the participant had for the stimuli, with greater factual knowledge leading to further increases in task performance. This demonstrates that prior semantic knowledge increases task performance, and that this performance boost is proportional to the amount of knowledge one has for a specific stimulus, in line with previous findings (van Overschelde et al., 2001).

The specific purpose of this study was to contrast prior knowledge with AS, which has received limited investigation despite evidence suggesting it boosts performance in various experimental tasks (Renoult et al., 2015; Westmacott & Moscovitch, 2003). Using participants' own self-report of prior experience and disclosure of associated memories, we were able to contrast these two processes within-subjects. Our results demonstrate superior performance for autobiographically significant stimuli compared to stimuli associated with prior knowledge but no associated memory. This increase in performance was observed across accuracy, confidence, and reaction times within the semantic and the episodic experimental tasks. This is in line with previous findings using the remember-know paradigm, that indicated stimuli associated with 'remember' responses were associated with faster semantic fame judgements, speeded reading, and episodic recognition and recall (Westmacott & Moscovitch, 2003). These findings demonstrate a level of separation between prior knowledge and AS, and that the association of episodic memory is more beneficial to associated task performance than the interaction of prior semantic knowledge alone.

This is an important finding, as knowledge of famous persons is typically categorised as semantic general world knowledge, whereas these findings indicate a high level of episodic involvement. Therefore, tasks surrounding famous person knowledge, including the dead-or-alive judgement task (Kapur et al.,1997) or the fame-judgement task (Jennings & Jacoby, 1993) may not only measure semantic knowledge as expected, but instead involve a level of underlying episodic processing.

However, it is not clear from these findings if these processes are totally distinct, as a complete dissociation is not possible; one cannot have AS for a stimulus without an element of prior knowledge. It will therefore be useful to contrast the underlying neural correlates of prior knowledge and AS to investigate if they are driven by two separate underlying processes. This will be undertaken within an ERP paradigm in chapter three.

In this study, familiarity, factual knowledge, and emotional salience levels were higher for autobiographically significant stimuli compared to those associated only with prior knowledge. As these variables have been shown to influence memory performance (Meng et al., 2017; van Overschelde & Healy, 2001; Yonelinas, 2002), respectively), it was important to ensure these were not causing the observed AS boost in task performance. As participants were asked about their prior experience and to rate each stimulus for those factors, we were able to control for these confounding elements within-subjects. The effect of AS (i.e., superior performance for stimuli associated with an episodic memory compared to stimuli associated with only prior knowledge but no associated memory) was still present after controlling for familiarity and factual knowledge, and after controlling for emotional salience at the participant level. There was, however, some reductions in the strength of the effect, in that the mean difference in performance associated to AS and prior knowledge was greater before controlling these variables. This indicates that AS may contain elements of familiarity, factual knowledge, and emotional salience, but that these factors are not essential to enhance task performance.

For the first time we examined AS in young and older adults within a single paradigm, in order to examine the effects of healthy ageing on this process.

It is important to discuss here the slight variations in methodology used between the young and older adult participants. The young adults completed the follow-up questionnaire immediately after the old-new recognition task and under the same lab conditions, whereas the older adults were allowed to complete the questionnaire at home using an online link. This alteration in the methodology was necessary to limit the experimental strain and fatigue resulting from lengthy computer tasks in older adults. However, this naturally resulted in two limitations which could have affected the findings:

Firstly, the older adults were debriefed in the lab before leaving, which is a requirement of our ethics protocol. This meant that the older adults knew the aim of the experiment prior to completing the final task. This could have resulted in them producing more associated memories than they would have if the aim was unknown to them. Secondly, this caused variation in the time between the old-new recognition task and the follow-up questionnaire, whereby the young adults completed the questionnaire immediately, but the older adults may have completed either hours later, or the following day. This delay could also have influenced memories produced, whereby the young adults could have been cued by the tasks and associated memories were fresh in their mind making the retrieval process easier, whereas the older adults would be retrieving the associated memories hours after the memories had been cued.

However, averages for prior knowledge responses and for associated memories produced by older adults were largely consistent with their lab-based young adult counterparts. Moreover, as the experimental design focused on the implicit effect these underlying episodic memories had on previous dead-alive and old-new judgements, it was felt that the impact of the delay or of knowing the true aim of the study in completing the final task would have been limited.

As AS is largely driven by episodic processes as indicated by patient studies (Westmacott et al., 2004) and neuroimaging findings (Denkova et al., 2006; Renoult et al., 2015), we expected the older adults to show both a reduction in the prevalence of AS, and a reduction in the task performance boost caused by association of AS, in line with findings of reduced episodic processing in older compared to young adults (Nyberg et al., 1996; Park et al., 2002).

Interestingly, we found no significant difference in the prevalence of AS for the famous person stimuli, in that both young and older adults were able to disclose memories for around 30 per cent of the recognised stimuli. However, in line with expectations the effect of AS on task performance was weaker within the older adults, whereby older adults had the lowest increase in semantic and episodic task accuracy between stimuli associated with AS and stimuli associated with prior knowledge but no-AS.

We also noted unexpected age effects within the effect of prior knowledge on stimuli, whereby the performance boost in superior accuracy and faster reaction times for stimuli associated with prior knowledge compared to those unknown to the participant was smaller within older adults compared to young adults. This finding was not predicted as prior knowledge was considered a largely semantic driven process, and older adults typically demonstrate maintained if not improved semantic knowledge during the healthy ageing process (Kan et al., 2009). This reduction in the effect of prior knowledge is interesting within ageing, as it indicates that it may be more than semantic knowledge and contain a level of episodic processing.

Although previous research has demonstrated similar neural correlates between effects of prior knowledge and semantic processing, within the greater N400 amplitude for famous stimuli participants held factual knowledge for, compared to those stimuli participants held associated memories for (Renoult et al., 2015). This study focused on young adult participants, which may differ in their underlying processing compared to older adults. This will be further investigated within our own ERP investigation within chapter three.

Interestingly, when familiarity and factual knowledge were controlled, the observed age effects within AS, for reduced boosts in accuracy for the older compared to young adults, were eliminated. This indicates that there may have been differences in how young and older adults rely on familiarity and factual knowledge when processing the stimuli.

This experiment offered the first opportunity to examine effects of prior knowledge and AS across modalities; as incidentally all previous investigations on prior knowledge were on famous faces (Backman & Herlitz, 1990; Wahlin et al., 1993) and examinations of AS used famous names (Westmacott & Moscovitch, 2003; Renoult et al., 2015). In line with expectations (Burton et al, 2019) we found participants predicted their memory for faces was greater than their memory for names, but despite this prediction older adults performed more accurately and faster for the name stimuli compared to the face stimuli. This is typical of other findings which show individuals have an objectively better memory for names (Burton, Jenkins & Robertson, 2019; Clarke, 1934; Nielson et al., 2010). In contrast, the young adults that viewed famous faces demonstrated superior performance to those that viewed names, which is inconsistent with previous comparisons of faces and names and instead more closely aligns with the phenomena of the pictorial superiority effect (Durso & O'Sullivan, 1983; Snodgrass et al., 1972, 1974), which demonstrates greater recognition for pictures over words. It is not clear what would cause these modality differences between the age groups, as young adults have previously demonstrated superior performance for names (Burton et al., 2019; Nielson et al., 2010), and even the oldest older adults have shown the pictorial superiority effect (Cherry et al., 2008). It is however worth noting, that these modality effects were between-subject, in that participants viewed stimuli either as faces or as names, so may be influenced by a level of individual differences between participants.

There was also interesting modality by age effects within the prevalence of reported prior knowledge and AS. Within young adults those that viewed name stimuli reported a greater level of prior knowledge than those that viewed faces, but the reverse was true for AS, which was reported more frequently for the participants that viewed famous faces. Whereas the older adults demonstrated the mirrored effect: those that viewed famous faces reported a greater level of prior knowledge, and those that viewed name stimuli reported a higher proportion of AS. It is not clear what is responsible for the differences relating to age and modality, but it is an important finding as most experimental tasks tend to be single modality, and this evidence suggests that faces and names may be differently associated with semantic and episodic knowledge in young and older adults.

These modality effects were also extended to the extent of task improvement for the association of prior knowledge. Within young adults, those that viewed famous names had the greatest effect of prior knowledge on task performance, whereas within the older adults the greatest effect of prior knowledge was observed within the participants that viewed face stimuli. These modality effects were less clear cut, when the effect of AS was examined: older adults that viewed faces consistently showed a greater boost in performance than those that viewed names, whereas within the young adults the modality effect did not reach significance and seemed to vary across task, with AS being greater for face stimuli within episodic task, but greater for names within the semantic task. This again echoes the idea that faces, and names may be differently affected by age and underlying memory processes.

The influence of time was also examined, hypotheses were driven by consolidation theory (Squire & Alvarez, 1995) and the transformation hypothesis (Moscovitch et al., 2016), that there would likely be a greater proportion of semantic prior knowledge for more dated stimuli, and a greater proportion of episodic driven AS for more recent stimuli. This was not found within our results, older adults reported a high level of prior knowledge for both the most dated and most recent stimuli, and the greatest proportion of prior knowledge of stimuli or AS was observed for the most dated stimuli. In fact when the effect of association on task performance was examined, prior knowledge had the greatest effect on the most recent stimuli, and AS had the greatest effect on the most dated stimuli within the older adults, which was contrary to our predictions. This could be taken as evidence that dated information is not necessarily more semantic in nature than more recent information, in line with other memory theories including Multiple Trace Theory which proposes that every instance of retrieval lays a new trace in the hippocampus and so even the most dated can be a vivid and re-experienceable episodic memory (Moscovitch et al., 2005). However, it is important to note that these findings may be due to the fact that although famous persons were counterbalanced by peak of fame, their careers often span a long period of time, and therefore their prior knowledge or associated memory may be from another time period. This is supported when participants’ own dates of memory were examined, which showed a high portion of AS for the most recent five years. The impact of time will be investigated further within chapter four, with the use of public events which are better time locked.

Finally, as participants disclosed their associated memory, we were able to examine the influence of a number of other variables within subject. Previous investigations had required the association of unique events to define AS (Renoult et al., 2015; Westmacott & Moscovitch, 2003), and within the present study these still made up two-thirds of the reported memories without the restriction in place. However, one-third or associated memories were memories of repeated events. When task performance was investigated, no main effect of type of memory on was found, indicating that participants' performance boost from AS was not affected by the association of a repeated event over a unique event. This is in line with repeated events having similar neural correlates to unique episodic events (Addis et al., 2004; Brown et al., 2018; Renoult et al., 2012). This study therefore highlights that AS does not need to be formed through the association of a unique event, as previously understood. There were too few autobiographical facts provided for a valid comparison, so in future it will be of interest to examine whether these can also be associated with AS.

Interesting modality effects were present within type of reported memory, whereby participants that viewed name stimuli reported a greater proportion of memories for repeated events, and those that viewed faces reported a greater number of unique events. These differences extended to task performance, where young adults that viewed face stimuli showed the greatest decrease in semantic reaction time from AS if a unique event was associated compared to a repeated event, whereas those that viewed name stimuli showed the greatest increase in episodic confidence when repeated events instead of unique events were associated. These effects are puzzling, similar to modality difference in prevalence and effect or prior knowledge and AS and seem to indicate that faces and names have different relationships with episodic and semantic memory. Where unique events are considered more episodic on the episodic-semantic continuum (Renoult et al.,2012), it seems faces may have preferential links with episodic memories, which is apparent within the report of a greater proportion of associated memories for these stimuli, and names may be preferentially associated with semantic information, as evidenced by increased prevalence of prior knowledge, and the association of a greater proportion of repeated events, which are more semantic than unique events on the episodic-semantic continuum. Although there is limited evidence for this conclusion, instead the results add to the growing body of evidence that faces and names are processed differently (Mackenzie & Donaldson, 2009; Nielson et al., 2010), and so it is increasingly important to not draw conclusions across modality.

Finally, although additional investigation of the associated memory revealed both a higher frequency of associated memories from the most recent five years, and also a ‘reminiscence bump’ (Rathbone et al., 2009) of associated memories from when the participant was 10-30 years old, there was no impact of the time of associated memory on the effect of AS on task performance indicating date of associated memory did not affect AS. There was also no main effect of emotional salience of the associated memories, nor effects of memory vividness on task performance, which have both previously been shown to influence strength of memory (Xie & Zhang, 2017; Levine & Pizarro, 2004), and so were expected to affect the performance boost resulting from the associated memory. This indicates that overall, it is merely the association of a memory that results in superior performance for the stimuli, rather than any one element of the memory.

In summary, both the association of semantic prior knowledge and the association of episodic AS of stimuli led to increased performance across both semantic and episodic tasks. We also demonstrated a level of separation between prior knowledge and AS as the latter resulted in increased accuracy, confidence and reduced reaction times compared to the former, indicating that association of episodic memory results in greater performance benefits, as compared to the association of semantic knowledge. Contrary to expectations there was no difference in the prevalence of associated memories within older adults, but there was a significant decrease in the effects of AS on task performance, consistent with the literature proposing that it is driven by episodic processing. We also found unexpected modality effects, pointing towards different processing of faces and names in young and older adults which requires further investigation

CHAPTER THREE

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The Neural Correlates of Autobiographically Significant Concepts within Older Adults

3.1. Introduction

Within the previous chapter, we demonstrated that both prior knowledge of and associated AS for a stimulus can improve participants' task performance for those stimuli in both young and older adults. We were also able to demonstrate a level of separation between these two processes; with the association of AS resulting in superior task performance for the stimuli compared to when participants had prior knowledge of the stimuli but no associated memory. However, we were unable to confirm a dissociation between these processes, as participants naturally have prior knowledge of stimuli, they consider autobiographically significant stimuli. For this reason, it is important to examine the underlying neural correlates of these processes, to determine if there is evidence to suggest differences, or whether it is more likely that AS is an extension of prior knowledge.

The assumption based in part on research using the remember-know paradigm (Westmacott & Moscovitch, 2003; Westmacott et al., 2004), is that AS is related to 'remember' responses; when participants can recollect a unique episode involving the stimuli, and therefore is grounded within the episodic processing system. Whereas prior knowledge relates correlates closely to a 'know' response; where participants cannot recollect any specific memory but hold factual knowledge for or a feeling of knowing the stimuli, which is based within the semantic system (Tulving, 1985). This distinction was evidenced within patient studies; amnesic patients with deficits in episodic memory gave far fewer 'remember' responses than controls, whereas semantic dementia patients with degradation within semantic knowledge but general resilience of episodic memory, recognised far fewer famous names than controls, but gave remember responses for over eighty per-cent of their recognised names (Westmacott et al., 2004). Patient studies such as this provide a good indication of the underlying processes of prior knowledge and AS, but individual differences mean it is difficult to draw generalised conclusions.

Neurological investigations contrasting functional activations for famous compared to non-famous person stimuli, representing prior knowledge, revealed activations within the ventromedial prefrontal cortex and areas of the MTL (Douville et al., 2005; Elfgren et al., 2006; Nielson et al., 2006) and stronger activations within these areas were observed when associated memories were present for the stimuli (Liu et al., 2016). However, it is important to note within these paradigms, participants were not asked to disclose their own experience, instead prior knowledge was assumed based on the likelihood of being exposed to a stimulus (i.e., more likely to have prior knowledge for a famous over a non-famous person). Therefore, the observed functional activation within these regions may relate to increased familiarity, to associated memories or to prior knowledge.

To counter this, Denkova & colleagues (Denkova et al., 2006) utilised an interview prior to the scanning session to create individualised stimuli for each participant, made up of celebrities the participant had prior knowledge of, and famous persons the participant had an episodic memory for. This allowed a direct functional contrast between prior knowledge and AS. Their findings revealed MTL activation only for stimuli that participants had an associated episodic memory for, but not for those the participants had prior knowledge of, but no associated memory. This MTL activation was proposed as underlying episodic processing present for the autobiographically significant stimuli but not the stimuli with prior knowledge but no associated memory consistent with MTL activation observed during autobiographical memory retrieval (Conway et al., 1999; Gilboa et al., 2004; Piolino et al., 2002; Rekkas & Constable, 2005; Steinvorth et al., 2006), which is in line with conclusions from patient findings (Westmacott et al., 2004).

However, different tasks were used within the scanner for the two types of stimuli; participants made fame judgements on the stimuli they declared prior knowledge for and were asked to actively retrieve episodic memories for the stimuli they considered autobiographically significant. These differing tasks may therefore be responsible for the diverging activations observed. Although, previous investigations utilising the fame judgement task within the scanner reported MTL activation (Henson et al., 2002), therefore it is more likely that distinguishing between prior knowledge and associated memory is responsible for the differing activations.

Functional MRI is a useful tool for determining areas of activation during tasks, but EEG is a better method to determine the underlying processing and can therefore be effectively used to examine the contributions of semantic versus episodic processing during tasks.

Renoult and colleagues (2015) used this method of investigation to examine processing within AS, using two ERP components that are traditionally associated with either semantic (n400) or episodic processing (LPC).

The N400 ERP component is a negative deflection observed across centroparietal regions which develops between 200-500ms after stimuli onset. This ERP component has been shown to be modulated by tasks examining semantic relations (Heinze et al., 1998), world knowledge (Hagoort et al., 2004) and those considering the number of semantic features (Kutas & Federmeier, 2011; Rabovsky et al., 2012), and therefore demonstrates a reliable association with semantic processing (Vilberg et al., 2006). The second ERP component of interest is the Late Positive Component (LPC); a positive deflection which develops between 500-800ms after stimuli onset across parietal scalp sites. The amplitude of this component is modulated by amount of information recollected about a memory (Wilding & Rugg, 1996), including source information (Voss & Paller, 2008), and is widely considered to have a reliable association with episodic processing (Denkova et al., 2006a; Liu et al., 2016; Renoult et al., 2015).

Renoult et al., (2015) asked participants to implicitly encode famous name stimuli through a fame-judgement task, and their episodic memory for these encoded stimuli was then tested through an old-new recognition task. EEG was recorded from participants while they completed both tasks. They found the amplitude of the N400 was modulated by the number of facts participants knew for the famous persons, but it was not affected by whether stimuli were high or low in AS (AS). In contrast, the amplitude of the LPC was not modulated by number of facts, and instead was greater for stimuli considered highly autobiographically significant over low AS names within both tasks. This was an important finding indicating a level of dissociation, whereby factual knowledge for the famous person is linked to modulations of the N400 and therefore likely driven by semantic processing, whereas AS modulates the LPC, and therefore is most likely associated with episodic processing, providing evidence towards a distinction between these processes.

However, all investigations to date into the underlying neural correlates of AS have focused on young adults. Within the previous chapter we highlighted a difference in the effect of both prior knowledge and AS between young and older adults, whereby the effect on task performance of both processes was considerably reduced within the older adult participants. This was expected for the effect of AS on task performance, as an episodic driven process which is typically reduced in healthy ageing (Nyberg et al., 1996). However, the reduction in the effect of prior knowledge on task performance, as a semantically driven process which is typically resilient within healthy ageing (Nyberg et al., 1996; Park et al., 2002), was unexpected. It is therefore of interest to examine the neural correlates of these processes within an older adult sample, to examine if differences within the underlying neural correlates can explain these behavioural variances.

Although the previous ERP investigation (Renoult et al., 2015) used famous names to successfully capture the neural correlates of AS, within the previous chapter we demonstrated a clear modality effect for both associated prior knowledge and associated AS (see section 2.3.2.2 and 2.3.4.2). Whereby for older adults, the greatest effect of both prior knowledge and AS was observed for participants that viewed famous faces, as compared to those that viewed names. For this reason, this ERP investigation will present famous faces rather than names to capture a greater level of AS within the older adults. This has the added benefit that images can be better time locked for ERPS, compared to names where reading speed between participants may vary (Jackson & McClelland, 1979).

For this investigation we were also able to recruit older adults that had been genotyped for the Apolipoprotein E (ApoE) gene, which is a strong genetic determinant for Alzheimer disease (Harold et al., 2009; Lambert et al., 2009). Each individual holds two ApoE alleles, and there are three allele variants; ε4 allele carriers have an increased risk of Alzheimers, whereas carrying the ε2 allele decreases the risk, in comparison to the most common ε3 allele (Bernard et al., 2004;

Douville et al., 2005; Liu et al., 2016; Nielson et al., 2006). ApoE has a role in lipid homeostasis and transport (Mahley & Rall Jr, 2000), but also in amyloid-β aggregation and clearance (Ellis et al., 1996), it is this latter function which is affected by different structures within the allele variants, and results in increased amyloid-β deposits within the ε4 carriers compared with non-carriers (Frieden & Garai, 2012; Kok et al., 2009; Zhong & Weisgraber, 2009), which is one of the structural changes leading to Alzheimers disease (Ittner & Götz, 2011; LaFerla et al., 2007).

In addition to the Alzheimer risk-factor, cognitively healthy ε4 carriers show earlier cognitive decline to ε2 or ε3 carriers (Caselli et al., 2009; Izaks et al., 2011), with an accelerated decline in working (Reinvang et al., 2010) and episodic memory performance (Caselli et al., 2004, 2007; Mayeux et al., 2001). These early differences are exasperated by the onset of mild cognitive impairment (Dik et al., 2000; Ramakers et al., 2008).

Limited ERP investigations in ApoE carriers have been undertaken, however attenuation of N1 and N2 ERP components, linked to attentional processes, has been observed (Reinvang et al., 2005), as well as differences in olfactory event-related potentials between the allele variants (Corby et al., 2012), but to date no investigation has been completed on the semantically driven N400 and particularly the episodic LPC.

It was therefore of interest to examine whether the effect of AS, as an episodic memory driven process, would be modulated by the ApoE genotype of the participant, and whether any variation within the N400 and LPC ERPs would be observed.

3.1.1. Chapter Aims & Hypotheses

1. To examine differences in behavioural task performance for stimuli participants have prior knowledge of, and those associated with AS
    i. As observed within chapter two and the prior literature (Westmacott & Moscovitch, 2003; Renoult et al.,2015) we expect participants to demonstrate superior task performance (greater accuracy and faster reaction times) for stimuli they have prior knowledge of compared to those unknown to them, and that autobiographically significant stimuli will be associated with further performance benefits compared to stimuli for which participants have prior knowledge of but no associated memory.
2. To examine the underlying neural correlates of prior knowledge and AS within older adults using EEG
    i. The previous ERP investigation (Renoult et al., 2015) demonstrated greater LPC amplitude for autobiographically significant stimuli in young adults, so we expect to see some modulation of this ERP component for autobiographically significant stimuli within the older adults. Although comparatively the magnitude may be reduced, due to the degradation of episodic memory in healthy ageing (Nyberg et al., 1996)
    ii. In chapter two there were unexpected reductions in the effect of prior knowledge within the older adults, therefore we are

interested to see if this effect is modulated by the semantically driven N400, or the episodically driven LPC.

3. To examine differences in the behavioural effect of AS and prior knowledge on task performance between ApoE ε3 and ε4 carriers
    i. Some early memory changes have been observed within healthy ApoE ε4 carriers (Reinvang et al., 2009; Casseli, et al., 2004; 2007; Mayeux et al., 2001; Caselli, Dueck et al., 2009; Izaks et al., 2011), so we predict there may be differences in the effect of AS on task performance.
    ii. No effect on semantic knowledge has previously been observed, therefore we do not expect the ApoE genotype of participants to influence the effect of prior knowledge on task performance.
4. To examine differences within the underlying neural correlates of prior knowledge and AS between ApoE ε3 and ε4 carriers
    i. Limited prior ERP research has been completed to contrast performance between APOE carriers (Reinvang et al., 2005; Corby et al., 2012), and to date no investigation has been completed examining the N400 or LPC. Due to observed attenuations in ERP components related to attentional processes and the early memory changes for the ε4 carriers, we expect to see some reduction in the magnitude of the LPC between ε4 and ε3 carriers.

3.2. Method

3.2.1. Participants

Thirty-three participants (24 female) aged 55-78 years (*M* = 66.52, *SD* = 6.28), were recruited from the Norwich Medical School's participant database. These individuals had previously participated in studies within the medical school and agreed to be re-contacted about future studies. They were sent an email advertising the study (Appendix I) and were recruited following an expression of interest.

Of these, 22 individuals (15 female) aged 57-78 years (*M* = 67.32, *SD* = 5.81) were found to hold the ApoE ε3alleles, and 11 individuals (9 female) aged 55-76 years (*M* = 64.91, *SD* = 7.42) were found to hold the ApoE ε4 alleles. We found no significant difference relating to age t (31) = 1.023, p =.314, nor any association between ApoE group and gender (X^2 (1) = *.688, p* = .407) nor education (X^2 (5) = 6.911, p = .227), indicating the groups were appropriately matched for these variables.

All participants gave their informed consent and were financially compensated for their time in line with the School of Psychology's financial reimbursement policy.

3.2.2. Stimuli

For this study, sixty famous faces were taken from the stimuli set used in Chapter two (*see section 2.2.2.*). Responses from the final celebrity questionnaire (*see section, 2.2.4.)* were used to determine the average 'prior knowledge' response (when participants reported they recognised or had heard of the famous person before), and the average 'AS' response (when participants were able to provide associated memories for the famous person). From this we were able to create two stimuli types; High AS and Low AS, similar to those previously used in the literature (Westmacott & Moscovitch, 2003; Renoult et al., 2015). Low AS were stimuli that had been rated as high in prior knowledge (36-100% of the previous participants provided recognition responses, *M* = 69.03, SD = 17.89) but low in associated memories (0% of participants provided associated memories, *M* = 0, *SD* = 0), whereas High AS stimuli were rated both high in prior knowledge and high in associated memories (100% of participants had prior knowledge and provided associated memories for these stimuli, *M* = 100, *SD* = 0). An equal number of famous dead and famous alive persons were required for the dead or alive semantic task, this resulted in 30 High AS stimuli; 15 dead and 15 alive, and 30 Low AS stimuli; 15 dead and 15 alive.

A further 60 famous persons were introduced as 'new' faces within the old-new recognition task. These were not pre-rated as High AS or Low AS and varied greatly for prior knowledge (8-100% of the previous participants recognised the stimuli, *M* = 46.80, *SD* = 25.84) and associated memories (1-94% of previous participants provided associated memory responses to the stimuli, *M* = 53.30, *SD* = 28.28). There was however an equal number of dead or alive persons, within these 'new' faces.

All stimuli were presented as faces, the selected images taken from chapter two (section 2.2.2) were presented as 13.5 x 12 cm on the centre of the screen, they were head and shoulder shots with the individual facing towards the camera, to ensure uniformity. All photos were presented in black and white for consistency across time periods, and care was taken to control for distracting backgrounds, and items such as hats or sporting accessories that could help identify the celebrities.

3.2.3. Experimental Tasks

Participants completed the two computer-based tasks from chapter two (see section 2.2.3). These were presented on a 24-inch monitor using E-Prime 2.0 (Psychology Software Tools, Pittsburgh, PA). The first was a semantic task based on the dead or alive paradigm (Kapur et al., 1998). In this task participants viewed 60 stimuli of famous individuals and asked to make a dead or alive judgement (for full presentation details see section 2.2.3). In order to provide more trials for the ERP investigation, each stimulus was presented four times randomly through the task, resulting in the presentation of 240 trials. Participants were provided with breaks in the task after each 60 faces.

The second task was an old-new recognition task (episodic). Within this task participants viewed the same stimuli from the dead or alive task, plus an equal number of new stimuli, resulting in 120 stimuli, and were asked to make an old or new judgement, following this pressed a button to indicate how confident they were on their prior old-new judgement (for full presentation details see section 2.2.3). Participants were provided with breaks in the task after each 60 faces.

3.2.4. EEG Acquisition

EEG was recorded from participants during the semantic and episodic tasks. A 64-channel active electrode system was used (Brain Vision UK, GmbH), 63 electrodes were placed within an antiCAP system (using the 10:10 system), the 64th electrode was placed under the left eye to monitor any eye movements or blinks.

The continuous EEG signal was recorded at a 500-Hz sampling rate using a central reference, and the impedance was kept below 20 kΩ. The high filter was set at 500 Hz, and the time constant was 10 sec.

Participants were asked to limit eye and head movements during the experimental task. ‘Blink’ screens were included prior to the presentation of each famous face to reduce the chance of artefacts affecting the analysis.

3.2.5. Celebrity Questionnaire

Following the two experimental tasks, participants completed the same celebrity questionnaire from Chapter two (*see section 2.2.4).* For this questionnaire, participants were asked questions only for the ‘old’ stimuli (N = 60) that had been pre-rated for High and Low AS, and presented in both the semantic and episodic task. This questionnaire was presented using Qualtrics (Qualtrics, Provo, UT) a web-based survey tool capable of collecting quantitative and qualitative data (for full details see section 2.2.4).

The time taken to complete the survey varied between participants due to the variance in number of famous persons known, and number of associated memories present, but it took approximately 60-90 minutes to complete.

3.2.6. Procedure

All participants responded to an email advertisement sent to them via the Norwich Medical School’s participant panel. They were informed the study was examining how personal significance would affect judgements and, that they would have their

EEG recorded whilst completing two computer-based tasks within the lab, which involved making factual or personal judgments on a series of famous persons. They were also informed that there would be a follow-up questionnaire on these famous faces to be completed at home. Upon attending the lab, they were provided with an information sheet (Appendix J) and given the opportunity to ask any questions prior to giving their informed consent.

Participants were seated at a computer desk, in front of a computer screen approximately 60cm distance in front of their eyes. They were fitted with 63 electrodes within the Brain Vision acti-CAP system and the additional electrode was placed under their left eye. Continuous EEG was recorded from the cap during the semantic and episodic tasks.

After they had completed both tasks, the EEG cap was removed from the participants' head, and they were given the opportunity to wash the conductive gel from their scalp prior to continuing.

Participants were then shown an example questionnaire using Qualtrics. The example presented all the questions that participants would be asked and gave example responses for clarity (Appendix K). The participants at this point were given the opportunity to complete the celebrity questionnaire at home, to reduce their fatigue following a lengthy lab session. Participants were sent an email with instructions and a link to the questionnaire (Appendix L) and told they could complete the questions at their own pace.

Before leaving the lab, participants were thanked for their time, and given a verbal and written debrief (Appendix M) detailing the aims of the investigation.

3.3. Results

Task accuracy and reaction time for each stimulus were taken from both the dead or alive (semantic) task and the old-new recognition (episodic) task and confidence judgements were taken from the episodic task, these were linked to the participant responses from the follow-up celebrity questionnaire. Participants' questionnaire responses were used to evaluate prior knowledge (recognition yes or no) of the famous persons, as well as familiarity (0-4), emotional salience (0-4), factual knowledge (score out of 6) and whether there was an associated episodic memory present (yes or no) and the details surrounding the memory for each stimulus (see section 2.2.4 for questionnaire details). Episodic confidence, familiarity, emotional salience, and factual knowledge scores were converted to percentages for ease of comparison.

Offline analyses were conducted for the electrophysiological data using EEGLAB (Delorme & Makeig, 2004) and ERPLAB (Lopez-Calderon & Luck, 2014), two open-source toolboxes running under MatLab 7.12 (R2011a, The MathWorks, Natick, MA). High- and low-pass filter half-amplitude cut-offs were set at 0.01 and 40 Hz, respectively. An average reference was computed offline and used for all analyses. Before averaging, trials contaminated by excessive artifacts were rejected automatically with a step function (Luck, 2005) with a voltage threshold of ±100 μV in moving windows of 200 ms and with a window step of 100 ms. The EEG was segmented into epochs from −200 ms before to 1000 ms after name onset.

The amplitudes of the N400 and the LPC were measured as the mean of all data points between 300–500 ms and 500–700 ms, respectively. They were measured relative to the mean of all data points in the 200 ms pre-stimulus baselines, using the baseline correction option of ERPLAP.

Key electrode sites were grouped into two ROIs, each including eight electrodes (four for each hemisphere). These were identical to those used in Renoult et al. (2015). A centroparietal ROI, where the amplitude of the N400 is maximal (Curran, Tucker, Kutas, & Posner, 1993), was chosen to measure this ERP component. It was comprised of electrodes C1/C2, C3/C4, CP1/CP2, and CP3/CP4. The LPC was measured using a posterior parietal ROI, where its amplitude is maximal (Rugg & Curran, 2007; Friedman & Johnson, 2000). It included electrodes P1/P2, P3/P4, P5/P6, and PO3/PO4.

Although four repetitions of each stimulus were included within the semantic task, no significant main effects of repetition or interaction effects, were found within behavioural task performance or within the electrophysiological response ($p > .05$). Therefore, results presented for the semantic task throughout, are averaged across these four repetitions.

3.3.1. Overall Task Performance

The participants achieved an average accuracy of 89.57% (SD = 25.98) on the semantic task and 96.11% (SD =19.34) on the episodic task. We observed no significant difference in semantic task accuracy between the ApoE ε3 participants (M =89.4, SD = 25.84) and the ApoE ε4 participants (M = 89.91, SD = 26.27), t (1976) = -.41, p = .68, nor for the factual knowledge scores produced from the final celebrity questionnaire between the ApoE ε3(M =88.47, SD = 19.39) and the ApoE ε4participants (M 87.38, SD = 20.68), t (1630) = 1.054, p =.292.

However, there was a significant difference in performance on the episodic task between the ApoE ε3(*M* = 94.84, *SD* = 22.12) and ApoE ε4(*M* = 98.64, *SD* = 11.61) participants, *t* (1977) = -4.128, *p* <.0001, contrary to expectations the ApoE ε4participants performed significantly better on this task.

We found no correlation between participants' sleep quality (PSQI; *M* = 3.79, *SD* = 2.25) nor their depression score (PHQ-9; *M* = 1.97, *SD* = 2.90) and their memory performance within the episodic task (*M* = 96.11, *SD* = 9.52), *r (*33) = -.027, *p* = .883 and *r (*33) = -.187, *p* = .297, respectively, so these were not included as co-variates in the following analyses.

3.3.2. The Impact of Pre-Rated AS on Task Performance

The stimuli set used Low AS stimuli (pre-rated as high in prior knowledge, but low on associated memories) and High AS stimuli (pre-rated as high in prior knowledge and associated memories) taken from participant responses from Chapter Two. Participants' own prior knowledge and associated memory ratings for stimuli, collected at the end of the experiment, were consistent with these pre-rated groupings. Participants had prior knowledge for a high proportion of both the high AS (*M* = 89.68, *SD* = 12.96) and low AS (*M* = 82.13, *SD* = 16.59) stimuli, although they knew significantly more of the High AS stimuli, *t* (30) = -4.460, *p* <.001. They also had associated memories for significantly more of the High AS (*M* = 40.59, *SD* = 19.58) than Low AS (*M* = 21.23, *SD* = 14.36) stimuli, *t* (30) =-7.089, *p* <.001.

Behavioural averages for accuracy, reaction time and confidence were calculated from the semantic and episodic experimental tasks for both the pre-rated High AS and Low AS stimuli. Means for these variables are displayed in Figure 28 and Figure 29 below.

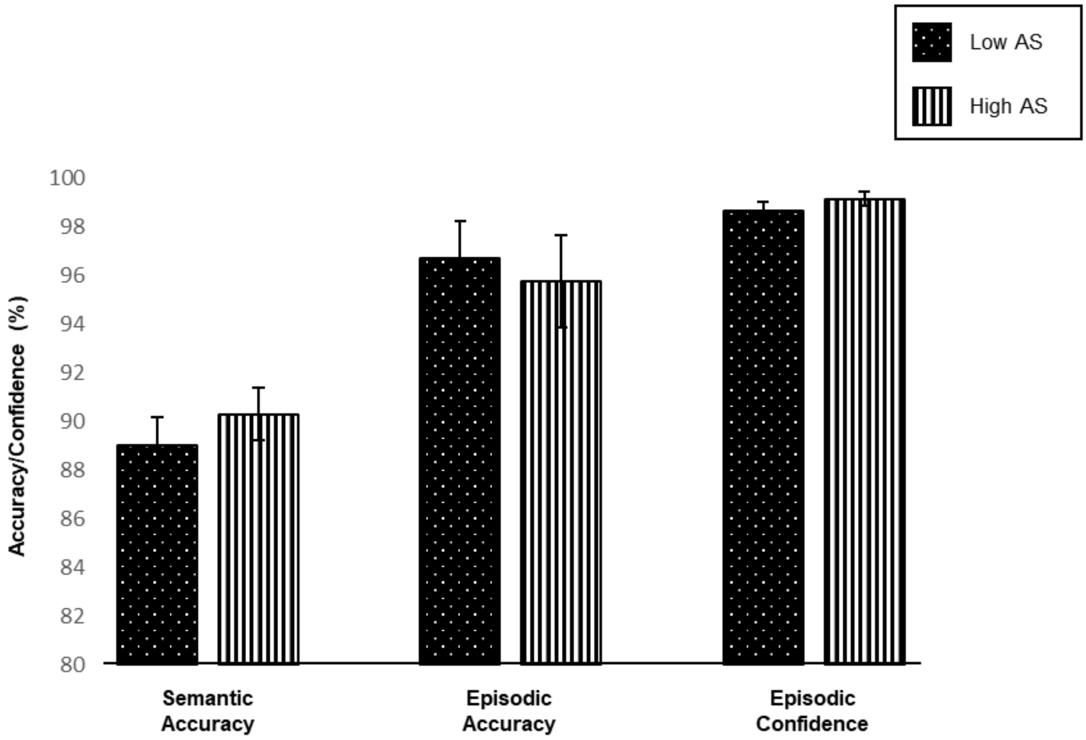

Figure 28 Mean Accuracy and Confidence within the Semantic and Episodic Task for Stimuli Pre-Rated as Low AS or High AS.

It appears from Figure 28 that minimal differences are present in accuracy across both the semantic and episodic tasks and within confidence ratings for the episodic task between the stimuli that was pre-rated as Low AS and High AS. There also appears to be no difference in participants' reaction times for the two tasks between the pre-rated stimuli (Figure 29).

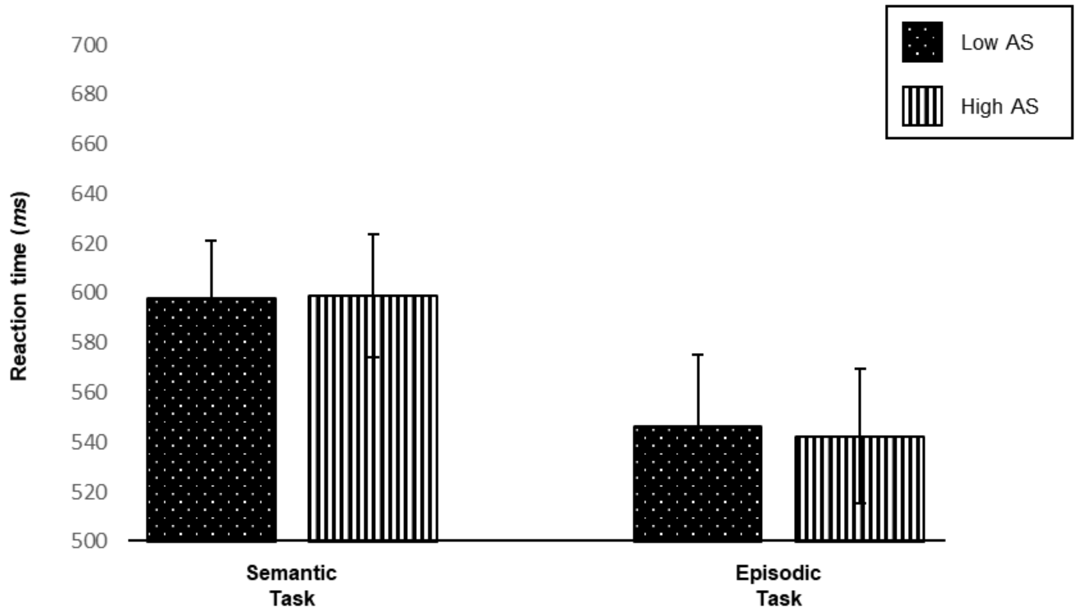

Figure 29 Mean Reaction Time within the Semantic and Episodic Task for Stimuli Pre-Rated as Low AS and High AS Stimuli

3.3.2.1. Effect of Pre-Rated AS on the Semantic Task

A repeated measures ANOVA examining the effect of pre-rated AS in the dead or alive task revealed no significant difference in semantic accuracy for the stimuli that was pre-rated as High AS and those pre-rated as low AS (F (1, 29) = 1.73, p = .20), there was also no significant difference related to AS in participants' reaction time during the semantic task (F (1, 29) = .042, p = .84). Additionally, no interaction was present between pre-rated AS and the APOE group of the participant was present for either semantic accuracy (F (1, 29) = .37, p = .55) or their semantic reaction time (F (1, 29) = .31, p = .59).

Comparison of High AS versus Low AS stimuli within the ERP analysis resulted in the following number of trials per condition: high AS (M = 93.51, SD = 10.39), low AS (M = 94.10, SD = 19.88). All subjects were included in the below analysis.

The repeated-measures ANOVA on the mean voltage amplitudes within the N400 time window (300-500ms) found no significant effect of pre-rated AS, F (1, 29) = .089, p = .77, nor any interaction between pre-rated AS and the factors hemisphere (F (1, 30) = .97, p = .33) and electrode (F (3, 28) = .44, p = .73). There was also no interaction between pre-rated AS of the stimuli and the APOE genotype of the participant on the mean voltage amplitude (F (1, 29) = 2.79, p = .11), nor any three-way interaction between these factors and hemisphere (F (1, 29) = 1.33, p = .26) or electrode (F (1, 27) = .47, p = .70). Therefore, the amplitude of the N400 did not differ between the pre-rated High AS and Low AS stimuli within the semantic task.

A repeated-measures ANOVA on the mean voltage amplitudes within the LPC time window (500-700ms) also found no significant effect of pre-rated AS, F (1, 30) = .47, p = .50, nor any interaction between pre-rated AS and the factors hemisphere (F (1, 30) = .29, p = .60) and electrodes (F (1, 28) = .56, p = .65). We also found no interaction between pre-rated AS of the stimuli and the APOE genotype of the participant and the mean voltage amplitude (F (1, 29) = 3.13, p = .09), nor between these factors and hemisphere (F (1, 29) = .43, p = .52) or electrode (F (3, 27 = .62, p = .61). Therefore, the amplitude of the LPC was not modulated by the pre-rated AS of the stimuli within the semantic task.

3.3.2.2. Effect of Pre-Rated AS on the Episodic Task

Further analysis was completed examining the effect of pre-rated AS on the episodic task. There was no significant difference between participants' accuracy within the episodic task for the stimuli that were pre-rated as high and low in AS (F (1, 28) = 1.20, p = .28), nor any significant difference related to AS in participants' confidence ratings within the episodic task (*F* (1, 28) = 1.43, *p* = .24) or their reaction times (*F* (1, 28) = .45, *p* = .51). There was also no interaction present between the pre-rated AS of the stimulus and the APOE genotype of the participant for episodic accuracy (*F* (1, 28) = .015, *p* = .90), confidence within the episodic task (*F* (1, 28) = .001, *p* = .97) or episodic reaction time (*F* (1, 28) = 2.24, *p* = .15).

Comparison of High AS versus Low AS stimuli within the ERP analysis resulted in the following number of trials per condition; high AS (*M* = 25.5, *SD* = 31.15), low AS (*M* = 25.42, *SD* = 3.70). After pre-processing, five subjects had less than 15 trials remaining so were removed from the below analyses (final sample = 26 participants; 20 ε3 carriers and 10 ε4 carriers).

The repeated-measures ANOVA on the mean voltage amplitudes within the N400 time window (300-500ms) found no significant effect of pre-rated AS, *F* (1, 25) = .37, *p* = .55, nor any interaction between the factors hemisphere (*F* (1, 25) = .32, *p* = .58) and electrode (*F* (3, 23) = .36, *p* = .79). We also found no interaction between pre-rated AS of the stimuli and the APOE genotype of the participant on the mean voltage amplitudes, (*F* (1, 24) = .37, *p* = .55), nor any interaction between the factors hemisphere (*F* (1, 24) = .043, *p* = .84) and electrode (*F* (3, 22) = .56, *p* = .65). Therefore, the amplitude of the N400 was not modulated by the pre-rated AS of the stimuli within the episodic task.

A second repeated-measures ANOVA was run examining the mean voltage amplitudes within the LPC time window (500-700ms) This revealed no significant effect of the pre-rated AS of the stimuli, *F* (1, 25) = .06, *p* = .81, nor any interaction between the factors hemisphere (*F* (1, 25) = 0.17, *p* = .90) and electrode (*F* (3,23) =

.99, *p* = .41). There was also no interaction between pre-rated AS of the stimuli and the APOE genotype of the participant (*F (*1, 24) = 1.72, *p* = .20), nor any interaction with the factors hemisphere (*F (*1, 24) = 1.79, *p* = .19) and electrode (*F (*3, 22) = 1.56, *p* = .23). Therefore, the amplitude of the LPC did not differ between the pre-rated High AS and Low AS stimuli within the episodic task.

In summary, we found no behavioural differences in accuracy, confidence, or reaction time between stimuli pre-rated as High-AS or Low-AS within either the semantic or episodic task. There were also no observed electrophysiological differences relating to the pre-rated AS within the N400 and LPC ERP within either experimental task.

3.3.3. Effects of Prior Knowledge of Stimuli on Overall Task Performance

As in the previous chapter, we were able to examine the effect of an individual's prior knowledge for the stimuli on their associated task performance. Data from the final celebrity questionnaire revealed participants had prior knowledge for 86.19% (SD = 14.22) of presented stimuli. Interestingly, there was a significant difference between the proportion of stimuli the participants had prior knowledge for between participants with the ApoE ε3genotype (*M* = 82.27, *SD* = 38.41) and those with ApoE ε4alleles (*M* = 93.01, *SD* = 25.52), where the ApoE ε4participants reported a greater number of prior knowledge responses to stimuli *t* (1857) = -6.23, *p* <.0001.

Behavioural averages were calculated for accuracy, reaction time and confidence ratings taken from the semantic and episodic experimental tasks for stimuli that participants had prior knowledge for, and those that were unknown to the participant. Means for these variables are displayed in Figure 30 and Figure 31 below.

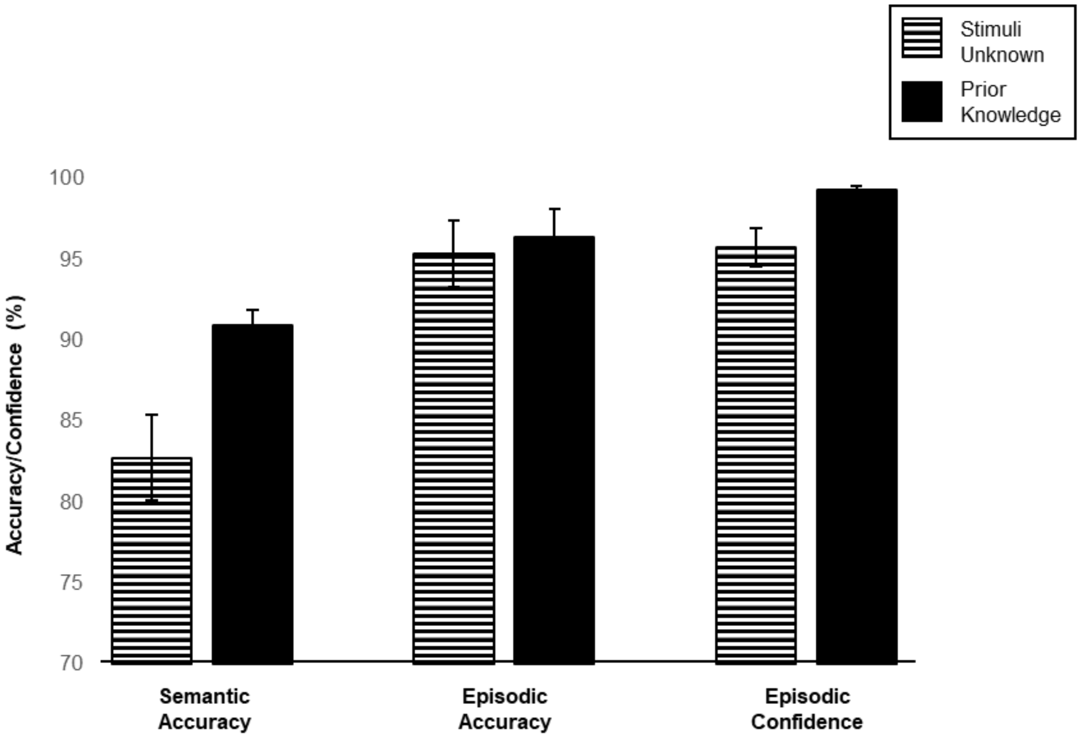

Figure 30 Mean Accuracy and Confidence Ratings for Stimuli Unknown to the Participants, and those they have Prior Knowledge for, across the Semantic and Episodic Task.

It appears from Figure 30 that despite high levels of accuracy and confidence in both tasks, participants responded marginally better to stimuli they had prior knowledge for compared to those unknown to them, this was most pronounced for accuracy within the semantic task.

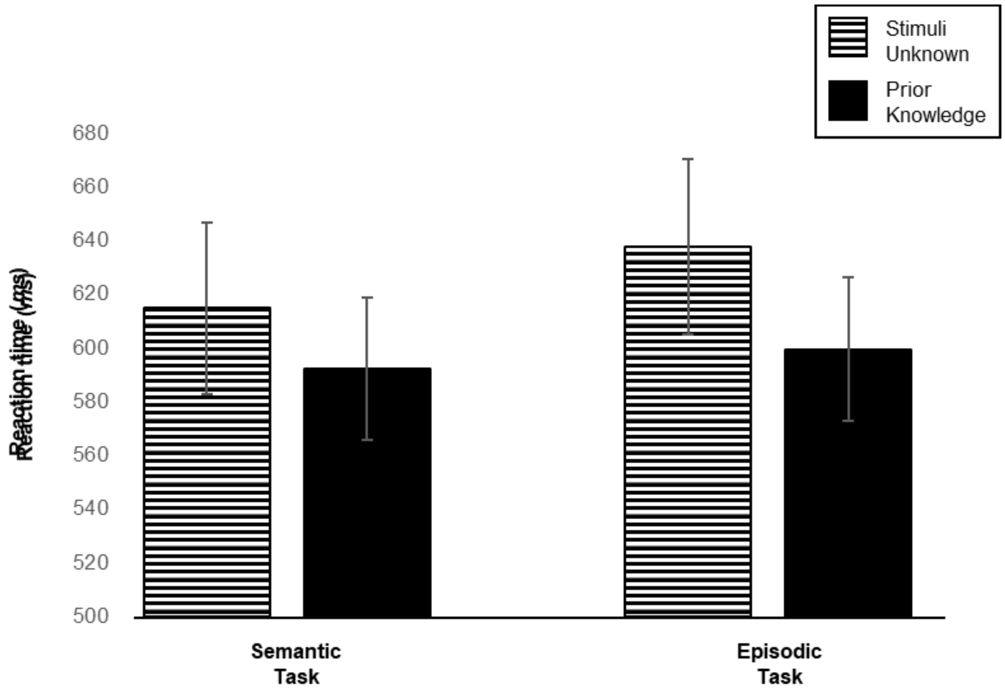

Figure 31 Mean Reaction Times within the Semantic and Episodic Task for Stimuli Unknown to the Participants and those they had Prior Knowledge for.

The same pattern of benefit was observed within the reaction time variables in Figure 31, whereby participants responded faster to the stimuli they had prior knowledge for compared to those they had no knowledge of prior to the study.

3.3.3.1. Effect of Prior Knowledge on the Semantic Task

A repeated measures ANOVA examining the effect of prior knowledge on semantic task performance was conducted, there was a significant difference in semantic accuracy for the stimuli that participants had prior knowledge of and those they did not know prior to the task (F (1, 29) = 9.03, p = .005). From Figure 30, we can see that subjects were more accurate for the stimuli they had prior knowledge of, compared to those that were unknown to them. There was however no significant difference in participants' reaction time during the semantic task (F (1, 29) = .14, p = .71), nor any interaction between prior knowledge and the APOE group of the participant for either semantic accuracy (F (1, 29) = .003, p = .96) or semantic reaction time (F (1, 29) = 2.31, p = .14).

Comparison of stimuli with prior knowledge and those unknown to the participant within the ERP analysis resulted in the following number of trials per condition: prior knowledge (M = 148.94, SD = 38.67), stimuli unknown (M = 41.18, SD = 28.61). Fourteen subjects averaged less than 15 accepted trials after pre-processing, so the below analysis was run with 17 subjects (10 ε3 carriers and 7 ε4 carriers).

A repeated-measures ANOVA on the mean voltage amplitudes within the N400 time window (300-500ms) found no significant effect of prior knowledge of the stimuli, F (1, 15) = .27, p = .61, nor any interaction between prior knowledge and the factors hemisphere (F (1, 15) = .65, p = .43) and electrode (F (3, 13) = .95, p = .44). There was also no interaction between prior knowledge and the APOE genotype of the participant on mean voltage amplitude (F (1, 15) = .05, p = .82), nor any interaction between these factors and hemisphere (F (1, 15) = .17, p = .69) or electrode (F (3,13) = .87, p = .48). Therefore, the amplitude of the N400 was not modulated by prior knowledge within the semantic task.

A second repeated-measures ANOVA on the mean voltage amplitudes within the LPC time window (500-700ms) found no significant effect of prior knowledge, F (1, 15) = .80, p = .38, nor any interaction between prior knowledge and the factors hemisphere (F (1, 15) = .25, p = .63) or electrodes (F (3,13) = .79, p = .52). There was also no interaction between prior knowledge and the APOE genotype of the participant on the mean voltage amplitude (*F (*1, 15) = .42, *p* = .53), nor any interaction between the factors hemisphere (*F (*1, 15) = .16, *p* = .69) and electrode (*F (*3, 13 = .54, *p* = .66). Therefore, the amplitude of the LPC did not differ within participants for stimuli they had prior knowledge of and those unknown to them within the semantic task.

3.3.3.2. Effect of Prior Knowledge on the Episodic Task

Further analysis was completed examining the effect of prior knowledge on episodic task performance. A repeated measures ANOVA found no significant difference between participants' accuracy within the episodic task for the stimuli that were associated with prior knowledge and those unknown to the participants (*F* (1, 29) = 51, *p* = .48), nor within their reaction times within the episodic task (*F* (1, 29) = 1.31, *p* = .26). There was however a significant difference in participants' confidence ratings within the episodic task (*F* (1, 29) = 8.21, *p* = .008), from Figure 30 it is clear participants were more confident in their episodic judgements for stimuli they had prior knowledge for than for those that were unknown to them.

There was no interaction present between the prior knowledge of the stimuli and the APOE genotype of the participant within episodic accuracy (*F (*1, 29) = .03, *p* = .86), episodic confidence (*F (*1, 29) = .07, *p* = .79) or episodic reaction time (*F (*1, 28) = 1.17, *p* = .29).

After pre-processing the EEG data, 27 subjects had less than 15 accepted trials so were removed from the analyses, leaving only 2 available participants. For this reason, no meaningful comparison could be run examining the effect of prior knowledge within the N400 and LPC ERP within the episodic task.

In summary, participants had superior semantic accuracy and greater episodic confidence for stimuli they had prior knowledge of compared to those unknown to them. However, no electrophysiological differences were observed within the N400 or LPC during the semantic task between stimuli associated with and without prior knowledge.

3.3.4. Associated Memory for Stimuli on Task Performance

We also examined the effect of AS on related task performance, based on the final questionnaire. Participants produced associated memories for 31.10% (*SD* = 15.43) of the presented stimuli. Contrary to expectations, there was no significant difference between the ApoE ε3 (*M* = 32.70, *SD* = 46.93), and the ApoE ε4(*M* = 30.89, *SD* =46.24) participants, in terms of the proportion of reported associated memories for stimuli, t (1629) = .75, p = .45.

Behavioural averages were calculated for accuracy, reaction time and confidence ratings for the semantic and the episodic tasks, for stimuli that participants had prior knowledge and an associated memory for (AS), and those that they had prior knowledge of but had no associated memory for (no-AS). Means for task accuracy for the variables associated with AS and those associated with prior knowledge, but no-AS are presented in Figure 32 and Figure 33 below.

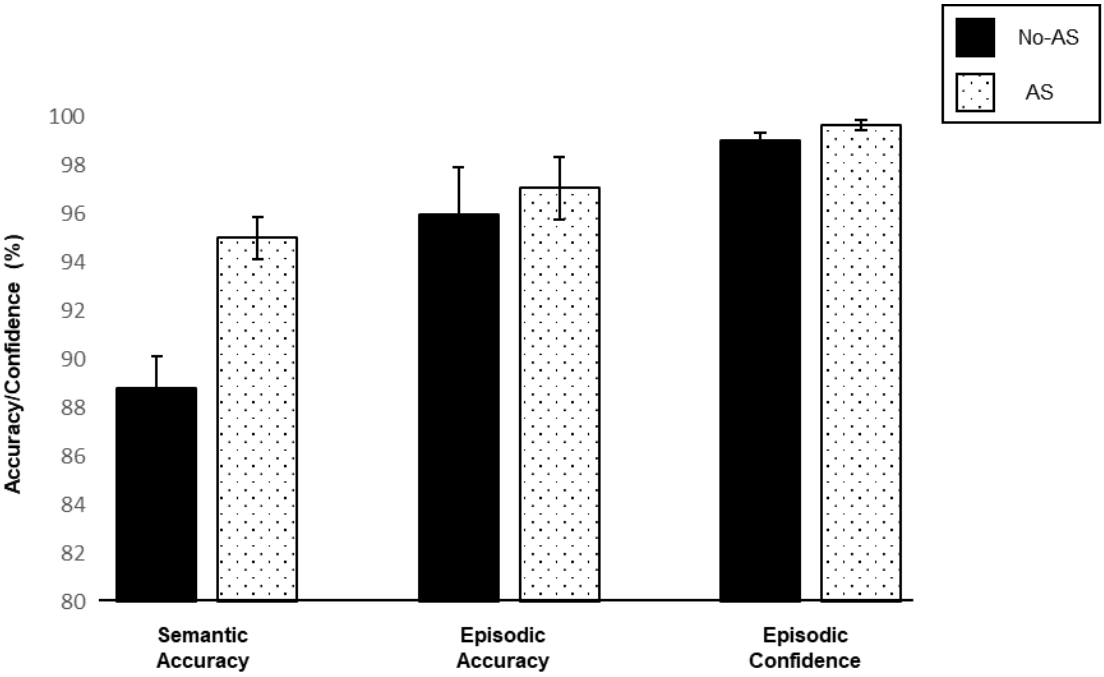

Figure 32 Mean Accuracy and Confidence Levels for the Stimuli Associated with AS and those Associated with Prior Knowledge but no-AS.

It appears from Figure 32 that having an associated memory improves accuracy compared to having prior knowledge to the stimuli alone. This is most apparent within accuracy for the semantic task, although a smaller effect can also be seen within the episodic task.

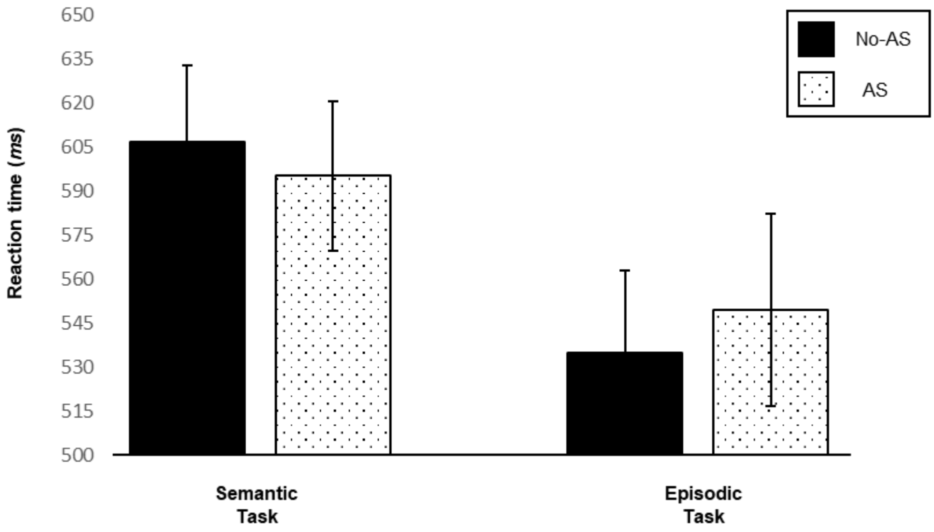

Figure 33 Mean Reaction Times for Stimuli Associated with AS and those Associated with Prior Knowledge but no AS, for both the Semantic and Episodic Task

The same pattern is observed within the semantic reaction time, participants responded faster for stimuli they had an associated AS for. Conversely within the episodic reaction time variable participants were slower for the stimuli with associated memories than for those with prior knowledge but no-AS

3.3.4.1. Effect of Autobiographical Significance on the Semantic Task

A repeated measures ANOVA on the effect of AS on semantic task performance found a significant effect of the associated memory on semantic accuracy (F (1, 29) = 15.71, p <.001), participants were more accurate for the AS stimuli, compared to stimuli they had prior knowledge but no-AS (Figure 32). However, there was no significant effect of AS on participants' reaction time within the semantic task (F (1, 29) = .84, p = .37), nor a significant interaction between AS and the APOE genotype of the participant on their episodic accuracy (F (1, 29) = .76, p = .39) or episodic reaction time (F (1, 29) = .17, p = .68).

Comparison of stimuli associated with AS and those with prior knowledge, but no AS within the ERP analysis resulted in the following number of trials per condition: AS (M = 57.25, SD = 24.96), no-AS (M = 106.64, SD = 37.03). Three subjects were excluded from the below analyses due to having less than 15 accepted average trials (N = 28; 18 ε3 carriers and 10 ε4 carriers).

A repeated-measures ANOVA on the mean voltage amplitudes within the N400 time window (300-500ms) found a significant effect of AS, F (1, 26) = 4.94, p = .04. Whereby stimuli associated with AS were linked with increased negativity within the N400 time period (M = -1.26, SD = 0.20), compared to stimuli associated with prior knowledge but no-AS (M = -0.98, SD = 0.20). Indicating AS has an influence on the N400 ERP within the semantic task (Figure 34). The scalp map shows a negative deflection across centroparietal and posterior parietal regions at the 400ms time window (Figure 35).

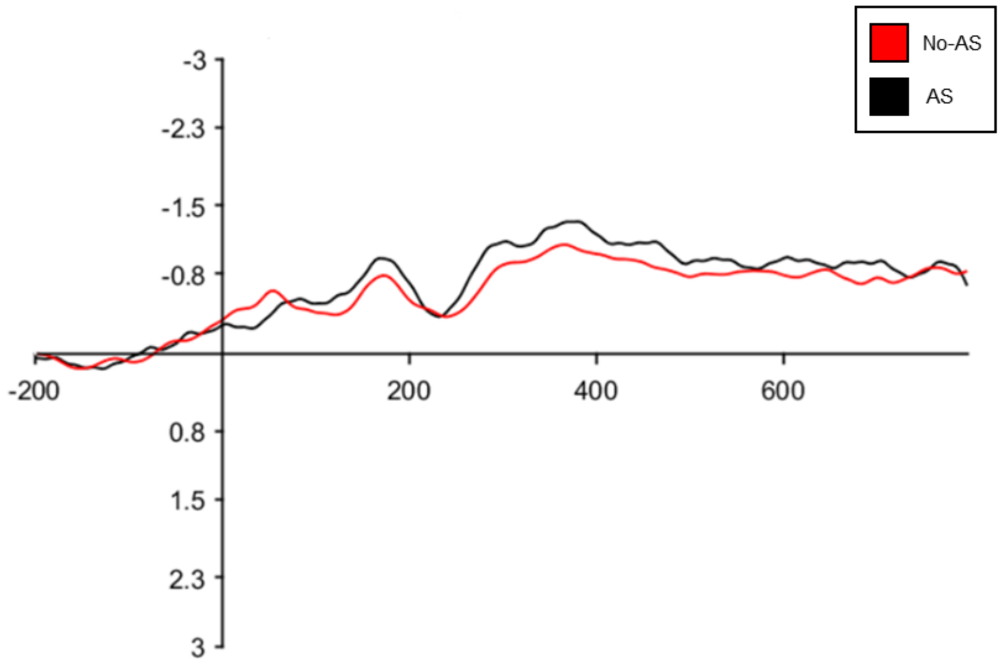

Figure 34 Grand Averaged ERP (n =28) to Faces Participant had Associated AS for and those they had Prior Knowledge of, but no -AS within the Semantic Task. ERPs were Averaged across C1/C2, C3/C4, CP1/CP2, CP3/CP4 to form a Centroparietal ROI.

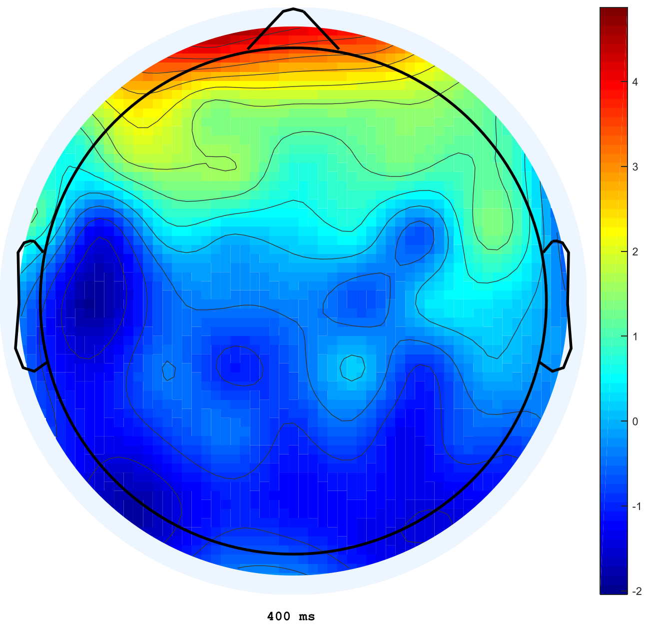

Figure 35 Spline Interpolated Isovoltage Map of the Effect of AS in the 300-500ms Time Window. This Map was Obtained by Subtracting the Mean Voltage of the Grand Mean ERPs Evoked by non-AS Stimuli from those Evoked by AS Stimuli within the Semantic Task

The ANOVA found no interaction between AS and the factors hemisphere (*F* (1, 26) = .02, *p* = .88) or electrode (*F* (3, 24) - .28, *p* = .84), nor was there any interaction between AS and the APOE genotype of participants on the ERP magnitude during the N400 window (*F (*1, 26) = .63, *p* = .43), or between these factors and hemisphere (*F (*1, 26) = 1.99, *p* = .17) or electrode (*F (*3, 24) = .47, *p* = .70).

A second ANOVA on the mean voltage amplitudes within the LPC time window (500-700ms) found no significant effect of associated memory of the stimuli, *F* (1, 26) = .75, *p* = .40. There was also no interaction present between AS and the factors hemisphere (*F* (1, 26) = .21, *p* = .65) and electrode (*F* (1, 26) = .82, *p* = .47), nor any interaction between the mean voltage amplitudes within the LPC time window, the effect of AS and the APOE genotype group of the participant (*F (*1, 26) = 1.98, *p* =

.17) nor between these and the factors hemisphere (*F* (1, 26) = .37, *p* = .55) and electrode (*F (*3, 24) = 1.43, *p* = .26).

3.3.4.2. Effect of Autobiographical Significance within the Episodic Task

Further analysis was completed on the effect of AS on task performance within the episodic task. A repeated measures ANOVA found no significant difference between stimuli associated with AS and those associated with prior knowledge but no-AS for episodic accuracy (*F (*1, 28) = .48, *p* = .49), episodic confidence (*F (*1, 28) = 2.60, *p* = .12) or episodic reaction time (*F (*1, 28) = 1.61, *p* = .22). There was also no interaction between AS and the APOE genotype group of the participant on their task performance for episodic accuracy (*F* (1, 28) = .29, *p* = .60), confidence within the episodic task (*F (*1, 28) = .009, *p* = .92) or episodic reaction time (*F (*1, 28) = .78, *p* = .38).

For the ERP analysis, 20 participants were excluded from the analyses as they had fewer than 15 accepted averaged trials per condition. Eleven participants (8 ε3 carriers and 3 ε4 carriers) were included in the below analysis with the following trials per condition; stimuli associated with AS (*M* = 21, *SD* = 4.62) and stimuli associated with prior knowledge and no-AS (*M* = 27.45, *SD* = 5.84).

The repeated-measures ANOVA on the mean voltage amplitudes within the N400 time window (300-500ms) found no significant effect of associated memory of the stimuli, *F* (1, 9) = 3.90, *p* = .08. There was also no interaction between pre-rated AS and the factors hemisphere (*F* (1, 9) = 1.32, *p* = .28) and electrode (*F* (3, 7) = .18, *p* = .91), nor any interaction with the genotype of the participant and AS on the EEG amplitudes (F (1, 9) = .002, p = .96) or with these factors and hemisphere (F (1, 9) = .02, p = .902) or electrode (F (3, 7) = .50, p = .69.

A second repeated-measures ANOVA on the mean voltage amplitudes within the LPC time window (500-700ms) also found no significant effect of AS, F (1, 9) = .31, p = .59, nor any interaction between AS and the factors hemisphere (F (1, 9) = .56, p = .47) or electrode (F (3, 7) = 1.70, p = .25). There was also no interaction with the genotype of the participant and AS on the EEG amplitudes (F (1, 9) = .35, p = .57) nor any three-way interaction between these factors and hemisphere (F (1, 9) = .07, p = .80) or electrode (F (3, 7) = 1.02, p = .44.

In summary, participants were more accurate in the semantic task for autobiographically significant stimuli compared to those they had prior knowledge of but no-AS. However, there was no effect of AS on semantic reaction time or any of the episodic task variables. Additionally, contrary to expectations, AS was associated with modulation within the N400 within the semantic task, and no effect was observed within the LPC within either experimental task.

3.4. Discussion

Within this chapter, older adult participants encoded famous faces through a dead or alive judgement task, before having their episodic memory tested through an old-new recognition task. Their EEG was recorded through both tasks, following which they completed a follow-up questionnaire to determine their prior experience and ratings towards a stimulus. Their behaviour performance and electrophysiological responses to stimuli were matched to their prior experience, to examine the influence of prior knowledge and AS.

The previous literature (Renoult et al., 2015; Westmacott & Moscovitch, 2003; Westmacott et al, 2004) used normed stimuli that had been previously rated as either very likely to be associated with an episodic memory (high-AS) or stimuli that was generally well known but participants wouldn't typically be able to think of a specific memory for (low AS). When these stimuli were contrasted, they found participants demonstrated superior semantic and episodic task performance for the High-AS stimuli compared to the Low-AS stimuli. However, when similar norming was undertaken within this chapter there was no observable behavioural differences in performance. For this study, stimuli ratings were taken from chapter two to create specialised high-AS and low-AS sets, but we found no significant difference in participants' accuracy or reaction times within the semantic and episodic task, nor were there any differences in confidence ratings within the episodic task, contrary to previous findings (Renoult et al., 2015; Westmacott & Moscovitch, 2003).

One possible explanation for the differing findings lies within individual differences, as all participants have differing personal experiences. Some participants may have high personal memories for stimuli pre-categorised as low-AS by the norming group, or no associated episodic memories for the high-AS stimuli. However, when participants were asked for their prior knowledge and associated memories within the follow-up questionnaire, these responses were highly consistent with the pre-ratings. Therefore, it is unlikely that individual differences would play a large role.

Instead, it is likely that the lack of behavioural findings may relate more to ease of the task; dissimilar to the previous chapter and to the studies by Westmacott and colleagues. (Westmacott & Moscovitch, 2003; Westmacott et al., 2004), this chapter presented each stimuli four times within the semantic task, this was to increase the number of trials for the ERP analysis. This increased repetition gave the participant multiple opportunities to correctly answer the semantic dead-or-alive judgement task, whereas in previous studies they were only asked once. This is illustrated by participants' accuracy of over eighty per-cent for stimuli unknown to them within this chapter, compared to less than sixty per-cent for the unknown stimuli in chapter two (section 2.3.2). This increased stimulus repetition also led to increased rehearsal which inevitably increased participants' recognition memory (Seamon et al., 2002), again evidenced by almost ninety-five per-cent recognition accuracy for the unknown stimuli within this chapter, contrasted with less than eighty per-cent accuracy for the stimuli unknown to participants within chapter two (see section 2.3.2.).

This ease of the tasks may also explain the reduced benefits on task performance effects within this chapter when participants' own prior knowledge or AS was considered. Within chapter two, we demonstrated consistent findings of improved semantic and episodic task performance when a participant had prior knowledge for a stimuli compared to those unknown to them, and a further task performance boost if the stimuli was autobiographically significant to them, as compared to having only relevant prior knowledge. However, within this study the effect of prior knowledge was limited to semantic accuracy and episodic confidence, and the effect of AS was further restricted to participants' semantic accuracy. Although we have again demonstrated an effect of prior knowledge on task performance, and a further improvement for the association of AS, the effect was not observed within the episodic task, inconsistent with the previous chapter and with prior literature (Westmacott & Moscovitch, 2003; Westmacott et al., 2004).

The main purpose of this chapter was to further investigate the underlying processes of prior knowledge and AS by examining the presence and magnitude of the N400 and LPC when participants respond to certain stimuli. Our first comparison utilised the pre-rated stimuli to imitate the study by Renoult and colleagues (2015), however we were unable to replicate their significant findings of increased LPC amplitude in young adults for high as compared to low AS stimuli. We in fact observed no differences in behavioural task performance, nor any electrophysiological differences within either the N400 or LPC between stimuli pre-rated as High-AS or Low-AS stimuli, which is inconsistent with the previous literature (Westmacott & Moscovitch, 2003; Renoult et al., 2015).

One possibility is that no significant findings may in itself be an interesting result and may reflect reductions within AS in ageing. Within the previous chapter, we demonstrated that AS had a greater effect in the young compared to the older adult participants, and as the prior EEG investigation (Renoult et al., 2015) focused solely on young adults there is the possibility that the present reduced effects are the result of reductions within the effect of AS in this older adult sample. This would be supported by other findings that have demonstrated reduced ERP effects in older adult for the N400 (Kutas & Iragui, 1998) and the LPC (Wolk et al., 2009). However, minimal conclusions can be drawn on non-significant findings.

In Renoult et al. (2015), similar effects of AS on the amplitude of the LPC were observed when participants' own associated memories and prior knowledge were considered. As some behavioural benefits were observed for participants having prior knowledge of the stimuli or relevant memories in this chapter, it was of interest to investigate the effect of these processes on the N400 and LPC ERPs within the older adults. Within chapter two, the behavioural effects of both of these processes on task performance was reduced within the older adult sample, and although this was expected for the episodically driven AS, this was not predicted for the effect of prior knowledge of stimuli, which is predominantly semantic. Therefore, one of the aims within the present chapter was to examine if the underlying processes of prior knowledge and AS were more similar within the older adults, compared to young adults (Renoult et al., 2015).

Within the young adults (Renoult et al., 2015) it appeared that level of associated factual knowledge modulated the N400, whereas AS affected the magnitude of the LPC. Within this chapter, we found no significant electrophysiological differences within the N400 or LPC time window for stimuli associated with prior knowledge as compared to stimuli unknown to the participants, despite behavioural differences in semantic accuracy and episodic confidence.

We did however find an unexpected finding where the N400 appeared to be modulated by AS during the semantic task. The mean amplitude of the N400 was more negative for stimuli associated with AS, compared to stimuli with prior knowledge but no-AS. This contrasts with the findings in young adults, of the N400 being modulated only by factual knowledge (Renoult et al., 2015), and not by AS. Although it is worth noting, that we were unable to control for individual factual knowledge for stimuli, due to trial numbers required for the ERP analysis. Therefore, as demonstrated within chapter two and within previous investigations (Renoult et al., 2015), factual knowledge is typically higher for autobiographical significant stimuli compared to those with associated with prior knowledge but no-AS, and this increased deflection within the N400 may reflect this difference in factual knowledge.

In future, a method similar to Denkova and colleagues (Denkova et al., 2006) may be useful, whereby instead of basing the stimuli set on normed information from a number of participants, it may be more efficient to create individual stimuli sets based on participants' own prior knowledge and AS responses, this set can then be controlled for factual knowledge and familiarity prior to the ERP investigation, so as to still provide a high number of trials to contrast the effect of prior knowledge and AS on the N400 and LPC ERPs. Using such method to directly contrast older and young participants may be the best method for investigating the underlying processes of these effects.

The second aim of this study was to contrast participants with APOE ε3and APOE ε4variant alleles, with the expectation that those who carried the APOE ε4 allele may show early degradation in episodic memory (Caselli et al., 2004, 2007; Mayeux et al., 2001). Within this study this would materialise as a poorer recognition performance in the old-new task, a reduced number of associated memories for the stimuli produced, and a reduction in the effect of AS on task performance. We found no differences in the proportion of associated memories reported by either of the APOE genotyped groups, indicating that the APOE 3-4 participants were able to produce a similar portion of episodic memories for stimuli as the APOE 3-3 participants, demonstrating no impact on their episodic performance. This further correlated with no observed differences in the effect of either prior knowledge or AS on associated task performance between the two groups.

Contrary to expectations, the APOE ε4 participants outperformed the APOE ε3 participants in the episodic recognition task, showing greater accuracy, although it is worth noting that both groups achieved an accuracy of over ninety per-cent on this task. Moreover, there was a ratio of eleven APOE ε4participants to twenty-two APOE ε3participants which may have skewed the results and it is also worth noting that the ε3 carriers were marginally older in age than the ε4 carriers which although did not reach significance, may have influenced participants' performance on tasks. For these reasons it is difficult to draw firm conclusions from this finding.

A further aim of this chapter was to contrast the magnitude of the LPC and the N400 between these two APOE groups, as although EEG investigations within these groups are limited, those that have been completed observed attenuation in the amplitude of a number of ERP components (Reinvang et al., 2005; Corby et al., 2012) within those who carry the e4 allele. In this study we found no between-subject effect of APOE group on either the semantically driven N400 ERP time window, nor on the episodic LPC time window.

Although we found no significant differences relating to the APOE carriers, it is worth noting that previous behavioural studies found the greatest episodic deficits for homozygous ε4carriers (Casseli et al., 2004; 2007), and the greatest attenuation in the amplitude of ERP component related to attentional processes was also found in participants that carried two ε4 alleles (Reinvang et al., 2005), therefore it is in line with these findings that no differences were observed within heterozygous ε4 carriers.

In summary, this chapter set out to investigate the underlying brain processes in older adults for stimuli they had prior knowledge of and those associated with AS.

Consistent with chapter two and the discussed prior literature we demonstrated increased semantic accuracy for stimuli associated with prior knowledge compared to those unknown to the participant, and an even greater increase in semantic accuracy for autobiographically significant stimuli. However, contrary to predictions, ERP analyses revealed no significant impact of prior knowledge on either the N400 or LPC time window. Also, contrary to previous findings, the N400 was modulated by AS within the semantic task, which could be indicative of different underlying processes between young and older adults, however firm conclusions are difficult to draw.

CHAPTER FOUR

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Autobiographical Significant Concepts within Public Events and the Relationship to Flashbulb Memory

4.1. Introduction

Findings from the previous chapters, were consistent with literature in the field (Denkova et al., 2006a; Renoult et al., 2015; Westmacott et al., 2004; Westmacott & Moscovitch, 2003) that having prior knowledge of a stimuli leads to improved related task performance for that stimuli; increased accuracy and faster reaction times within semantic and episodic tasks, compared to stimuli unknown to the participant, and that task performance was further improved if the stimuli was autobiographically significant to the participant. However, these findings, and those of the prior literature, have been limited to famous person knowledge. Therefore, the focus of this chapter, is to determine if the influence of AS on task performance can be extended to other semantic concepts, such as public events.

These findings surrounding AS have demonstrated a clear interaction between the semantic and episodic memory systems, wherein an associated episodic memory appears to be influencing performance on both an episodic recognition and a semantic categorisation task, despite the memory not being directly relevant to the task. This demonstrated that even largely semantic concepts, such as famous persons, may also contain episodic elements, but it is not clear if this interaction is exclusive to person knowledge or can extend beyond this.

There is reason to expect that AS may be limited to person knowledge, based on research in semantic dementia patients (Graham et al., 1997; Snowden et al., 1996). In this literature patients with severe degeneration within their anterior temporal lobes, who demonstrated an inability to name famous persons, showed a level of preservation for people who were personally relevant to them including their family, members or neighbours (Giovannetti et al., 2006; Snowden et al., 1996). However, this preservation of knowledge was not able to extend much beyond this. Patients were able to recognise and complete tasks on individuals they personally play sports with and some famous sporting people (Grahams et al.,1997), but their semantic resilience did not extend when tested to the rules of the game, nor any of the sporting terms (e.g., bunker, hole-in-one, etc.). Graham and colleagues (1997) concluded that this specificity of preserved knowledge may relate to distinct person recognition systems, whereby presentation of a name or face activated perceptual units within the brain, which in turn activates multi-modal person-identity nodes (Bredart et al., 1997) and allow accurate familiarity judgements in neurologically intact individuals. It is likely, that person recognition is a special case in which AS can benefit recognition judgements, but that this influence does not extend to other types of knowledge including sporting terms and rules. If this is the case, it is unlikely that AS will influence event knowledge.

However, in healthy individuals, there is some evidence to suggest that AS can increase accessibility of a person's public event knowledge, wherein individuals recall a greater proportion of public events that fall within their reminiscence bump (Janssen et al., 2008b). It is possible that their knowledge of public events for this time, interact with their significant autobiographical memories for this period, which makes these public events more familiar and more accessible for retrieval. Therefore, an element of autobiographical influence may be present for event knowledge, and this increased familiarity and accessibility for certain events could implicitly influence participants' associated task performance.

The secondary element of interest for this chapter is the effect of time on participants' prior knowledge of events and the prevalence of AS responses and the interaction between time and these processes on task performance. Literature examining the effect of prior knowledge has indicated that the presence and influence of this is greater for dated stimuli within older adults, and greater for more recent stimuli within young adults (Bäckman et al., 1987; Backman & Herlitz, 1990; Wahlin et al., 1993; Xie & Zhang, 2017). Whereas, when examining AS within semantic dementia patients, the effect appears for most recent stimuli (Graham et al., 1997; Snowden et al.,1996). This is consistent with Consolidation Theory (Squire & Alvarez, 1995) and The Transformation Hypothesis (Moscovitch et al., 2016) which propose that information becomes more semantic over time. In line with this, it is likely semantic prior knowledge responses will have greater prevalence and a greater influence on task performance for the most dated information, whereas episodic AS will be more prevalent and have greater influence on more recent information.

However, the results of chapter two did not match these expectations. We observed that levels of prior knowledge in the older adults were greatest across both the most dated and most recent time periods compared to an intermediary period, and the greatest number of autobiographically significant stimuli fell within the most dated time period. Moreover, when considering task performance, we found that having prior knowledge was most beneficial for the most recent stimuli and least beneficial for the most dated. The opposite was true for AS, which had the greatest effect on stimuli that fell within the most dated time period. Therefore, within these results, semantic knowledge had the greatest influence on more recent stimuli and episodic memories held greatest influence on the most dated information, contrary to theories of semanticisation over time (Squire & Alvarez, 1995; Moscovitch et al., 2016).

However, the time span of the stimuli used within chapter two limited the findings, stimuli ranged from 1961 to 2016 for the older adults, so conclusions for date of stimuli were restricted to the previous fifty years. The young adults were also not included in these analyses, as their stimuli set spanned only eight years (2008-2016). Further to this, the use of famous persons made it difficult to accurately time stamp the stimuli, as often celebrities have careers spanning lifetimes and participants could have prior knowledge from any given period of time, which creates validity issues. To better investigate the effect of time on prior knowledge and AS, public event knowledge will be examined within this chapter. Public events benefit from being temporally locked, they have a specific date on which they occurred, and therefore can provide a more valid method of examining the effect of time. We are also able to extend the presented date span of the stimuli, as participants are likely to have knowledge of historical events having taken place before their birth. For this reason, within this chapter, event stimuli for the older adults ranged from 1933-2018, and from 1983-2018 for the young adults, a span of 85 and 25 years, respectively. This covered the majority of each participants' lifespan and provides a wider date range for the investigation of time on AS.

The majority of studies to date have focused on knowledge surrounding public events to examine participants' semantic knowledge (Hirano et al., 2002; Howes & Katz, 1992; Katz & Howes, 1988; Sagar et al., 1988; Squire, 1974), but one study by Petrican and colleagues (2010), utilised the remember-know paradigm (Tulving, 1985) to examine episodic involvement in event knowledge over time. Participants were asked to make remember, know, or don't know judgements for a series of real world and imaginary events. They found that semantic 'know' responses followed a linear decrease from the most recent (1992-2001) to the most dated events (1952-

1961) and ‘remember’ responses for events showed a sharp decrease from the most recent time period (1992-2001) to the intermediary time period (1982-1991), then remained stable across the three most dated time periods (1952-1981). Their findings for prior knowledge were similar to our own findings from chapter two, that prior knowledge responses were greatest for most recent stimuli, which is inconsistent with semanticisation theories (Squire & Alvarez, 1995; Moscovitch et al., 2016), which predict the opposite linear trend. However, the higher proportion of remember responses found for the most recent stimuli are supportive of these theories, and consistent with previous findings in semantic dementia patients (Snowden et al.,1996). This chapter will further this research by examining the prevalence of prior knowledge and AS for stimuli across the lifespan, but also the impact of time on these processes and the effect on participants’ associated task performance.

A third line of interest for this chapter, is the contrast between AS and flashbulb memories. As discussed in chapter one (section 1.6.1), flashbulb memories are a special type of autobiographical memory encoded when a public event is experienced (Brown & Kulik, 1977), for example a vivid memory for hearing about the 9/11 terrorist attacks (Conway et al., 2009) or even the EU referendum results (Raw et al., 2020). What makes these memories interesting is that the memory for the source of event learning (how they heard about the event), and the associated event knowledge are stable over long periods of time (Curci et al, 2015; Hirst et al., 2015; Schmolck, Buffalo & Squire, 2000). There is clear conceptual overlap between the memory boost observed from the association of a flashbulb memory, and the task performance boost we have evidenced for the association of AS. Therefore, it is of interest within this chapter to examine whether any performance boosts associated with flashbulb memories may differ from the effects of AS.

Additionally, as the strength of flashbulb memories and their general resilience to time decay has been found to vary by proximity to the event (Er, 2003; Kopp et al., 2020; Neisser, 1996; Schmolck et al., 2000; Talarico & Rubin, 2007) and event valence (Bohn & Berntsen, 2007; Kensinger & Schacter, 2006; Peace & Porter, 2004; Raw et al., 2020), it will be of interest to examine what impact these factors will have on participants' task performance for stimuli associated with 'typical' episodic memories, and for stimuli associated with more specific flashbulb event memories.

In summary, the main purpose of this chapter is to determine whether the consistent findings of improved task performance following association of prior knowledge and AS, specifically within famous person knowledge, can be extended to public event knowledge. Additionally, by using event stimuli which are naturally temporally fixed, we can better examine the impact of time on both the prevalence of prior knowledge and AS, but also the interaction of time with these processes on task performance. Finally, we can examine if the phenomena of flashbulb memory are a form of AS, and whether their association will result in superior task performance compared to stimuli associated with prior knowledge but no event memory.

4.1.1. Chapter Aims & Hypotheses

1. To examine if having prior knowledge of a public event or associated AS will result in superior semantic or episodic task performance for that event compared to those unknown to the participant.
    a. Previous research for famous persons (Westmacott & Moscovitch, 2003; Renoult et al., 2015) and our own findings from chapter two

have shown that the association of prior knowledge leads to superior task performance for that stimuli compared to those unknown to the participant, and that task performance is further improved for autobiographically significant stimuli. Based on this, we predict that participants will perform better within the semantic and episodic task for public events they have prior semantic knowledge of, and that their task performance will be further improved for events that are autobiographically significant to them.

2. To examine the impact of time period of stimuli on the prevalence of prior knowledge and AS responses, and also the impact of time on the behavioural effect of these processes on associated task performance.
    a. Consolidation theory (Squire & Alvarez, 1995) and the Transformation Hypothesis (Moscovitch et al., 2016) propose memories become more semantic over time. In line with this proposal, Petrican and colleagues (2010) noted that participants gave a greater number of 'remember' responses for more recent compared to dated public events, and investigations within semantic dementia have also highlighted the effect of AS as greatest for most recent stimuli (Snowden et al., 1996). For this reason, we expect the greatest proportion of AS responses to be for stimuli in the most recent time periods, and that the effect of associated AS on behavioural task performance will also be greatest within this period.
    b. In an extension of this, prior knowledge should be most prevalent for the most dated period. However, our own findings from chapter two indicated that prevalence of prior knowledge was greater for both the

most dated and most recent, and that the behavioural effect of prior knowledge on task performance was greatest for the most recent time periods. This was in line with Petrican et al., (2010) who found a linear decrease of 'know' responses from most recent to most dated. Therefore, within this chapter we predict that the greatest proportion of participants' prior knowledge will fall within the most recent time periods, and that the associated behavioural effect of prior knowledge on task performance will also be greatest for these periods.

3. To investigate the impact of elements of the associated event memory, including proximity to the event and event valence on participant task performance

- **a.** Previous investigations on flashbulb memory have indicated that proximity to the event affects memory strength, and later recall resilience, with the strongest memories being observed for events the participant had first-hand experience of (Er, 2003; Neisser et al., 1996; Pezdek, 2003). We therefore predict that the behavioural effect of AS on task performance will be greatest for events with the closest level of participant proximity.
- b. Event valence has also been shown to affect the strength of the associated flashbulb memory, with positive events typically receiving more rehearsal (Bohn & Bertsen, 2007; Talarico & Moore, 2012), but negative events typically being better factually remembered (Kensinger & Schacter, 2006; Peace & Porter, 2004; Raw et al., 2020). As findings on event valence are mixed, we expect differences

within associated task performance for events participants considered positive and those they consider negative.

4.2. Method

4.2.1. Participants

A total of sixty-four participants took part in this study, thirty-five were young adults (5 male) aged 18-24 (*M* = 19.94, *SD* = 1.37) and twenty-nine were older adults (9 male) aged 65-80 (*M* = 72.14, *SD* = 4.12). The young adult sample were recruited from the University of East Anglia's School of Psychology SONA participation system, and the older adult sample were recruited from the School of Psychology's paid participant panel.

All participants were free from any known neurological or cognitive impairment (older adults M-ACE score > 25, *M* = 28.76, *SD* = 1.37). Young and older adult participants were matched in education, with young adults having on average 13.5 years of education (*SD* = .56) which did not significantly differ from the older adults average of 14.1 years of education (*SD* = 1.85), t (60) = -1.639, p = .112.

All participants gave their informed consent and were compensated for their time. Older adults were financially compensated in line with the schools' financial reimbursement policy, and the young adults received partial course credit through the SONA system.

4.2.2. Stimuli

The first experimental task used a ‘Home’ or ‘Away’ judgement as an objective semantic measure for evaluating public events, so both events from the UK and overseas were required. The events were selected following a pilot (*N* = 62, 38 participants 18-35 years, and 24 participants 65-72) of 544 events taken from ‘onthisday.com’. Public events included natural disasters, royal weddings, political events etc., that took place between 1933-2018. This time range was taken to capture AS across the lifespan of the older adult participants, considering the oldest participant could be 85 years of age. This meant some events could occur prior to the participants birth, although it is anticipated that memories may still be present from learning through schooling or other second-hand sources.

The pilot presented participants with a series of events and asked them to select whether they remember, know, or don’t know each event. The ‘remember’ response was detailed as ‘*you can recollect a particular image from the TV, radio or newspaper coverage of the respective event, or you have a personal experience associated with it, such as your thoughts, emotions or the specific circumstances under which you first found out about the event*'. Participants were asked to tick the ‘know’ response if ‘*the event is familiar to you, or you know factual knowledge surrounding it but you cannot recollect any personal experience or any specific details related to the TV, radio or newspaper coverage of the respective event*’, and participants were asked to select ‘don’t know’ if the event was completely unfamiliar to them (taken from Petrican et al., 2010).

From this pilot, events were awarded a recognition score. Remember responses were scored two, know responses were scored one and don’t know responses were coded as zero. These scores were summed and divided by the number of participants that participated, to form an average prior experience score. The events with the overall highest prior experience score were used as stimuli (young adults; *M* = 85.41, *SD* = 11.38, older adults; *M* = 71.57, *SD* = 32.11).

Events were counterbalanced across 17 time periods for the older adult participants (1933-37; 1938-42; 1943-47; 1948-52; 1953-57; 1958-62; 1963-67; 1968-72; 1973-77; 1978-1982; 1983-87; 1988-92; 1993-97; 1998-02; 2003-07; 2008-12; 2013-18), and 7 time periods for the young adult participants (1983-87; 1988-92; 1993-97; 1998-02; 2003-07; 2008-12; 2013-18) to ensure presented events were spread relatively evenly across the lifespan.

There was not an equal split of UK and world events due to the pilot resulting in a higher recognition score for the UK events (*M* = 71.36, *SD* = 27.94) compared to the world events (M = 60.68, *SD* = 21.97), which reached significance (t (430) = 3.861, p <.0001). Therefore, both the older and young adults were presented with events in a 5:4 ration for UK and world events, respectively.

This resulted in 180 public events (Appendix N) made up of 100 UK events and 80 world events. Events were presented as written text in 48pt font and Courier New type case. As the events were chosen based on pilot responses, there was great variation in the number of characters; young adult list ranged from 13-73 characters (*M* = 42.04, *SD* = 12.17) and the older adult list ranged from 13-75 characters (*M* = 39.40, *SD* = 13.09). Character length can affect reading speed and therefore task reaction time (Jackson & McClelland, 1979), however, we found no significant difference in character number between the UK or world events (Young; t (176) = 1.464, p = .145, Old; t (176) = .038, p =.970) nor between the designated old or new events *(*Young; *t* (176) = 1.095, *p* =.275, Old; *t* (176) = -.869, *p* = .386*)*, so variation within character length is not expected to impact task performance.

4.2.3. Experimental Tasks

Participants completed two computer-based tasks presented in E-Prime 2.0 (Psychology Software Tools, Pittsburgh, PA), presented on a 24-inch monitor.

4.2.3.1. Home or Away (Semantic) Task

The first was an objective location-based semantic task. In this task participants viewed 120 events and were asked to make a judgement on whether the event took place within the UK, or somewhere else in the world.

In this task, participants first viewed written instructions explaining that they would be making a location judgement for each presented stimulus. First, they would see a fixation cross '+' on screen for one second that they should focus on to prepare for the stimulus to appear. Following this, a famous event was presented on screen, they were asked to press '1' on the keypad if they thought the event took place within the UK or '2' on the keypad if the event took place anywhere else in the world. They had up to four seconds to do this. Text was presented in Courier New font and 46pt type face. The words '*1 = HOME'* and '*2 = AWAY'* were presented in the bottom left and right-hand corner, respectively, to remind participants if required.

Once they pressed a response, participants were instructed to make a confidence rating based on this judgement, where they could press keys '1','2', or '3' to indicate their confidence level. The instructions '*How confident are you in that decision?*'

were presented at the top of the screen, with '*1 = Highly Confident*' written directly below, followed by '*2 = Somewhat confident'* and '*3 = not at all confident'*. This text was presented in Courier New font and 24pt type face and aligned to the centre of the screen. Following this judgement, the fixation cross was shown on screen again and the procedure repeated.

Break screens were included every thirty events to reduce participant fatigue. The task took approximately six minutes to complete. Response buttons were counterbalanced within this task so half of the participants were asked to press '1' to indicate a world event and '2' to indicate a UK event.

4.2.3.2. Old-New Recognition (Episodic) Task

Within the old-new recognition task participants viewed the same stimuli from the semantic task, plus an additional 60 new stimuli and were asked to make an old or new judgement.

For this task, participants were again given written instructions. They were told they would see a fixation cross '+' on screen for one second and following this the event would appear on the centre of the screen. When the stimuli were on screen they were instructed to press '1' on the keypad if they believed the stimuli was 'old' and that it had appeared in the previous task, or to press '2' on the keypad if they believe the stimuli was 'new' and that it had not appeared in the previous task. They had up to four seconds for this judgement. Text was presented in Courier New font and 46pt type face. The words '*1 = OLD*' and '*2 = NEW*' were presented in the bottom left and right-hand corner, respectively.

Following this, they were instructed to make a confidence rating based on this judgement, where they could press keys '1','2', or '3' to indicate their confidence level. The instructions '*How confident are you in that decision?*' were presented at the top of the screen, with '*1 = Highly Confident*' written directly below, followed by '*2 = Somewhat confident'* and '*3 = not at all confident'*. This text was presented in Courier New font and 24pt type face and aligned to the centre of the screen. Following this judgement, the fixation cross was shown on screen and the procedure repeated.

Break screens were again provided after every thirty events to reduce participant fatigue. The task took an average of 12 minutes to complete. Again, response buttons were counterbalanced within this task, so half of the participants were asked to press '1' for events they believed were new, and '2' for events they considered old (already presented in the home-away task).

4.2.3.3. Final Event Questionnaire

Following both experimental tasks, participants were asked to complete an in-depth questionnaire about the public event stimuli. This questionnaire was presented using Qualtrics (Qualtrics, Provo, UT) a web-based survey tool capable of collecting quantitative and qualitative data.

The questionnaire asked participants a series of questions that were repeated for each public event stimuli shown in the home-away semantic task ("old" stimuli in the recognition task). Participants were first shown an example event with these questions and example responses, prior to completing the questionnaire (Appendix O).

For each public event participants were asked firstly '*what is your prior knowledge of this event?*' with three possible responses; remember, know, or don't know. As with the pilot a 'remember' response was detailed as '*I can recollect a particular image from the TV, radio or newspaper coverage of this event or I remember a personal experience such as my thoughts and emotions, or the specific moment in which I found out about the event'.* The 'know' response was detailed as *'This event is familiar to me, or I know some factual information about this event, but I cannot recall any news coverage of this event nor do I have an associated personal experience*' or participants could select don't know if 'the *event was completely unfamiliar to me'.* If they selected 'remember' or 'know', they continued onto the next question. If they selected 'don't know' to this question, the survey skipped all other questions for this event and presented the next event.

The next question asked how the participant learnt about the event with the options; '*First-hand experience - personally witnessed the even*t', '*Saw the media coverage - on the day/around the time of the event. e.g., Newspaper, TV or radio*', '*Second-hand experience - told about the event by another person such as a friend or relative*', '*Later or historical media coverage*' or '*Other - please state*' to capture proximity to the event.

The next question asked a judgement of familiarity for the event on a Likert scale from 0-4 where 0 is '*I don't know about this event*' and 4 is '*I followed the news coverage for this event closely*'. Following this, to capture event valence participants were asked for their opinions or emotions towards the event on another Likert scale from '*I feel very negatively about this event*' through to '*I feel very positively about this event*'.

The next few questions asked for factual knowledge relating to the event. Participants were asked to briefly describe the event, to name persons of interest within the event, and name the country in which the event took place. They were also asked when the event took place, selecting one time period among selectable options (17 time periods for the older adult participants; 1933-37; 1938-42; 1943-47; 1948-52; 1953-57; 1958-62; 1963-67; 1968-72; 1973-77; 1978-1982; 1983-87; 1988-92; 1993-97; 1998-02; 2003-07; 2008-12; 2013-18, and 7 time periods for the young adult participants ; 1983-87; 1988-92; 1993-97; 1998-02; 2003-07; 2008-12; 2013-18). They could also type the exact date in an additional box if they could remember. These responses were marked to provide an objective factual knowledge score out of five.

Crucially, within the questionnaire participants were asked '*Do you have a personal event memory related to this event? For example, a particular episode in which you watched, listened to, or heard about the famous person, or if reading the person's name triggers some other specific memory. E.g., recalling a time, you sang along to their album in the car*'. If participants gave a no response, the survey skipped the remaining questions and proceeded to the next stimuli. If they stated that they did have a memory, they were asked if they were happy to disclose it, and to provide ratings of vividness (0-4 Likert scale, not at all vivid to very vivid) and for their emotional response at the time of the memory (very unhappy, somewhat unhappy, indifferent, somewhat happy or very happy).

Additionally, they were asked when the memory took place, and if they could remember where they were when they experienced the memory, this was to capture flashbulb style memories where individuals report they can vividly recall where they were when they learnt about an event (Brown & Kulik, 1977).

The end of the final event questionnaire collected demographic information for each participant including gender, age and highest level of education achieved to date. The demographic element also asked participants to complete questions for the Pittsburgh Sleep Quality Inventory (Buysse et al., 1989) and the PHQ-9 (Kroenke et al., 2001) mood questionnaire, both of which have been correlated with episodic memory performance (Kizilbash et al., 2002; Miyata et al., 2013).

Participants completed the questionnaire at their own pace. The time taken to complete the questionnaire varied between participants due to the variance in number of events known and number of associated memories provided. On average, the young adult participants completed the questionnaire within 45 minutes and the older adult participants completed in 90 minutes.

4.2.4. Procedure

Young adult participants responded to an advert on the SONA participation system (Appendix P), and older adult participants responded to an email advertisement from the School of Psychology's paid participant panel (Appendix Q). They were informed the study was examining how personal significance would affect judgements and that they would be completing three computer-based tasks, making factual and personal judgements on a series of public events. Upon attending the lab, they were provided with an information sheet (Appendix R) and given the opportunity to ask any questions prior to giving their informed consent.

Participants were seated at a computer desk, in front of a computer screen approximately 60cm distance from their eyes. They worked through the home-away semantic judgement task followed by the old-new episodic recognition task on the computer. Following this they were then shown an example event questionnaire of the questions they would be asked and example responses. Participants were asked to work through the questions at their own pace. The older adult participants were given the opportunity to complete the event questionnaire at home to limit fatigue from lengthy lab sessions. They were instructed to complete within 24 hours of leaving the lab. Prior to leaving the lab, all participants were thanked for their time, and given a verbal and written debrief (Appendix S) detailing the aims of the investigation to examine how the presence of any autobiographical memories for stimuli disclosed in the event questionnaire, would affect performance in the earlier semantic and episodic behavioural tasks.

4.3. Results

Task accuracy, reaction time and confidence ratings were taken from both the semantic and episodic tasks, these were linked to the participant responses from the event questionnaire. Participants' questionnaire responses were marked to obtain ratings for prior knowledge (remember, know, don't know), familiarity (0-4 Likert scale), event valence (-2 to 2 Likert scale), factual knowledge (scored out of 5), whether there was an associated memory present (yes or no), and the details surrounding this memory for each individual stimulus. Percentages were calculated for task confidence, familiarity of the stimuli, associated factual knowledge for the stimuli and related emotional salience for ease of comparison.

We found no correlation between participants' sleep quality (PSQI; *M* = 5.55, *SD* = 3.29) nor their depression score (PHQ-9; *M* = 5.68, *SD* = 5.60) and their memory performance within the episodic task (*M* = 75.57, *SD* = 11.88), *r* (62) = .08, *p* = .56 and *r* (62) = .20, *p* = .12, respectively, so these were not included as co-variates in the following analyses.

4.3.1. Task Performance

Both young and older adults performed the home-away semantic task and old-new episodic task equally well, there was no significant difference between the young adults (*M* = 73.59, *SD* = 14.32) and the older adults (*M* = 79.46, *SD* = 18.03) in accuracy within the semantic task. *t* (62) = -1.45, *p* = .15, nor did we observe any age-related differences in accuracy between the young (*M* = 75.47, *SD*= 9.80) or older adults (*M* = 73.49, *SD* = 14.09) within the episodic task, *t* (62) = .66, *p* = .51.

4.3.2. Prior Knowledge of the Event

Participants were asked in the final event questionnaire about their prior knowledge of the event, particularly whether they 'remember' – could recollect a particular memory of the event, 'know' – had no retrievable memory for the event but had some factual knowledge or if they didn't know the event. Data from this questionnaire revealed no significant difference between young (*M* = 34.42, *SD* = 18.91) and older (*M* = 41.87, *SD* = 20.37) adults for the percentage of stimuli they had prior knowledge for (know or remember responses), *t* (61) = -1.50, *p* = .14. We also observed no significant difference between the young (*M* = 14.73, *SD* = 9.88), and the older (*M* = 20.37, *SD* = 15.98) adults in the percentage of remember responses they provided for the events, t (61) = -1.65, p = .11).

4.3.2.1. Effect of Prior Knowledge on Task Performance

To examine whether level of prior knowledge for the stimuli would affect associated task performance. Behavioural averages for accuracy, reaction time and confidence ratings were taken from the semantic and episodic tasks for stimuli that participants had prior knowledge of (provided a 'know' response to), those they had prior knowledge of and an associated memory for (provided a 'remember' response), and for those that were unknown to them (provided a 'don't know' response). Means for task accuracy and reaction times are presented in Figure 36 and Figure 37 below.

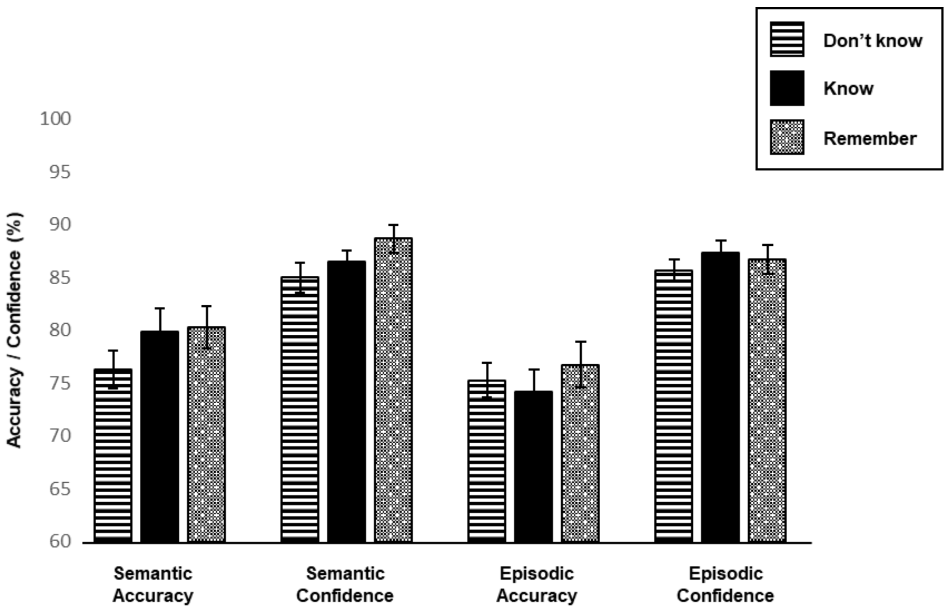

Figure 36 Mean Accuracy and Confidence Levels for Stimuli Associated with Participants' Don't Know, Know or Remember Responses Across the Semantic and Episodic Tasks.

Limited variation is seen within the accuracy and confidence variables between the prior knowledge responses in Figure 36. Within the semantic task it appears that participants responded marginally more accurately and with more confidence to the events they gave ‘know’ and ‘remember’ responses to, compared to those they didn’t know, however this pattern was not present within the episodic task.

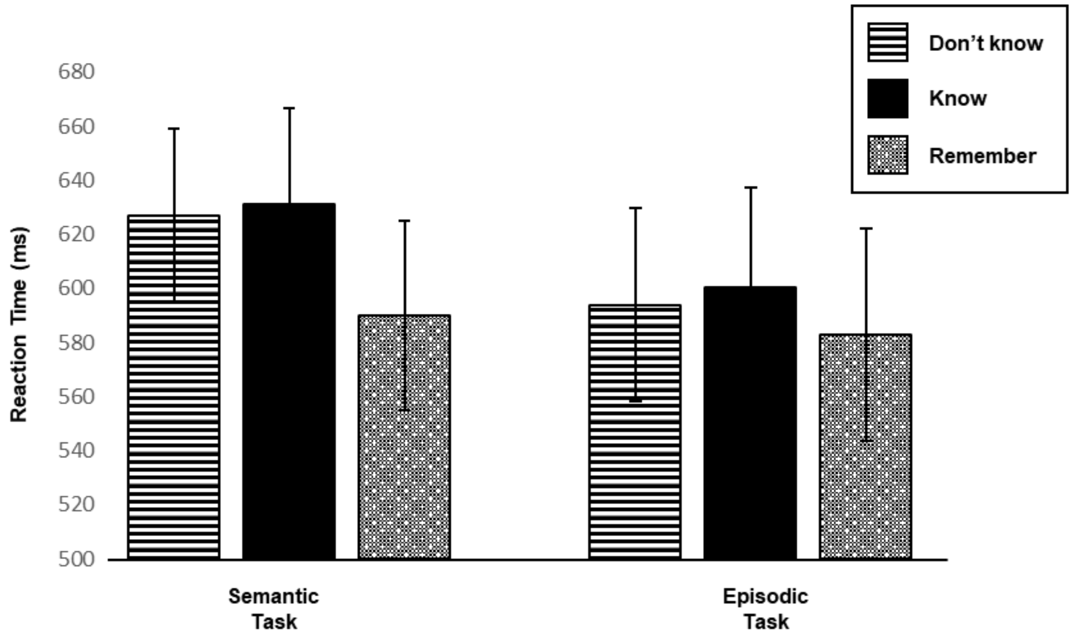

Figure 37 Mean Reaction Times Within the Semantic and Episodic Task for Stimuli Participants Provided Don’t Know, Know, or Remember Responses.

Observing the mean reaction times within Figure 37, it appears that participants were fastest for events they gave a ‘remember’ responses to, compared to those they awarded a ‘know’ response or those unknown to the participant across both the semantic and episodic task.

A repeated measures ANOVA was conducted, examining the impact of prior knowledge of the stimuli on task performance. ~~This revealed a significant main effect of prior knowledge, Wilks' Lambda = .80, F (12, 226) = 2.27, p =.01. Follow-up univariate analysis showed this was significant for; semantic accuracy (F (2, 118) = 3.50, p = .04), semantic confidence (F (1, 118) = 5.03, p =.01) and semantic reaction time (F (2, 118) = 3.23, p = .04).~~ There was a significant effect of semantic accuracy F (2, 60) = 5.28, p = .008; semantic confidence F(2, 59) = 4.72, p = .013 and semantic reaction time F (2, 59) = 2.93, p = .06. This did not reach significance for episodic accuracy F(2, 60) = .89, p = .42; episodic reaction time F(2, 60) = .35, p = .71 and episodic confidence F(2, 60) = 3.94, p = .34.

Paired samples t-tests highlighted that within the semantic accuracy variable, participants were significantly more accurate for events associated with 'know' responses (t (62) = -2.40, p = .02), and those associated with 'remember' responses (t (62) = -2.87, p = .006) compared to those they didn't know, but there was no significant difference in accuracy between the known or remembered events (t (62) = -.37, p = .76).

Within semantic reaction time, participants were faster at responding to the events they gave 'remember' responses to compared to those they didn't know (t (61) = 1.99, p =.05) and those they provided a 'know' response to (t (61) = 2.33, p =.02).

Finally, within the semantic confidence variable, participants were significantly more confident when they gave 'remember' responses to events compared to when they didn't know the event (t (61) = -3.22, p = .002). There was no significance in semantic confidence between the 'remember' responses and the 'know' responses (t

(61) = -1.89, p = .06). nor between the events they gave ‘know’ responses to and those they didn’t know (t (61) = -1.18, p = .24).

There was no significant interaction between the age group of the participant and prior knowledge of the event, ~~Wilks’ Lambda = .864, F (12, 266) = 1.43, p = .15~~ on participants’ semantic accuracy F (2, 60)= 1.68, p = .20; semantic confidence F (2, 59) = 6.38, p = .13; semantic reaction time F(2, 59) = .023, p = .98; episodic accuracy F (2, 60) = 1.28, p = .29; episodic confidence F (2, 60) = 1.29, p = .12 and episodic reaction time F (2, 60) = .95, p = .39.

Taken together, this indicates that having some prior knowledge of the event resulted in superior accuracy, faster responses and greater confidence within the semantic task, and providing a remember responses further improved participants’ reaction time and confidence within the semantic task compared to providing a known response. No significant effect of prior knowledge was found on episodic task performance.

4.3.3. Effect of Autobiographical Significance on Task Performance

Within the final questionnaire, participants were asked to disclose any associated memories they had for the events, this revealed a disparity between the proportion of ‘remember’ responses given and the disclosed associated episodic memories. The young adults provided associated memories to the remembered events only in 58.54% (SD = 32.63) of cases, and similarly the older adults reported memories for 51.47% (SD = 22.50) of ‘remember’ events. This proportion did not differ between the age groups (t (61) = 1.02, p = .31). We also observed no significant difference between young adults (*M* = 25.59, *SD* = 17.85), and older adults (*M* = 22.17, *SD* = 13.15) in the percentage of stimuli they produced associated memories for ($t(61) = .87$, $p = .39$).

Due to this variation between the remember responses and disclosable AS for event, it was of interest to examine any difference in task performance for stimuli associated with or without disclosable AS. Behavioural averages were calculated for accuracy, reaction time and confidence ratings for the semantic and the episodic tasks, for events that participants had prior knowledge of and had also produced an associated memory for (AS), and those that they had prior knowledge of but had no associated memory for (no-AS). Means for task accuracy and confidence for the variables associated with AS and those associated with prior knowledge, but no-AS are presented in Figure 38.

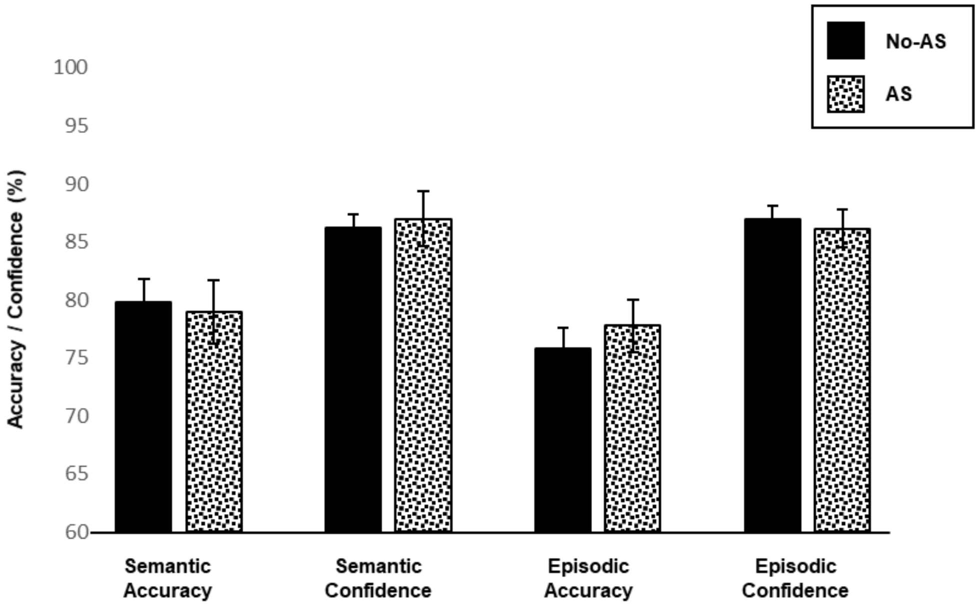

Figure 38 Mean Accuracy and Confidence Levels for Stimuli Associated with AS and Stimuli Associated with Prior Knowledge but No-AS

It appears from Figure 38 that limited differences in mean accuracy and mean confidence scores are present between the events participants had AS for and those they had no-AS. Similarly, minimal differences are observed within the reaction time variables for both the semantic and episodic task (Figure 39).

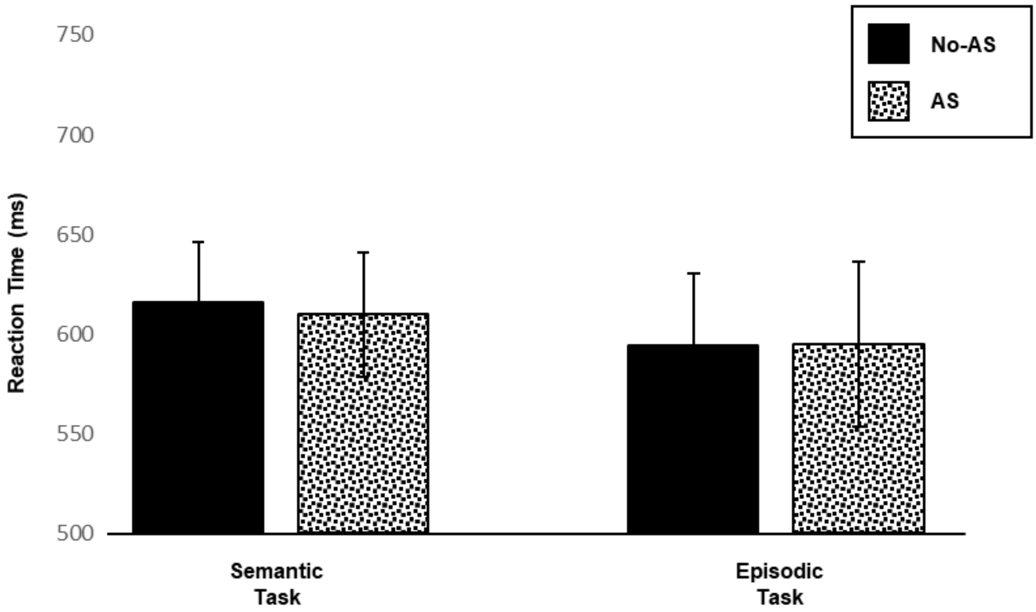

Figure 39 Mean Reaction Times Between Stimuli Associated with AS and Stimuli Associated with Prior Knowledge but No-AS Within the Semantic and Episodic Tasks

A repeated measures ANOVA examining the effect of AS on the task variables revealed no significant main effect of AS, on semantic accuracy $F(1, 60) = .63$, $p = .43$; semantic confidence $F(1, 60) = .11$, $p = .75$; semantic reaction time $F(1, 60) = .10$, $p = .75$; episodic accuracy $F(1, 60) = .02$, $p = .89$; episodic confidence $F(1, 61) = .14$, $p = .71$; episodic reaction time $F(1, 58) = .007$, $p = .93$.

There was also no significant interaction between AS and the age group of the participant on semantic accuracy $F(1, 60) = ..08$, $p = .78$; semantic confidence $F(1, 60) = 3.46$, $p = .07$; semantic reaction time $F(1, 60) = .09$, $p = .76$; episodic accuracy

F (1, 60) = .007, *p* = .94; episodic confidence *F* (1, 61) = ..23, *p* = .63 and episodic reaction time *F* (1, 58) = .36, *p* = .55.

~~Wilks' Lambda = .97, *F* (6, 52) = .61, *p* = .96,~~ nor any significant interaction with age group of the participants, ~~Wilks' Lambda = .94, *F* (6, 52) = .60, *p* = .73.~~ This indicates that having an associated memory for public events did not improve semantic or episodic task performance.

4.3.3.1. Investigating the Associated Memories

Similarly, to chapter two, as the participants disclosed associated memories for the event stimuli, we were able to code the participants' memories according to the personal semantic memory classification system developed by Renoult et al., (Renoult et al., 2020). Unique events were classed as memories that referred to a specific time or place, repeated events were considered memories that had common elements taken from multiple episodes and memories were classified as autobiographical facts if they did not relate to a single episode but were instead factual knowledge about their life.

Table 2 Percentage of Different Types of Disclosed Memories Between the Young and Older Adult Participants

	Frequency (%)		
	Young Adult	**Older Adult**	**Total**
Unique Events	98.59	91.77	94.64
Repeated Events	1.41	6.17	4.17
Autobiographical Fact	0.00	2.06	1.19

Consistent with that observed in the previous chapters, the largest portion of associated memories were unique events (*table x)*, although a considerably higher proportion than that observed for the famous persons in chapter two, and there were very few reported memories that were repeated events or autobiographical facts.

As the portion of repeated events and autobiographical facts were so few, no meaningful comparison on the effect of different types of memory on the effect of associated AS could be undertaken.

4.3.3.2. Effect of Vividness of Associated Memory on Task Performance

In addition to the details of the memory participants were also asked to rate their memories in terms of vividness. Vividness ratings ranged from 0-4 (M = 2.90, SD = 1.08). To determine if the vividness of the associated memories would impact on the task performance for these stimuli, we coded memories as either highly vivid (rated 3-4, 66.9%) or low-level vivid (0-2, 33.1%).

Behavioural averages for accuracy, reaction time and confidence ratings were taken from the semantic and episodic tasks for stimuli that participants had associated memories for with high vivid ratings, and those events participants had associated memories for with low vivid ratings. Means for these variables are displayed in x.

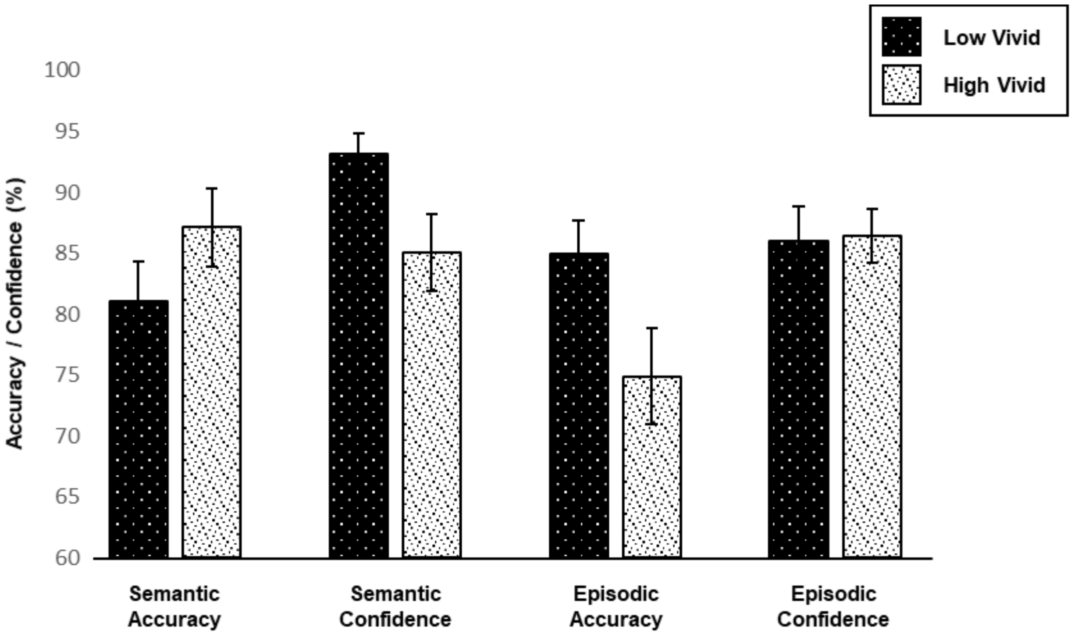

Figure 40 Mean Accuracy and Confidence for Stimuli Associated with High Vivid AS and Low Vivid AS within the Semantic and Episodic Task

The pattern for the vividness ratings seems mixed. It appears that for semantic accuracy having an associated memory associated with an event that is highly vivid improves accuracy, over those events associated with a low vivid AS memory. However, for semantic confidence and episodic accuracy it appears that the reverse is true.

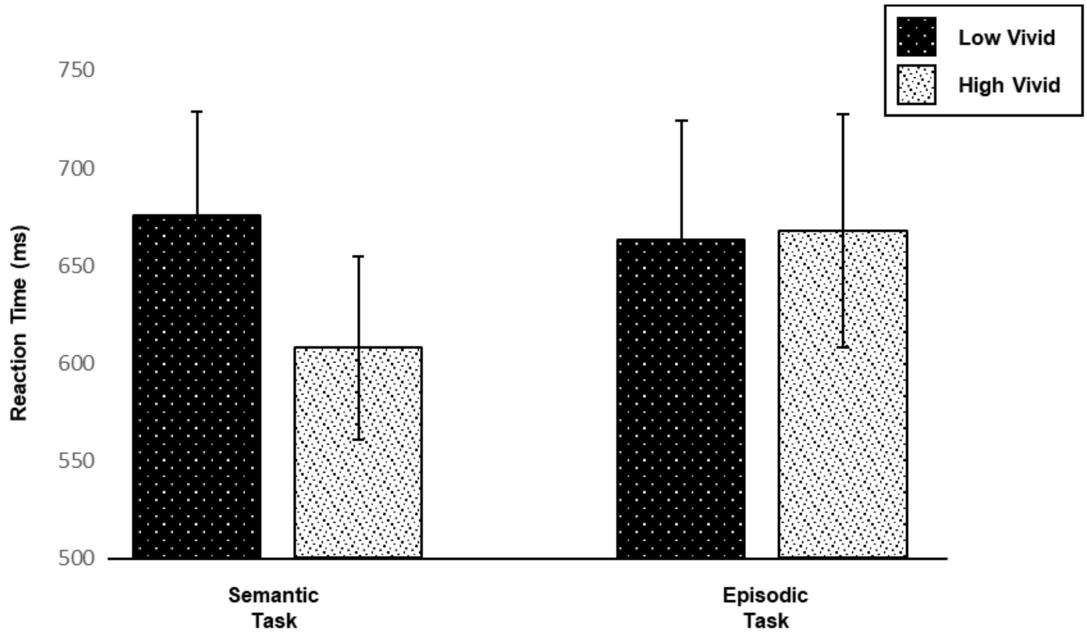

Figure 41 Mean Reaction Time for Semantic and Episodic Task for Stimuli Associated with High Vivid AS and Low Vivid AS.

Within the semantic task, as observed with the task accuracy, it appears participants are faster at responding to events that are associated with highly vivid AS compared to those associated with low-vivid AS, but no differences are apparent within the episodic reaction time.

A repeated measures ANOVA examining vividness of the associated memory on task performance revealed a significant effect of vividness on semantic confidence $F(1, 45) = .90$, $p = .04$; semantic reaction time $F(1, 41) = 2.75$, $p = .01$ and episodic accuracy $F(1, 53) = .11$, $p = .04$. There was no significant effect on participants' semantic accuracy $F(1, 53) = 3.40$, $p = .14$; episodic confidence $F(1, 46) = .37$, $p = .55$ and episodic reaction time $F(1, 40) = .04$, $p = .85$. ~~Wilks' Lambda = .63, $F(6, 32) = 3.13$, $p = .02$. Univariate tests showed the effect of vividness was significant for semantic confidence ($F(1, 37) = 8.20$, $p = .007$), semantic reaction time ($F(1, 37) = 4.7$, $p = .04$) and episodic accuracy ($F(1, 37) = 6.25$, $p = .02$).~~

There was also no significant interaction of vividness and age of the participant on semantic accuracy F (1, 53) = .90, p = .35; semantic confidence F (1, 45) – 2.08, p = .16; semantic reaction time F (1, 41) = 1.91, p = .17; episodic accuracy F (1, 53) = .15, p = .70; episodic confidence F (1, 46) = .03, p = .86 and episodic reaction time F (1, 40) = .96, p = .33.

This indicates that participants were counterintuitively more confident and faster at responding within the semantic task, and more accurate within the episodic recognition task for autobiographically significant stimuli associated with memories with low vividness ratings, compared to AS stimuli with high vividness ratings.

However, paired samples t-tests demonstrated that neither AS with low vivid ratings (t (53) = -.83, p = .41) nor AS with high vivid ratings (t (53) = -.40, p = .69) significantly improved semantic accuracy compared to having prior knowledge but no associated memory for the events.

This was also the case for semantic reaction time, whereby neither low vivid AS (t (48) = .05, p = .96) nor high vivid AS (t (46) = 1.16, p = .25) significantly differed in reaction time from the events that had prior knowledge but no associated memory. Episodic accuracy also did not significantly differ between the events associated with low vivid AS and those associated with prior knowledge but no AS (t (54) = -.29, p = .78, nor for those associated with high vivid AS (t (54) = -.55, p = .59). This indicates that vividness of AS did not have a large impact on task performance.

4.3.3.3. Effect of Emotional Salience of the Associated Memory on Task Performance

Participants were also asked to indicate how they were feeling at the time of their memory (extremely unhappy, unhappy, indifferent, happy, extremely happy). To see what impact this had on task performance, we coded memories as either positive (40.8%), negative (41.5%) or indifferent (17.7%). Behavioural averages for accuracy, reaction time and confidence ratings were taken from the semantic and episodic tasks for stimuli that participants had associated memories for with positive emotional salience, negative emotional salience or that they felt indifferent towards. A repeated measures ANOVA examining emotional salience of the associated memory on task performance revealed no effect of memory emotion, ~~Wilks' Lambda = .78, *F* (12, 78) = .85, *p* = .60,~~ on participants' semantic accuracy *F* (2, 33) = 4.93, *p* = .13; semantic confidence *F*(2, 32) = .49, *p* = .62; semantic reaction time *F*(2, 28) - .70, *p* = .51; episodic accuracy *F* (2, 33) = .63, *p* = .54; episodic confidence *F*(2, 32) = 1.17, *p* = .32 and episodic reaction time *F*(2, 26) = 1.29, *p* = .29.

There was also no interaction between emotional salience of the memory and participants' age on their semantic accuracy *F* (2, 33) = .86, *p* = .43; semantic confidence *F* (2, 32) - .55, *p* = .58; semantic reaction time; *F* (2, 28) = .14, *p* = .27; episodic accuracy; *F* (2, 33) - .26, *p* .77; episodic confidence *F* (2, 32) = .06, *p* = .94 and episodic reaction time *F* (2, 26) = 1.79, *p* = .19

nor any significant interaction between emotional salience and age group of the participant on the task variables, ~~Wilks' Lambda = .75, *F* (12, 78) = 1.03, *p* = .43~~.

4.3.4. Impact of Associated Location Memory on Task Performance

In addition to asking participants about associated memories for event stimuli, participants were also asked '*if they could remember where they were when they experienced the memory*'. This was to capture flashbulb style memories where individuals report they can vividly recall where they were when they learnt about an event (Brown & Kulik, 1977). These 'location' memories were reported for a small percentage of the presented events (M = 3.28, SD = 2.89). There was no significant difference between the young (M = 2.69, SD = 2.74) and older adults (M = 4.00, SD = 2.96), t (62) = -1.84, p = .07 in the proportion of these location memories reported.

To examine if associated location memories would influence task performance, behavioural averages were calculated for accuracy, reaction time and confidence ratings for the semantic and episodic tasks, for events that participants had a location memory for and those they had prior knowledge of but no location memory. Means for these variables are displayed on Figure 42 and Figure 43 below.

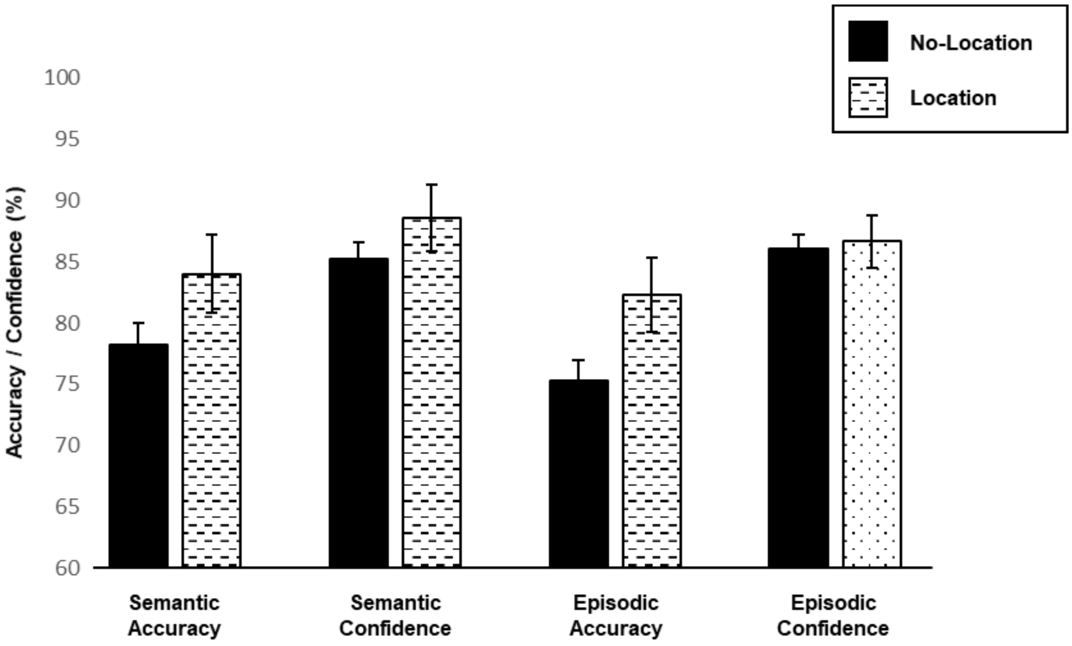

Figure 42 Mean Accuracy and Confidence Levels for Stimuli Associated with a Location Memory and those with Prior Knowledge but no Location Memory.

It appears from Figure 42 that participants responded with a higher level of accuracy within the semantic and episodic task for those events they had associated location memories for compared to the events they had prior knowledge for but no associated memories. They also demonstrated a slightly higher confidence level within the semantic task for these events.

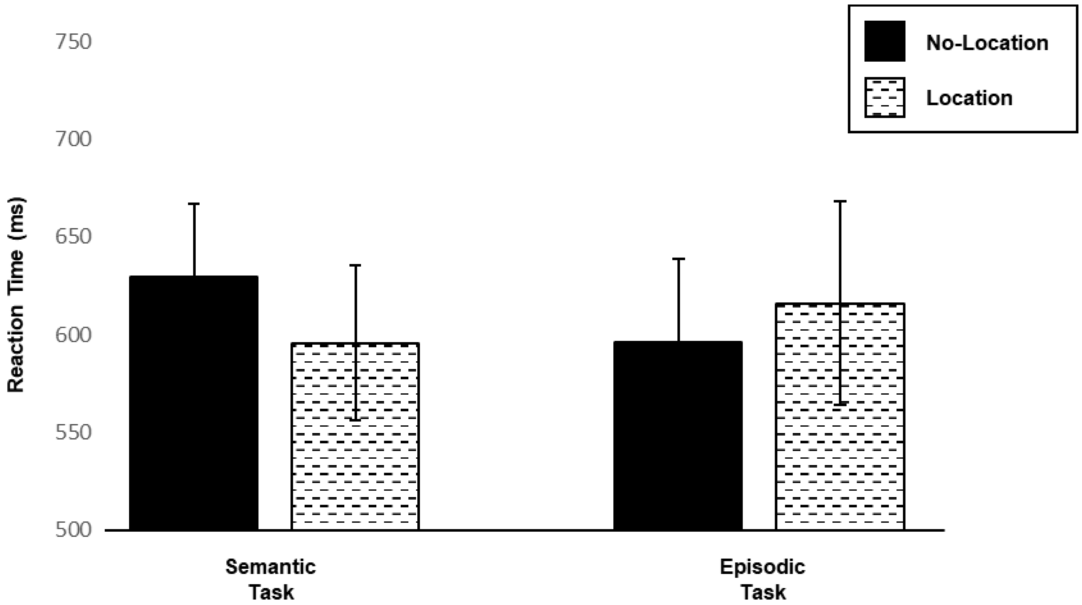

Figure 43 Mean Reaction Times Within the Semantic and Episodic Tasks for Stimuli Associated with or Without a Location Memory

It appears the effect of a location memory on reaction time was mixed (*Figure 43).* Within the semantic task participants' reaction times were faster for the events they had location memories for compared to those they had only prior knowledge of, whereas the opposite was true within the episodic task.

A repeated measures ANOVA examining the impact of associated location memory on the task variables, revealed a significant effect on participants' episodic accuracy F (1, 51) = 11.30, p < .001, participants were more accurate within the episodic task when the events were associated with a location memory (*M* = 82.30, *SD* = 21.16) compared to events associated with prior knowledge but no location memory (*M* = 75.53, *SD* = 14.49). This indicates that associated location memories had a small influence on participants' episodic task performance. There was no significant effect of having a location memory on participants' semantic accuracy ~~Wilks' Lambda = .80, *F* (6, 43) = 1.78, *p* = .13~~ *F* (1, 51) = 1.22, *p* = .27; semantic confidence *F*(1, 50)

= 2.52, *p* = .12; semantic reaction time *F* (1, 48) = 1..52, *p* = .22; episodic confidence *F*(1, 51) = .41, *p* = .53 and episodic reaction time *F*(1, 51) = .16, *p* = .70.

There was no interaction effect between associated location memory and age group of the participant, on their semantic accuracy *F* (1, 51) = .24, *p* = .62; semantic confidence *F* (1, 50) = .001, *p* = .97; semantic reaction time *F* (1, 48) = .03, *p* = .86; episodic accuracy *F* (1, 51) = 7.14, *p* = .11; episodic confidence *F* (1, 51) = .01, *p* = .92 and episodic reaction time *F* (1, 51) = .00, *p* = .98. ~~Wilks' Lambda = .88, *F* (6, 43) = .97, *p* = .46~~.

4.3.4.1. Level of Detail

There was considerable variation in the level of the detail provided for participants' location memory, 60% of memories were classified as very low detail ('*I was at home*'), 26.67% were considered mid-level detail ('*(I was) in my school close to the lockers area*'), whereas 13.33% were highly detailed ('*I was in my house in … when I received the news from my mother. I immediately went downstairs to put the television on, and was transfixed watching the event unfold … I can vividly remember the details of the rooms*').

It was of interest to examine whether this variation in the level of detail of the associated location memories could impact participants' task performance. Behavioural averages were calculated for accuracy, reaction time and confidence ratings for the semantic and the episodic tasks, for events that participants had high-level, mid-level or low-level detailed location memory. Means for these variables are displayed on Figure 44 and Figure 45 below.

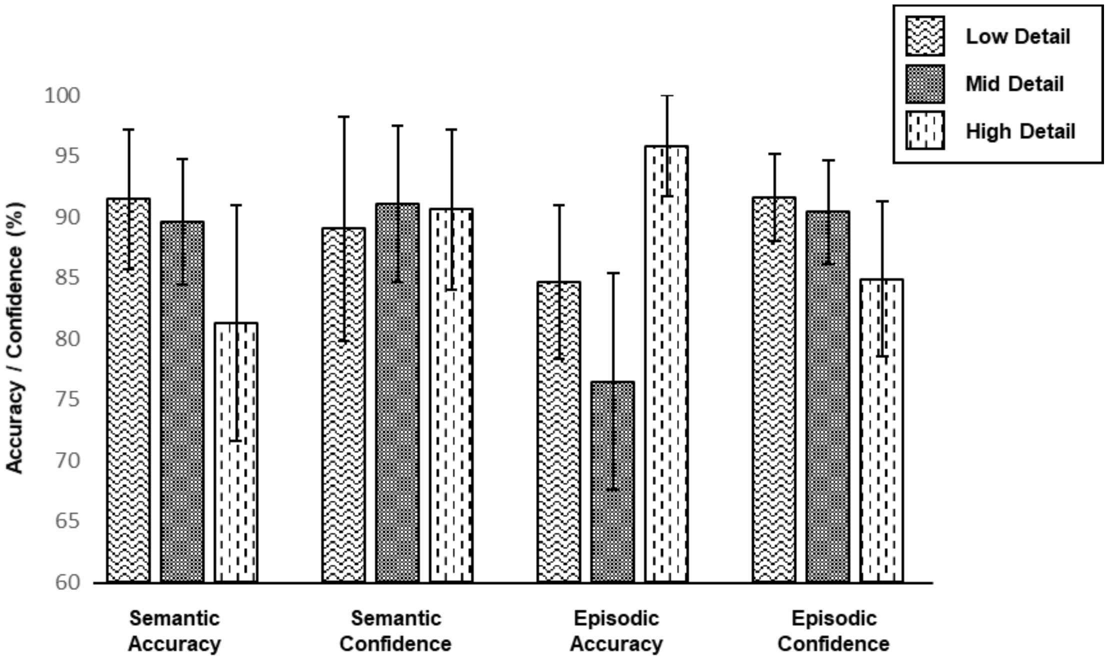

Figure 44 Mean Accuracy and Confidence Levels Across Semantic and Episodic Task for Stimuli Associated with Either High, Mid-Level or Low-Detailed Location Memories

No clear pattern is apparent across variables within Figure 44. Counterintuitively, it seems that within semantic accuracy participants were least accurate for the events they had high detail location memory for and most accurate for those events they had low detail location memory for. Whereas within episodic accuracy, participants were most accurate for the events they had highly detailed location memories for. The effect of level of detail of associated location memory also appears mixed within the reaction time variables (Figure 45)

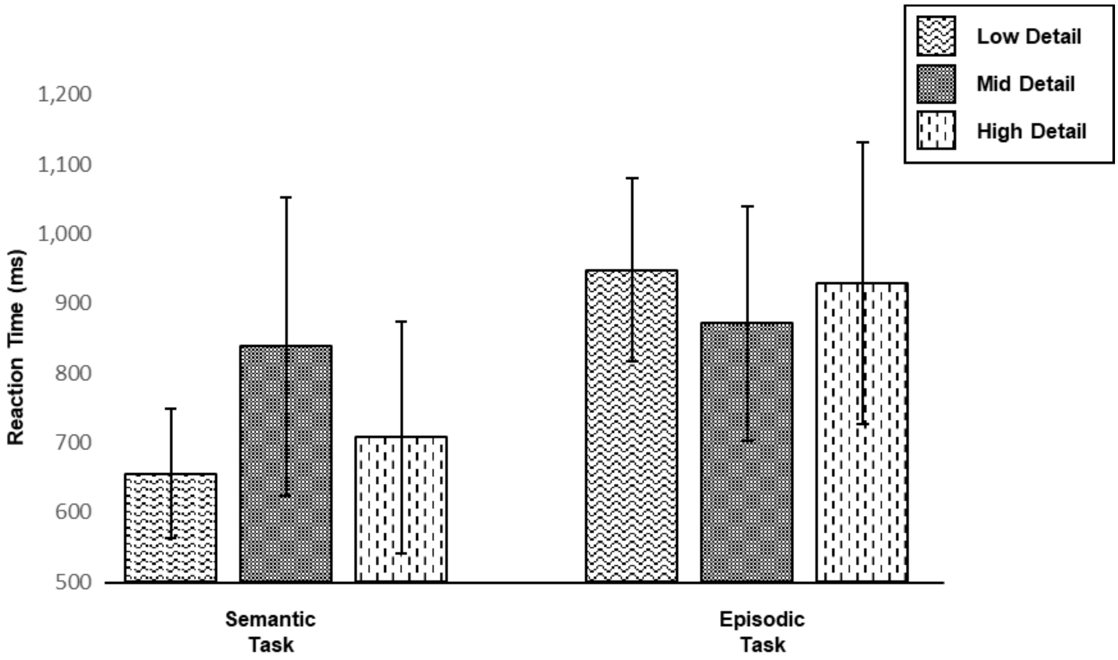

Figure 45 Mean Reaction Time within the Semantic and Episodic Task for Stimuli Associated with Either Low, Mid-Level or High Detailed Location Memory

A repeated measures ANOVA revealed a significant main effect of level of detail, on episodic accuracy *F* (2, 19) = .33, *p* = .02.

Although mean accuracy within Figure 44, would indicate that participants responded most accurately for events they provided highly detailed location memories for, paired samples revealed no significant difference in episodic accuracy between the events associated with low-detail, mid-detail or high-detail location memories, indicating that level of detail of the location memory did not influence participants' task performance.

There was no significant effect of level of detail on participants' semantic accuracy *F* (2, 19) = .83, *p* = .45; semantic confidence *F*(2, 19) - .03, *p* = .98; semantic reaction time *F* (2, 16) = .85, *p* = .45; episodic confidence *F*(2, 20) = .31, *p* = .74; episodic reaction time *F* (2, 15) = .01, *p* = .99. ~~Wilks' Lambda = .04, *F* (12, 14) =~~

~~4.90, *p* = .003. Post-hoc univariate tests indicated that level of detail of the associated location memory significantly affected episodic accuracy (*F* (2, 12) = 7.85, *p* = .02).~~

No significant interaction was present between the level of detail of the associated location memory and the age group of the participant, on their semantic accuracy *F* (2, 19) = .11, *p* = .90; semantic confidence *F* (2, 19) - .02, *p* = .98; semantic reaction time *F* (2, 16) = 1.80, *p* = .19; episodic accuracy *F* (2, 19) = .69, *p* = .52; episodic confidence *F* (2, 20) = .83, *p* = .45; episodic reaction time *F* (2, 15) = 1.25, *p* = .31.

4.3.5. The Impact of Event Proximity on Task Performance

Participants were asked how they learnt about the public event, to develop a measure of proximity to the event, which was noted to influence memory. Participants' prior knowledge of events came largely from media coverage surrounding the event (60%), but they were also informed by later coverage including through learning in school, and in some cases, they were told about events from family or friends, see table X for a breakdown of the event experiences.

Table 3 Percentage of Each Type of Learning Reported for the Public Events Across Young and Older Adults

	Frequency (%)		
	Young Adult	Older Adult	Total
First-hand experience - personally witnessed the event	2.66	4.46	3.73
Saw the media coverage - on the day/around the time of the event e.g., newspaper, TV, or radio	50.69	68.76	61.42

Second-hand knowledge - talked about the event by another person such as a friend or relative	18.35	5.28	10.60
Later or historical media coverage - including school learning, autobiographies, or documentaries	28.30	21.49	24.26

There was a significant association between the frequency of type of event learning and the age group of the participant $X^3(5) = 201.58$, $p <.001$. Examining the percentage frequencies above in table x, it would appear that older adults learn of more events through first- hand experiences than the young adults, whereas young adults learned a greater portion of events through being told about them second-hand.

To examine the effect of event proximity on task performance we calculated behavioural averages for accuracy, reaction time and confidence ratings from the semantic and episodic tasks for stimuli that participants had learnt of first-hand, through media coverage around the time of the event, second-hand from other people or later coverage of the event such as biographies, documentaries etc. Means for these variables are displayed in Figure 46.

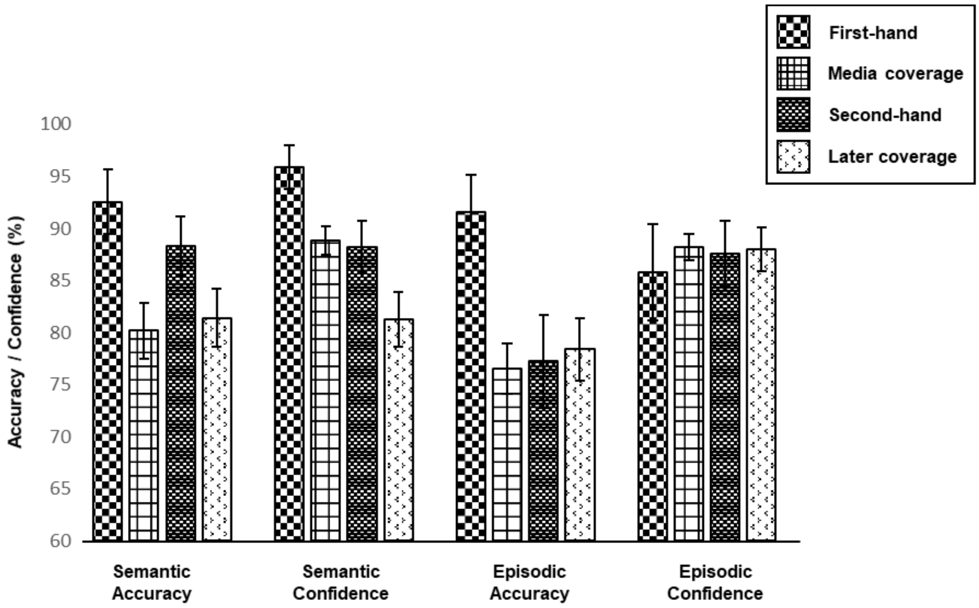

Figure 46 Mean Accuracy and Confidence for Stimuli within Semantic and Episodic Task Across Four Methods of Event Learning.

From Figure 46, we observe that participants were most accurate within the semantic and episodic task when the participants learnt about the event first hand, and appear less accurate in both tasks if they learnt about the event through media coverage either at the time of the event, or much later. The same pattern is observed within participants' confidence ratings during the semantic task; however, very little difference is observed within the episodic confidence variable.

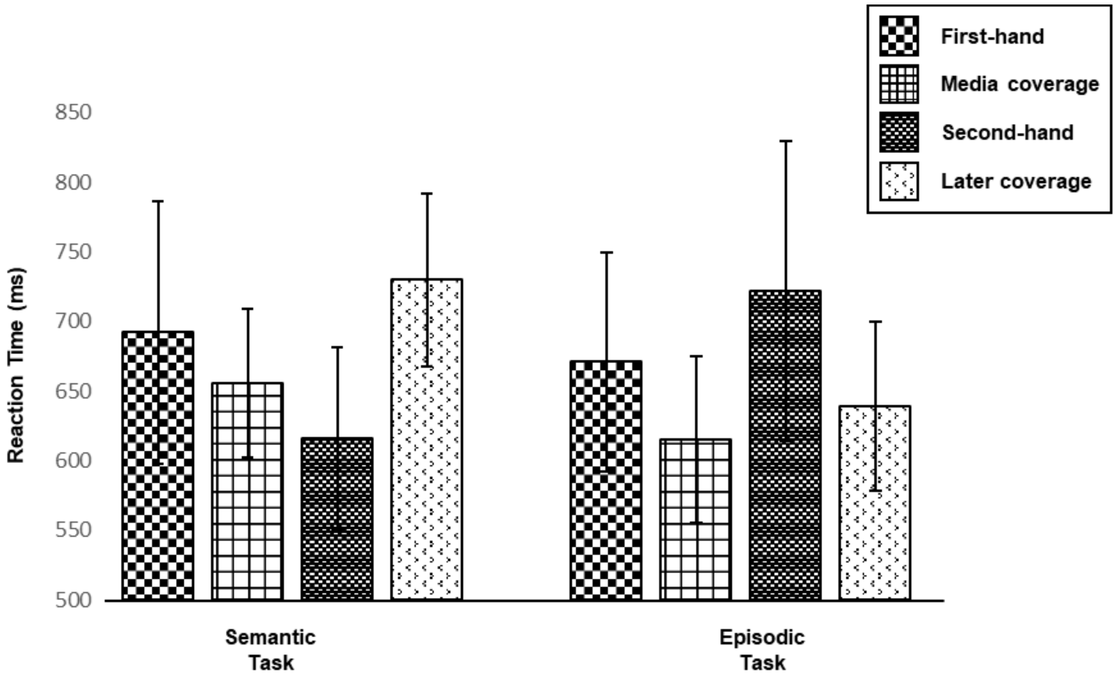

Figure 47 Mean Reaction Time within the Semantic and Episodic Task for Stimuli Across Four Event Methods of Learning

Findings were less clear within the reaction time variables (Figure 47). Participants were fastest during the semantic task for stimuli they learnt about through second-hand experience and fastest during the episodic task for stimuli they learned about through event media coverage.

A repeated measures ANOVA examining proximity to the event on the earlier semantic and episodic task variables revealed a significant main effect, on participants' semantic accuracy *F* (3, 32) = 4.87, *p* = .007 and their semantic confidence *F* (3, 32) = 5.19, *p* = .005, but did not significantly affect participants' semantic reaction time *F*(3, 29) = 1.54, *p* = .23; episodic accuracy *F*(3, 32) = 1.03, *p* = .39; episodic confidence *F* (3, 32) = .03, *p* = .99 and episodic reaction time *F* (3, 23) = 1.46, *p* = .25.; ~~Wilks' Lambda = .47, *F* (18, 198.48) = 3.35, *p* <.001. Post-hoc univariate tests revealed the proximity to the event affected task performance within~~

~~semantic accuracy (F (3, 75) = 4.46, p =.01), semantic confidence (F (3, 75) = 12.89, p <.001) and episodic accuracy (F (3, 75) = 5.78, p =.004).~~

Paired samples t-tests revealed participants were significantly more accurate for events within the semantic task if events were experienced first-hand compared to learning both through media coverage around the time of the event (t (44) = 3.50, p = .001) or through later coverage of the event (t (44) = 3.07, p = .004). The difference between accuracy for events learned first-hand and second-hand also approached significance (t (35) = 1.90, p = .07). The remaining paired samples did not reach significance.

Paired samples t-tests within the semantic confidence variable revealed, participants were significantly more confident for events they had experienced first-hand, than those they had learnt about through later coverage (t (44) = 2.12, p = .04). Participants were also more confident in the semantic task if they had learnt about the task from media coverage around the time of the event, than if they had learnt about the event through later coverage (t (59) = 2.41, p = .02). No other paired samples reached significance.

~~Paired samples t-tests revealed no significant differences in accuracy within the episodic task between any of the methods of learning about the events.~~ This suggests that semantic accuracy and confidence were greatest for first-hand experienced of the event compared to other methods of event learning, but proximity to the event did not influence episodic performance.

We observed no significant interaction between type of learning and the age group of the participant on ~~Wilks' Lambda = .75, F (18, 198.48) = 1.18, p = .28.~~ semantic accuracy F (3, 32) = 2.47, p = .08; semantic confidence F (3, 32) – 1.53, p = .23; Semantic reaction time F (3, 29) = .34, p = .80; episodic accuracy F (3, 32) = 2.79, p = .06; episodic confidence F (3, 33) = 1.41, p = .26 and episodic reaction time F (3, 23) = .71, p = .55.

4.3.5.1. Proximity to the Event and Autobiographical Significance

As there is some indication that proximity to the event, particularly having first-hand experience may influence participants' task performance for the event, it was of interest to determine what interaction this had with AS. An independent measures t-test revealed participants provided a greater percentage of associated memories for events they had first-hand experience of (M = 73.35, SD = 36.40) compared to those experienced second-hand (M = 20.71, SD = 13.82), t (44) = 10.47, p <.001.

A repeated measures ANOVA was conducted to examine the impact of proximity to the event and AS on participants' task performance within the semantic and episodic task. We found no significant interaction of these factors on participants' semantic accuracy F (1, 11) = .09, p = .77; semantic confidence F (1, 11) = .004, p = .95; semantic reaction time – F (1, 11) = .05, p = .83; episodic accuracy F (1, 11) = 8.95, p = .11; episodic confidence F (1, 11) = .37, p = .56 and episodic reaction time F (1, 9) = .004, p = .95. ~~Wilks' Lambda = .37, F (6, 4) = 1.16, p = .46.~~

There was also no significant interaction between these two factors and the age group of the participant on their semantic accuracy-F (1, 11) = .77, p = .40; semantic confidence F (1, 11) = 2.22, p = .16; semantic reaction time F (1, 10) = .34, p = .57; episodic accuracy F (1, 11) = .19, p = .68; episodic confidence F (1, 11) = .50, p =

.49 and episodic reaction time F (1, 9) = .79, p = .40 This indicates that although proximity has a direct effect on task performance, it does not interact with AS to influence participants' behavioural task performance.

4.3.6. Effect of Valence on Task Performance

Event valence has previously been shown to affect memory surrounding events, so it was of interest to examine whether it would affect participants' semantic and episodic task performance within this study. Within the final event questionnaire participants marked events as to whether they felt positively or negatively about the event. We calculated behavioural averages for accuracy, confidence, and reaction times for both tasks for events participants felt positively about, and those they had negative feelings towards, these averages are displayed in Figure 48 and Figure 49 below.

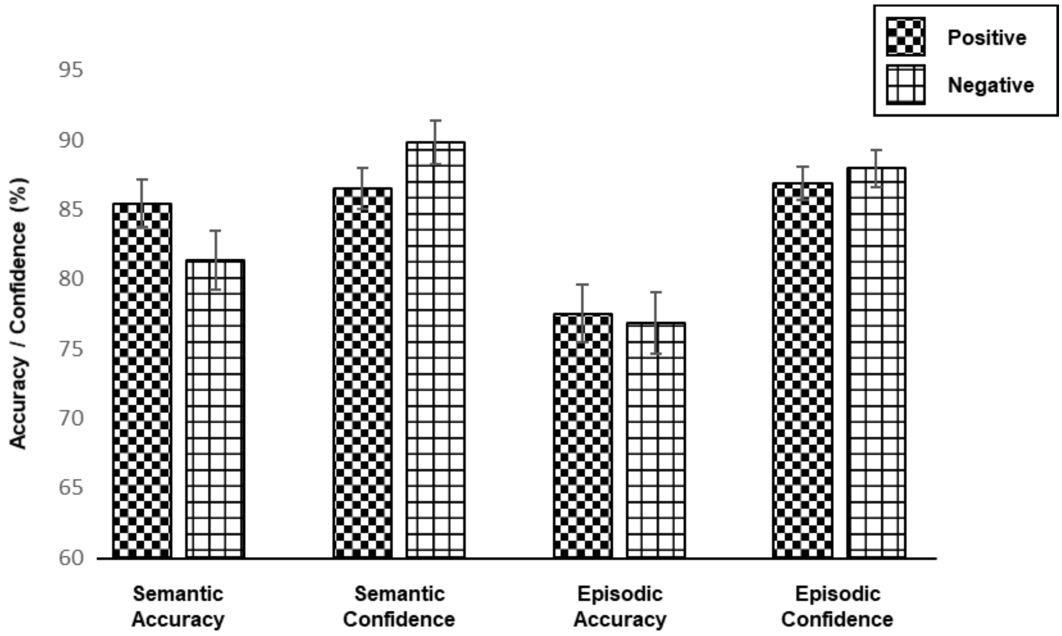

Figure 48 Mean Accuracy and Confidence Ratings for the Semantic and Episodic Task for Events Participants Considered Positive or Negative.

From Figure 48, it appears that valence has a mixed effect on participants' task performance. Participants were more accurate within the semantic task for positive events but appear more confidence in both the semantic and episodic task for events they consider negative.

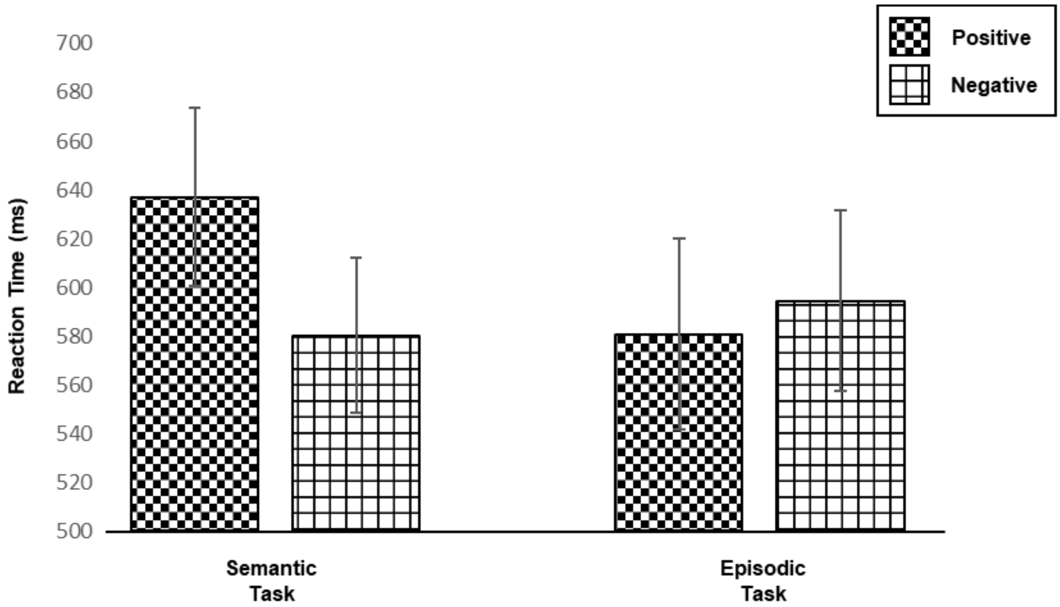

Figure 49 Mean Reaction Times within the Semantic and Episodic Tasks for Events Participants Considered Positive or Negative.

From the reaction time averages in Figure 49 it seems participants were faster at responding to negative events within the semantic task, but minimal differences were present between positive and negative events within the episodic task.

A series of repeated measures ANOVA examining the effect of event valence on participants' task performance revealed no significant effects on participants' semantic accuracy *F* (1, 44) = 3.17, *p* = .08; semantic confidence *F* (1, 44) = .41, *p* = .53; semantic reaction time *F* (1, 41) = .75, *p* = .39; episodic accuracy *F* (1, 41) = .04, *p* = .85; episodic confidence *F* (1, 45) = .001, *p* = .97 or episodic reaction time *F* (1, 41) = .26, *p* = .61.~~Wilks' Lambda = .75, *F* (6, 53) = 3.01, *p* = .01. Follow-up univariate analysis revealed valence significantly affected participants; semantic accuracy (*F* (1, 58) = 4.26, *p* = .04), semantic confidence (*F* (1, 58) = 4.51, *p* = .04) and semantic reaction time (*F* (1, 58) = 7.38, *p* = .009).~~

This indicates that participants were significantly more accurate when responding to positive compared to negative events within the semantic task but were more confident and responded faster to the events they considered negative.

The repeated measures ANOVA revealed no significant interaction between age group of the participant and event valence on participants' ~~*F* (6, 52) = 2.29, *p* = .06.~~ semantic accuracy *F* (1, 44) = .35, *p* = .56; semantic confidence *F* (1, 44) = 1.35, *p* = .25; semantic reaction time *F* (1, 41) = 3.16, *p* = .08; episodic accuracy *F* (1, 44) = .62, *p* = .44; episodic confidence *F* (1, 45)= 1.97, *p* = .17 or episodic reaction time *F* (1, 41) = .86, *p* = .36.

4.3.6.1. Event Valence and Autobiographical Significance

Participants' performance was affected by the valence of the event, so it was of interest to determine if any interaction was present between participants views of valence of the event and associated AS. An independent measures t-test found no significant difference in the percentage of associated memories for events that were considered negative to the participant (*M* = 25.20, *SD* = 21.94) and those participants felt were positive (*M* = 26.55, *SD* = 20.93), *t* (62) = -.42, *p* = .68.

A repeated measures ANOVA was conducted to examine the interaction of event valence and AS on participants' task performance within the semantic and episodic task. We found no significant interaction of these factors on semantic accuracy *F* (1, 45) = .20, *p* = .66; semantic confidence *F* (1, 44) = 3.56, *p* = .07; semantic reaction time *F* (1, 39) = .01, *p* - .99; episodic accuracy *F* (1, 45) = .10, *p* = .75; episodic confidence *F* (1, 45) = .42, *p* = .52 and episodic reaction time *F* (1, 41) = 2.78, *p* = .10. ~~, Wilks' Lambda = .83, *F* (6, 31) = 1.05, *p* = .41. Follow-up univariate analysis confirmed there was no significant interaction between event valence and AS on any~~

~~of the task performances variables (*p* >.05).~~ There was also no interaction between these two factors and the age group of the participant on the task variables~~;~~ semantic accuracy F (1, 45) = .27, p = .61; semantic confidence F (1, 44) = .18, p = .67; semantic reaction time F (1, 39_ = .73, p = .40; episodic accuracy F (1, 45) - .28, p = .6; episodic confidence F (1, 45) = 3,56, p = .07 or episodic reaction time F (1, 41) = .05, p = .83 ~~Wilks' Lambda = .74, *F* (6, 31) = 1.85, *p* = .12.~~

This indicates that although event valence has a direct effect on task performance, it does not interact with AS to influence participants' behavioural task performance.

4.3.7. Effect of Time on Task Performance

The stimuli used were counterbalanced across seventeen five-year time periods within the older adults, and seven five-year time periods within the young adults, to allow an even spread across the lifespan. To examine the effect of date of the presented stimuli on participants, prior experience and task performance, these time periods were further grouped for analysis to create four equally weighted periods within the older adults, representing a dated period (1933-1957), a mid-life period (1958-1982), a contemporary period (1983-2007) and the most recent period (2008-2018). Within the young adults the time periods were grouped to provide a dated period (1983-2007) and the most recent time period (2008-2018).

To examine what impact time period had on participants' task performance, averages were calculated for accuracy, confidence and reaction times for stimuli within each of the two time periods for the young adults, and four time-periods for the older adults. Means for these variables are displayed in Figure 50 and Figure 51 for the young adults, and Figure 52 and Figure 53 for the older adults.

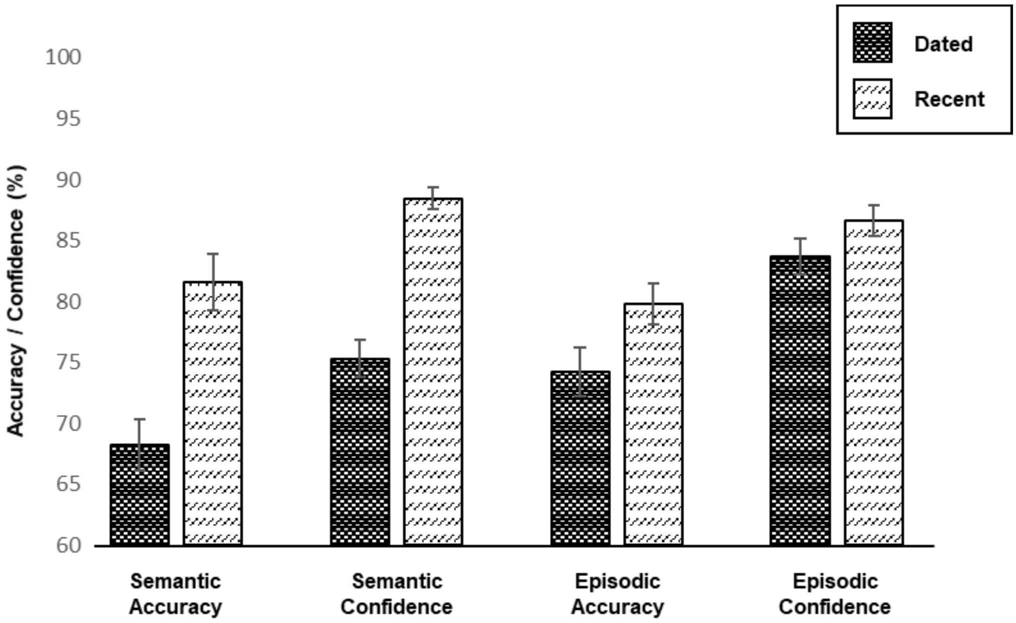

Figure 50 Mean Accuracy and Confidence Ratings within the Semantic and Episodic Tasks for Stimuli within the Dated and Recent Time Periods, for the Young Adults

Within the young adults (Figure 50) it appears that participants were consistently more accurate and confident for more recent compared to dated stimuli in both the semantic and episodic task. They also appear faster within the semantic task (Figure 51) for stimuli that were more recent compared to dated.

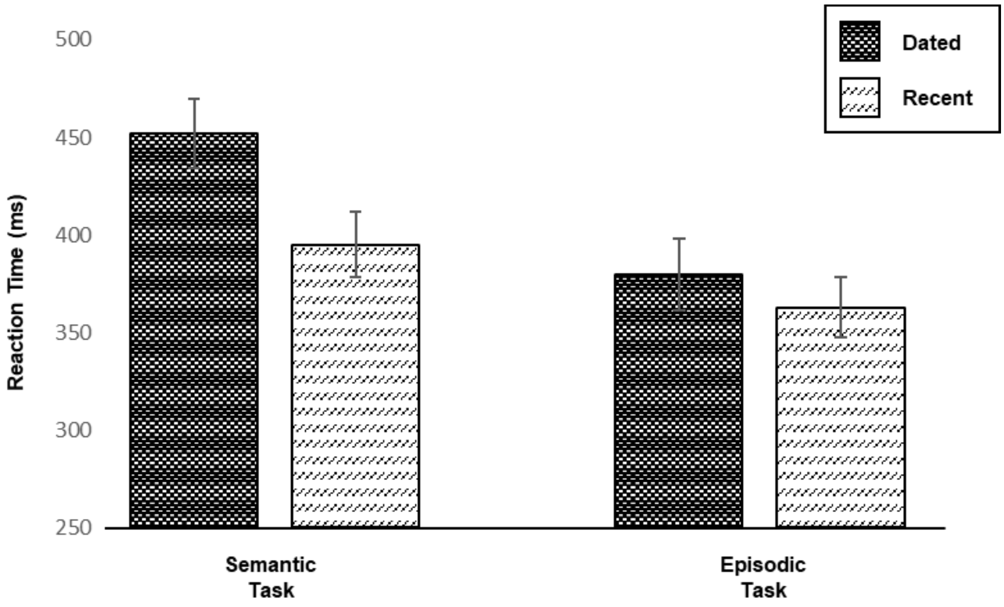

Figure 51 Mean Reaction Times within the Semantic and Episodic Tasks for Stimuli within the Dated and Recent Time Periods, for the Young Adults

To examine if these effects were significant a repeated measures ANOVA examining the effect of time period of stimuli on task performance was conducted within the young adults. It revealed a main effect of time period on semantic accuracy F (1, 32) = 12.48, $p < .001$ and semantic confidence F (1, 32) = 12.85, $p < .001$ ~~Wilks' Lambda = .10, F (6, 26) = 39.99, $p <.001$. Follow-up univariate analysis found that time period of stimuli significantly affected participants' semantic accuracy (F (1, 31) = 128.95, $p <.001$), semantic confidence (F (1, 31) = 118.78, $p <.001$) semantic reaction time (F (1, 31) = 15.41, $p <.001$), episodic accuracy, (F (1, 31) = 61.89, $p <.001$), episodic confidence (F (1, 31) = 8.53, $p = .006$) and their episodic reaction time (F (1, 31) = 7.95, $p = .008$).~~

Indicating within both tasks, young adult participants performed significantly better for stimuli that fell within the most recent time period compared to the most dated.

Within the older adults (Figure 52) the averages appear less clear cut. Within semantic accuracy performance was greater for the most dated and the most recent compared to the mid-life or contemporary time periods, this patten was also observed marginally within participants' confidence for the semantic task. Within the episodic task, participants were most accurate for the most recent time period, compared to the dated, mid-life or contemporary time periods.

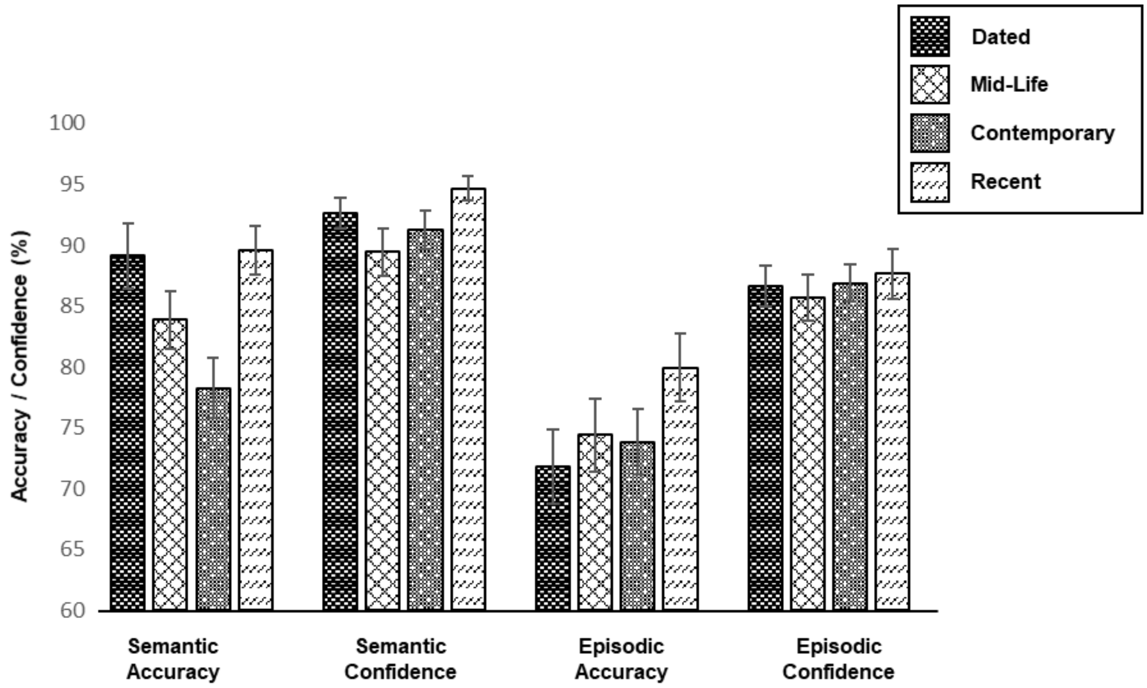

Figure 52 Mean Accuracy and Confidence Ratings within the Semantic and Episodic Tasks for Stimuli within the Dated, Mid-Life, Contemporary and Recent Time Periods for the Older Adults

Older adult reaction times within the semantic task appeared to be somewhat affected by time period (Figure 53) wherein participants were faster for the most recent and most dated time period, but effects on episodic reaction time were less clear-cut.

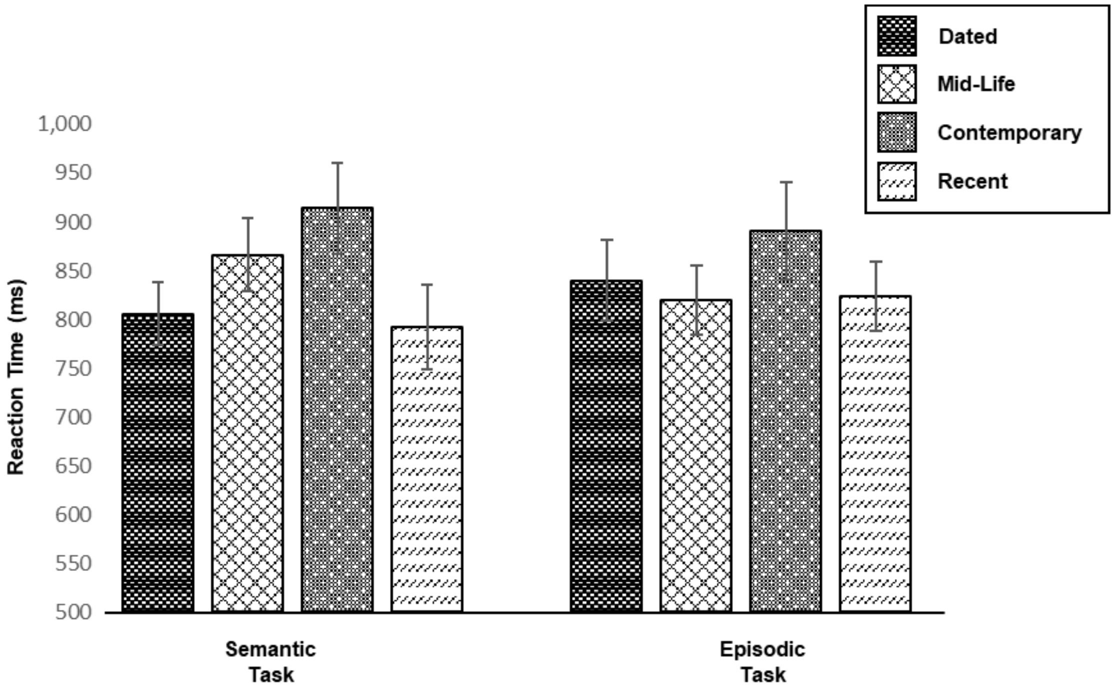

Figure 53 Mean Reaction Times within the Semantic and Episodic Tasks for Stimuli within the Dated, Mid-Life, Contemporary and Recent Time Periods, for the Older Adults

To determine if time period of stimuli had a significance effect on the older adult participants' task performance, a repeated measures ANOVA was conducted. This revealed a main effect of time period on participants' semantic accuracy $F(3, 25) = 8.35$, $p = .001$; semantic confidence F (3, 25) = .92, $p = .05$ and episodic accuracy F (3, 25) = 2.30, $p = .02$. ~~Wilks' Lambda = .33, F (6, 18) = 5.33, p <.001. Follow-up univariate analysis found time period of stimuli significant affected participants'; semantic accuracy (F (3, 75) = 18.14, p <.001), semantic confidence (F (3, 75) = 7.71, p = .002), semantic reaction time (F (3, 75) = 4.26, p = .01) and their episodic accuracy (F (3, 75) = 3.60, p = .02).~~

Within older adults' semantic accuracy, paired samples t-tests showed participants were more accurate for stimuli within the dated time period, compared to those in the mid-life (*t* (26) = 3.54, *p* = .002) and contemporary period (*t* (26) = 6.46, *p* <.001). They were also significantly more accurate for stimuli within the most recent time period, compared to those in the mid-life (*t* (26) = 3.19, *p* = .004) and contemporary period (*t* (26) = 5.67, *p* <.001). There was no significant difference in semantic accuracy for stimuli within the dated and recent time periods (*t* (26) = 5.67, *p* = .85).

Paired samples within older adult's semantic confidence found participants were more confident for the stimuli within the dated time period compared to those within the mid-life period (*t* (25) = 3.33, *p* = .003), and more confident for those within the most recent time period than those within the contemporary time period (*t* (25) = 3.10, *p* = .005), but no other paired samples reached significance.

Significant differences were also found within older adult's reaction time for the semantic task. Participants were significantly faster for stimuli from the dated time period compared to those within the contemporary period (*t* (25) = 2.75, *p* = .01). They were also significantly faster for stimuli within the most recent time period, than those within the contemporary period (*t* (25) = 3.41, *p* = .002), but no other paired samples t-tests reached significance.

Within the episodic task, older adults were significantly more accurate for the recent stimuli compared to the most dated (*t* (26) = 3.29, *p* = .003), the mid-life period (*t* (26) = 2.09, *p* = .046) and the contemporary period (*t* (26) = 2.49, *p* = .02). No other paired samples reached significance.

In summary, older adults were more accurate, more confident and faster within the semantic task for stimuli within the most dated and most recent time period, whereas within the episodic task participants were most accurate for stimuli within the most recent time period.

4.3.7.1. Effect of Time on Participants' Prior Knowledge

It was also of interest to examine the prevalence of remember and know responses across stimuli time periods, to examine semantic and episodic influence over time.

Proportion of remember and know responses given for stimuli within these time periods are shown below for the older adults (Figure 54) and the young adults (Figure 55).

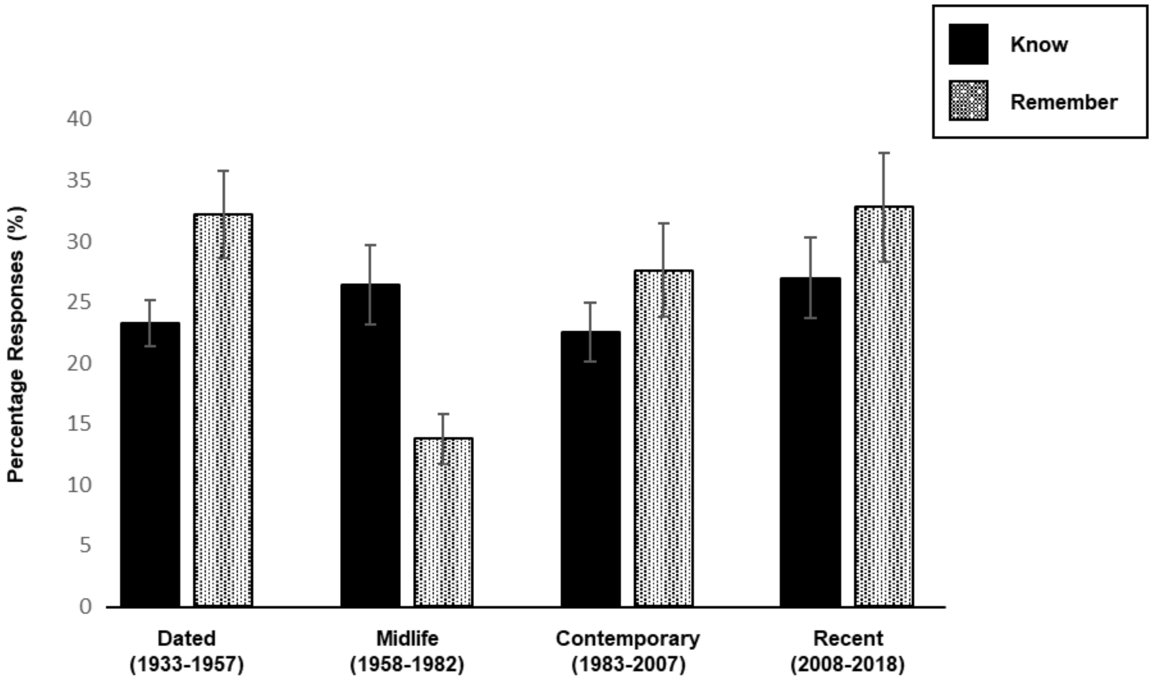

Figure 54 Percentage of Know and Remember Responses Given to Stimuli Across Four Time Periods within the Older Adult Participants.

Older adults know responses for stimuli were relatively consistent across the time periods, paired samples t-tests found no significant differences between any of the time periods for percentage of know responses provided (*p* >.05).

However, more variation was present within the proportion of remember responses. There was a significantly higher percentage of remember responses for the dated stimuli compared to the midlife (*t* (26) = 6.76, *p* <.001), and the contemporary (*t* (26)

$= 2.53$, $p = .02$) period, and for the contemporary compared to the midlife ($t\,(26) = -4.41$, $p < .001$). Participants also provided more remember responses for stimuli within the most recent time period than the midlife ($t\,(26) = -5.09$, $p < .001$) or contemporary period ($t\,(26) = -2.37$, $p = .03$), but there was no significant difference in proportion of remember responses between the most recent and most dated stimuli ($t\,(26) = -.27$, $p = .79$). This indicates that participants had the greatest level of episodic memories for stimuli within the most dated and the most recent time periods.

Interestingly, older adults gave a greater number of ‘remember’ responses compared to ‘know’ responses for stimuli within the most dated time period ($t\,(26) = -2.22$, $p = .04$), whereas the reverse was true within the midlife period, older adults provided a greater portion of ‘know’ compared to ‘remember’ responses ($t\,(26) = 3.63$, $p = .001$). Differences between remember and know responses did not reach significance within the contemporary or most recent time period.

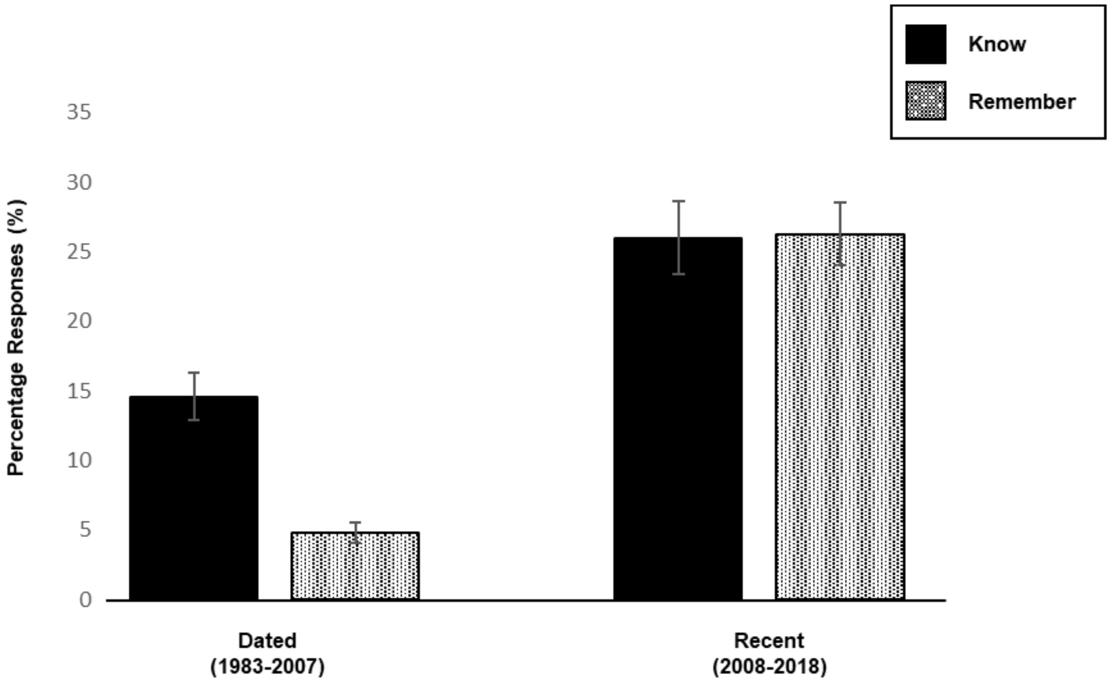

Figure 55 Percentage of Know and Remember Responses for Stimuli across Two Time Periods Within the Young Adult Participants

The young adults gave a greater percentage of know (t (26) = -4.83, p <.001) and remember (t (31) = -10.84, p <.001) responses for stimuli that fell within the most recent ten years, compared to those that were more dated to the participants. Interestingly, there was no difference in the level of know and remember responses within the most recent time period (t (31) = -.07, p = .95), but participants produced a greater number of ‘know’ compared to ‘remember’ responses for the more dated stimuli (t (31) = 5.54, p <.001).

4.3.7.2. Interaction between Prior Knowledge and Time on Task Performance

As differences were observed within the proportion of remember or know responses reported for different time period, it was of interest to investigate the impact of time period of stimuli on the effect of prior knowledge on task performance. Behavioural averages were calculated for accuracy, reaction time and confidence ratings across the semantic and episodic tasks for stimuli that participants had given know, remember or don't know responses across the four time periods within the older adults, and two time periods within the young adults.

A repeated measures ANOVA examining the effect of prior knowledge and time period of the presented stimuli on task performance revealed a significant interaction in the young adults for accuracy within the semantic task F (2, 28) = 6.37, p = .005

Means for this variable are displayed in Figure 56 below.

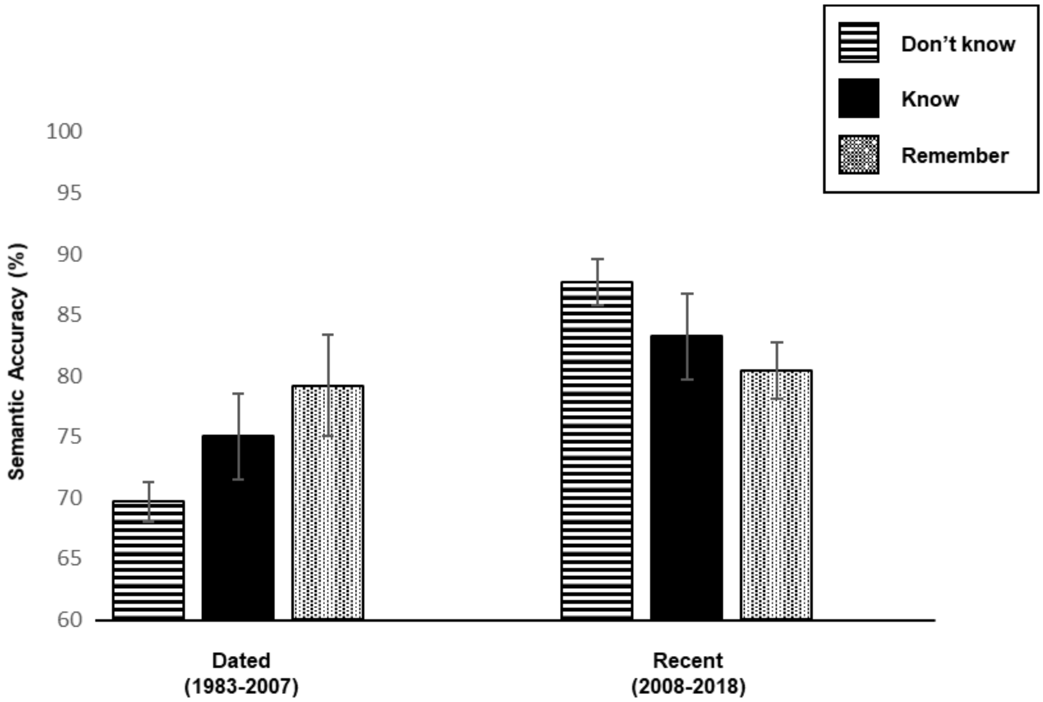

Figure 56 Mean Semantic Accuracy Across Participants' Prior Knowledge Responses for the Most Dated and Most Recent Stimuli within Young Adults.

Figure 56 shows an interesting pattern, within the dated period the effect of prior knowledge was as expected participants were most accurate for stimuli, they gave a remember response to compared to those associated with know or don't know responses. Whereas the opposite was apparent for stimuli within the most recent time period. This suggests that dated stimuli were more beneficially influenced by prior knowledge. However, paired samples t-tests revealed no significant differences in semantic accuracy between the prior knowledge responses within the dated or most recent stimuli (p <.05).

Within the older adults, the repeated measures ANOVA revealed no significant interaction between date of stimuli and participants' prior knowledge responses on their associated task performance for semantic accuracy F (6, 15) = .86, p = .54; Semantic confidence F (6, 15) = .58, p = .74; Semantic reaction time F (6, 12) = .61, *p* = .72; episodic accuracy *F* (6, 15) = 1.25, *p* = .33; episodic confidence *F* (6, 15) = 1.15, *p* = .38 and episodic reaction time *F* (6, 15) = 4.07, *p* = .07.

4.3.7.3. Effect of Time on Autobiographical Significance Responses

In order to examine whether date of stimuli would influence participants AS, we calculated the percentage of autobiographical significant stimuli between two time periods within the young adults, dated (1983-2007) and recent (2008-2018), and between the four time periods within the older adults; dated (1933-1957), midlife (1958-1982), contemporary (1983-2007) and recent (2008-2018).

The young adults had AS for a greater percentage of stimuli within the most recent time period (*M* = 32.03, *SD* = 23.13) than the more dated time period (*M* = 22.30, *SD* = 19.12), *t* (27) = -2.36, *p* = .03. Whereas paired samples t-tests within the older adults revealed no significant difference in percentage of autobiographical significant stimuli between any of the four time periods (*p* >.05).

4.3.7.4. Interaction between Autobiographical Significance and Time on Task Performance

To examine what impact the date of stimuli would have on the effect of AS on task performance, averages were calculated for accuracy, confidence and reaction time within both the semantic and episodic task for stimuli associated with AS, and for stimuli associated with prior knowledge but no-AS.

A series of repeated measures ANOVA examining the interaction between date of stimuli and AS revealed no significant effect of this interaction on any of the task variables within either the semantic or episodic task within the young adults for semantic accuracy F (1, 26) = 2.44, p = .13; semantic confidence F (1, 26) = .05, p = .82; semantic reaction time F (1, 20) = .44, p = .51; episodic accuracy F (1, 26) = .33, p = .57; episodic confidence F (1, 26) = ,56, p = *.46* or episodic reaction time F (1, 24) = 1.73, p = .20. Nor the older adults; Semantic accuracy – F (3, 18) = .51, p = .68; Semantic confidence – F (3, 18) = 1.98, p = .15; Episodic accuracy – F (3, 18) = .68, p = .58; Episodic confidence – F (3, 18) = 1.14, p = .36 or Episodic RT – F (3, 10) = 1.35, p = .31. This indicates date of stimuli did not influence any effect of AS on task performance.

4.4. Discussion

The main aim of this investigation was to examine whether the behavioural task advantage observed for prior knowledge and AS (Westmacott & Moscovitch, 2003; Renoult et al., 2015; Liu et al., 2016; Bellana et al., 2019) for famous person knowledge, could be extended to public event knowledge. Within this study participants encoded public events through an objective geographical location task following which their episodic memory was tested through an old-new recognition task. Their performance within these experimental tasks was later linked to their experience and ratings of these stimuli, to examine the impact of prior knowledge or AS for a stimulus on the associated task performance.

Consistent with our findings for famous persons within chapter two, we found participants were more accurate, gave higher confidence ratings and responded faster to stimuli they had prior knowledge of, in this case stimuli they awarded either a ‘know’ or ‘remember’ response to, compared to those events that were unknown to them. However, unlike previous findings this task performance boost was limited to accuracy, confidence, and reaction time only within the semantic task. The influence of prior knowledge on this task is expected, as if you know of the event, you would be more likely to then know where it took place. The interesting difference between these findings and those from chapter two and the prior literature (Westmacott & Moscovitch, 2003; Westmacott et al., 2004) is the lack of influence of prior knowledge on performance within the episodic task.

Similar findings were found for AS, when participants provided ‘remember’ responses for an event, these events were responded to faster and with more confidence within the semantic task than events they marked as ‘know’, consistent with previous literature utilising the remember-know paradigm to examine AS (Westmacott & Moscovitch, 2003; Westmacott et al., 2004) but again within this study there was no significant effect within the episodic task. This may have been due to the disparity between ‘remember’ responses and disclosable episodic memories, where participants reported relevant personal memories only for around half of the events, they awarded a ‘remember’ response to (58% of cases within the young adults and 51% of cases in the older adults). However, when contrasting events participants had disclosable associated memories for and those they did not, there was also no significant effect of AS on either the semantic or the episodic task,. contrary to the robust findings within the famous person literature (Westmacott & Moscovitch, 2003; Westmacott et al., 2004; Renoult et al., 2015).

Differences in the effect of prior knowledge and AS between famous person and public event knowledge may relate to differences in processing, as discussed by Graham et al., (1997). They suggested that the fact semantic dementia patients show some semantic resilience for recognising autobiographically significant people such as family members, neighbours, sports team mates etc., but do not show preservation of knowledge of a sport they frequently play, relates to differing methods of processing. Person recognition occurs in a distinct system in the brain whereby presentation of a face or name results in activation within perceptual units which in turn activates multi-modal person identity nodes (Bredart et al., 1997). It is likely, that person recognition is a special case in which AS can benefit recognition judgements, as tested in previous investigations, but that this influence does not extend to other types of knowledge including public events.

The secondary aim of this chapter was to investigate both the influence of time on the prevalence of prior knowledge and AS responses to stimuli, but also to examine any interaction between time and these processes on behavioural task performance. Expectations based on theories of semanticisation where memories become more semantic over time (Squire & Alvarez, 1995; Moscovitch et al., 2016) would predict that judgements of prior knowledge would be more frequent for more dated events and AS judgements would be more prevalent for more recent events. This would also extend to prior knowledge responses having the greatest effect on task performance for the most dated events, and AS responses causing the greatest increase in task performance for the most recent events. Within this chapter, the young adults did give more ‘remember’ responses indicative of AS for the most recent compared to dated events, in line with expectations, however, they also gave more ‘know’ responses indicative of prior knowledge for this most recent period contrary to predictions. Equally within the older adults, ‘know’ responses were relatively consistent across time periods, and we did not observe any significant increase in these prior knowledge responses for dated stimuli. Older adults remember responses also did not fall in line with predictions, their ‘remember’ responses were highest for both the most recent and the most dated stimuli, similar to our findings within chapter two. This indicates that participants’ subjective judgements of public event knowledge do not necessarily become more semantic over time.

However, a significant interaction was observed between time period of the stimuli and prior knowledge responses on young adults task performance, whereby the most dated events showed the greatest task performance boost and therefore benefitted the most from associated prior knowledge, in line with our predictions, but no significant interaction was found within AS.

The third element of interest within this chapter was the contrast between AS and flashbulb memory. Flashbulb memory literature has highlighted that when individuals encode the experience of learning about the event, both the source of learning and knowledge of the event remains resilient to decay over time (Curci et al., 2015; Hirst et al., 2015; Schmolck et al., 2000), which may reflect a form of AS. Within this chapter, we asked participants if they had any memories for the moment they learned about the presented public event, and found participants were able to report this type of memory in around 3 per cent of events. This proportion was consistent across young and older adults, which is in line with the literature that flashbulb memories are not reduced in healthy ageing (Berntsen & Thomsen, 2005; Davidson et al., 2006).

Notably, we found that associated location memories had a significant effect on performance within the episodic task, which was unaffected by both prior knowledge and general AS. Participants were more accurate within the old-new recognition task for events they had associated location memories for, compared to those they had prior knowledge of but no associated location memory. This suggests that relevant episodic memories for certain public events can implicitly influence their processing, but that such effects may be restricted to memories concerning the context (spatial in the present case) of the event.

We also found considerable variation within the amount of detail reported for these location memories, with some individuals providing a general geographical location, and others pinpointing their exact position within a room. However, although behaviourally it would appear that associated memories with higher levels of spatial detail led to greater accuracy within the episodic task, further analyses revealed no significant differences in task performance between events with high, mid, or low-level spatial detail. Although, one has to note that it is likely that as these memories are taken from typed self-report, the level of detail provided by the participant may not be conducive with the level of detail they actually hold for the memory. To fully examine the effect of location memory on performance, a post-task interview technique may be better suited.

Finally, flashbulb memory research had indicated that proximity to the event (Er, 2003; Kopp et al., 2020; Neisser, 1996; Pezdek, 2003) and event valence (Bohn & Berntsen, 2007; Raw et al., 2020; Talarico & Moore, 2012) may influence the strength of the associated memory and later recollection of it, so it was of interest to determine what impact these factors would have on task performance and particularly how these factors would interact with AS.

We found considerable variation within the way participants learnt about events, with older adults reporting a greater proportion of first-hand experiences and young adults being more likely to hear about an event from a second-hand source.

Behaviourally proximity to the event affected participants' semantic accuracy and semantic confidence, where participants' performance was most superior for events, they had first-hand experience of, in line with our predictions.

However, in terms of interaction with AS, although participants provided a greater percentage of associated AS for events, they experienced first-hand over those events they experienced second-hand through media coverage, schooling or other methods, there was no effect of the interaction between AS and event proximity on task performance.

Equally for event valence, although participants were more accurate for events, they considered positive and more confident and faster at responding to negative events within the semantic task, there was no significant difference between the proportion of reported AS between positive and negative events, and no significance effect of the interaction between AS and event valence on participants' task performance. So, although these factors influence the strength of flashbulb memories, they appear not to influence the effect of AS on task performance.

In summary, we have demonstrated that within event knowledge, participants' prior knowledge can influence performance only within a semantic task, but unlike previous findings AS for events did not impact task performance, unless the associated memory was related to spatial details (location) of learning about the event – in which case it resulted in increased episodic recognition performance.

CHAPTER FIVE

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Contrasting the Effect of Autobiographical Significance and Self-Reference on Experimental Memory Performance

5.1. Introduction

Within the previous three experimental chapters, the focus has been contrasting the effects of AS and prior knowledge to determine similarities or differences in these processes on associated task performance. Within this experimental chapter the focus is shifting to contrast AS with the well documented self-reference effect.

To date all literature directly examining the effect of AS on later memory performance has focused on its comparison to participants' prior knowledge of the stimuli, both using the remember-know paradigm (Westmacott & Moscovitch, 2003; Westmacott et al., 2004) or directly asking participants about their experience of the stimuli (Denkova et al., 2006; Renoult et al., 2015). In each of these cases, and within our own experimental chapters, we observe a general boost in task performance for stimuli participants have prior knowledge of, compared to those unknown to them, and that accuracy and reaction times are further improved if stimuli are autobiographically significant to the participant.

This performance boost draws considerable parallels with the self-reference effect, as participants are considering their own experience in relation to the stimuli. The self-reference effect is a well-documented process whereby memory performance is enhanced when participants encode information in relation to themselves (Symons & Johnson, 1997) , for example remembering the word 'bossy' in a word list because they considered themselves a bossy person.

An abundance of research has examined the self-reference effect over the past two decades particularly on its benefits for later memory performance. Typical studies find that trait adjectives participants consider descriptive of themselves are later better remembered in tests of recognition (Glisky & Marquine, 2009; Gutchess, Kensinger, Yoon, et al., 2007), free recall (Mueller et al., 1986), and source memory (which encoding task the word was presented in or how the word was presented; (Dulas et al., 2011; Leshikar & Duarte, 2012; Migo et al., 2012; Rosa & Gutchess, 2011).

Although this method of processing does not eliminate age related differences in subsequent memory performance between young and older adults, findings for an improvement in later memory performance for self-referenced trait adjectives are relatively robust in older adults (Gutchess et al., 2007; Leshikar et al.,2015; Yang et al., 2012). This makes the self-reference effect a useful mnemonic memory technique, whereby participants can improve their memory for important information by actively considering it in relation to themselves.

However, when episodic processing becomes greatly degraded such as in adults over 75 (Glisky & Marquine, 2009) or those with mild cognitive impairment (Carson et al., 2018; Leblond et al., 2016) or Alzheimer’s disease (Genon et al., 2014), any observed effect of the self-reference effect becomes limited or completely absent. This indicates that the self-reference effect is tightly linked to the episodic memory system, similar to the effect of AS.

The main focus of this chapter is therefore to directly compare the performance benefits of AS and self-reference to examine any observable differences or if it is likely that AS is an extension of the self-reference effect.

There is one marked difference between research on these two processes; literature around self-reference requires the participant to actively and explicitly encode stimuli through self-reference, i.e. consider whether they personally like an item, or whether they consider an adjective descriptive for themselves (Symons & Johnson, 1997), whereas research has examined AS implicitly whereby participants encode stimuli through another task e.g. is this person famous? (Westmacott & Moscovitch, 2003; Renoult et al., 2015) and are asked only later if they any of the presented stimuli are autobiographically significant to them. Therefore, in order to directly compare these processes within this chapter, both encoding methods will need to be explicit, asking participants if they believe the traits are reflective of their personality for self-reference, but also if they can remember a specific time when they demonstrated the trait as a measure of AS. This will then be the first-time AS has been examined as an active process. If findings of improved performance for autobiographically significant stimuli can be observed when the participants actively consider their associated episodic memories, this means that AS can also be manipulated for a useful mnemonic memory strategy. To compare results with previous AS studies, we also included a final questionnaire where participants were asked whether they had any personal memory associated with each of the stimulus presented in the experimental tasks.

Often research examining the efficacy of self-reference contrasts self-reference with a surface level task such as counting syllables or determining the valence of the word (Symons & Johnson, 1997). Although this is useful as a comparative tool and follows the tradition of depth of processing paradigms (reviewed in (Craik, 2002), this also contrasts subjective and objective encoding methods which have been shown to have differing impacts on memory. For example, older adults can perform as well as young adults for subjective recollections (Duarte et al., 2008; Folville, Bahri, et al., 2020; Folville, D’Argembeau, et al., 2020.) but typically perform worse for objective recollections. In the present study, we therefore included a subjective semantic measure as our third method of encoding to compare with self-reference and AS. In this task, participants were asked to judge whether they thought each presented word was common in the English language. This subjective semantic task was also compared to self-reference by Leshikar et al., (2015).

Therefore, this chapter will contrast participants' later recognition, free recall, and source memory performance for trait adjectives that participants encoded through three explicit and subjective measures: self-reference, frequency judgements and AS. Firstly, to directly contrast self-reference and AS, and secondly to determine whether explicit AS is an effective mnemonic technique.

5.1.1. Chapter Aims & Hypotheses

1. To directly contrast self-reference and AS encoding on recognition memory
    a. Literature has consistently shown self-reference encoding results in superior later memory performance as compared to surface level or semantic processing (Glisky & Marquine, 2009; Gutchess, Kensinger, Yoon, et al., 2007; Leshikar et al., 2015; Symons & Johnson, 1997), so it is expected that trait adjectives that are encoded through self-reference in this paradigm will be better recalled than those encoded through the subjective word frequency judgement.
    b. Equally, stimuli that are autobiographically significant have been shown to be better remembered than those only associated with semantic prior knowledge (Westmacott & Moscovitch, 2003; Renoult et al., 2015), so again we predict that in this paradigm trait adjectives encoded through AS encoding methods will be later better

remembered than those encoded through semantic word frequency judgements.

   c. Findings of reduced self-reference effect following breakdown of episodic processing (Carson et al., 2018; Genon et al., 2014; Glisky & Marquine, 2009; Leblond et al., 2016) suggest a strong role of episodic memory within this construct, similar to that observed within AS (Westmacott & Moscovitch, 2003; Westmacott et al., 2004; Renoult et al., 2015). We therefore expect similar performance between the two encoding methods.

2. This paradigm for the first time will examine if AS can be actively used by participants to improve later memory performance.
   a. All previous research focusing on the effect of AS on later memory performance has examined this effect implicitly (Denkova et al., 2006; Renoult et al., 2015; Westmacott & Moscovitch, 2003; Westmacott et al, 2004) whereby the participants encode the stimuli through another measure such as fame judgement and only reveal any associated episodic memories after the experimental recognition task. It is expected that actively retrieving the memories during the task will have the same beneficial effect on later memory performance.

5.2. Method

5.2.1. Participants

Participants were seventy-seven young adults aged 18-21 (*M* = 19.15, *SD* = .77) who were first-or-second-year psychology students from the University of East Anglia.

Of these, three participants requested their data to be withdrawn, and a further five individuals had evidence of severe clinical depression (PHQ > 20) so were removed from the analysis. This resulted in sixty-nine participants (64 female) aged 18-21 (*M* = 19.13, *SD* = .75). Participants were free from any known neurological or cognitive impairment and had English as a first language. All participants gave their informed consent and were compensated with partial course credits through the SONA participation system.

5.2.2. Stimuli

A series of 336 adjectives were used in this study (Appendix T), collated from the Anderson adjective norms (1968) and the affective norms of emotional words (Bradley & Lang, 1999). Affect was categorised as being either ‘positive’ or ‘negative’ based on the valence ratings from Anderson (1968) and Bradley & Lang (1999), these systems used a 7-point and 9-point affective rating scale, respectively. To make these ratings compatible to form a single valence rating in the present study, we calculated a valence percentage score. Negative affect was 0-50%, and positive affect was 50-100%.

As a subjective common-uncommon task was being used for one of the encoding methods, as used by Leshikar, Dulas & Duarte (2015), equal numbers of common and uncommon words were required. Words were categorised as being either ‘common’ or ‘uncommon’ based on the SUBTEX-UK lexical frequency classification system (Van Heuven, Mandera, Keuleers & Brysbaert, 2014) which examines the frequency words appear on BBC broadcasts. Zipf values of 1-3.5 were marked as ‘uncommon’ and 3.5-7 were marked as ‘common’.

The words were counterbalanced across twelve lists of words, each list contained 28 words: seven positive-uncommon, seven positive-common, seven negative-uncommon and seven negative-common. These lists had equal numbers of positive (50.14-91.33% valence, *M* = 62.9, *SD* = 7.38), negative (10.29-49.71% valence, *M* = 32.8, *SD* = 9.19), common (3.5-5.47 Zipf rating *M* = 4.06, *SD* = .45) and uncommon (1.17-3.48 Zipf rating, *M* = 2.80, *SD* .56) words. There was no significant difference in valence (F (12, 335) = .149, p = .99), lexical frequency (F (12, 335) = .399, p = .964) or character length (F (12, 335) = .769, p =.683) between these lists.

Six versions of the experiment were created to counterbalance the word lists so that each list had an equal chance of being presented in the three methods of encoding, or as novel items within the recognition task. Participants were randomly assigned to one of the experimental versions at sign-up.

5.2.3. Online Experiment

The Gorilla Experiment Builder (www.gorilla.sc) was used to create and host this experiment (Anwyl-Irvine, Massonnie, Flitton, Kirkham & Evershed, 2018). Data was collected between 27/04 – 15/05/2020 on BUILD 20200409.

5.2.3.1. Information Sheet & Consent

Participants were recruited via the SONA participation platform and were given a link to follow to participate in the online study. Upon clicking the link they were shown a digital version of the information sheet (Appendix U) and asked to tick three options to indicate their consent to participate; *'I have read and understood the information sheet'*, '*my participation is voluntary and I know that I am free to* *withdraw at any time, without giving any reason and without it affecting me at all*', '*I know that no personal information will be shared outside of the research team nor published in the final report from this research'* and '*I agree to take part in the above study*'. Only once all four options were ticked, could they proceed to the encoding task.

5.2.3.2. Encoding Phase

The encoding phase was divided in six study blocks. In each block, participants were asked to answer one of the three possible questions for a series of twenty-eight words; either '*Do you think this word is commonly used*?' as a subjective semantic measure, '*Does this word apply to you?*' as the self-reference encoding method, and '*Do you remember a time when you were this word?*' for AS. Instructions for these three methods were displayed to participants in 24 pt. Courier New font (see Figure 57 below).

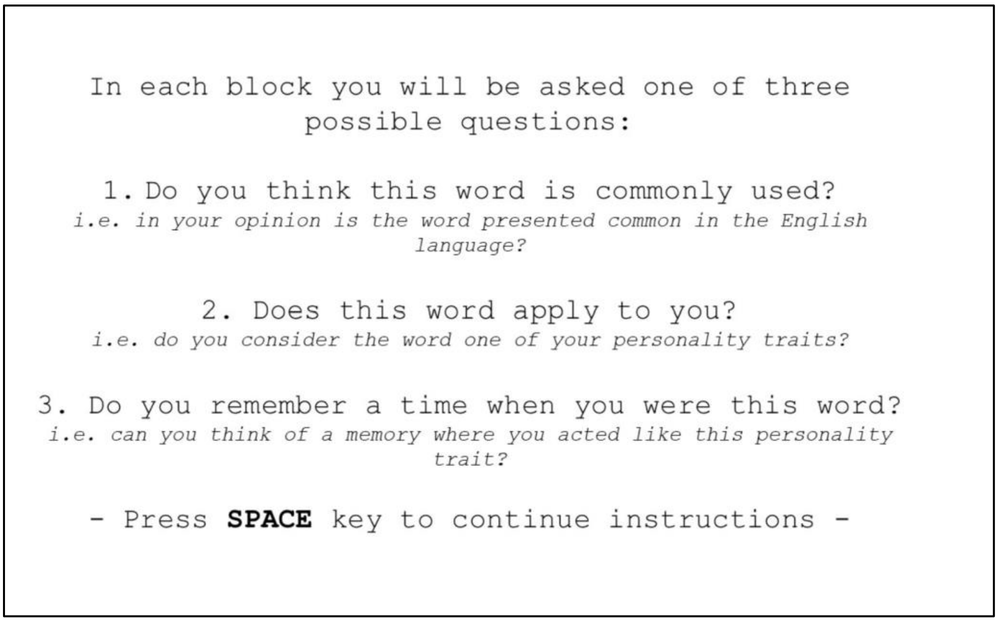

Figure 57 Instructions Provided to Participants for the Questions they would be Answering within the Encoding Phase

Participants were instructed that each block would begin with a random question instruction screen to tell them the question they would be answering and the buttons they would need to press, see example in Figure 58 below. In each case, presentation of this instruction was untimed, so participants were instructed to take a break if needed on these screens before beginning each block.

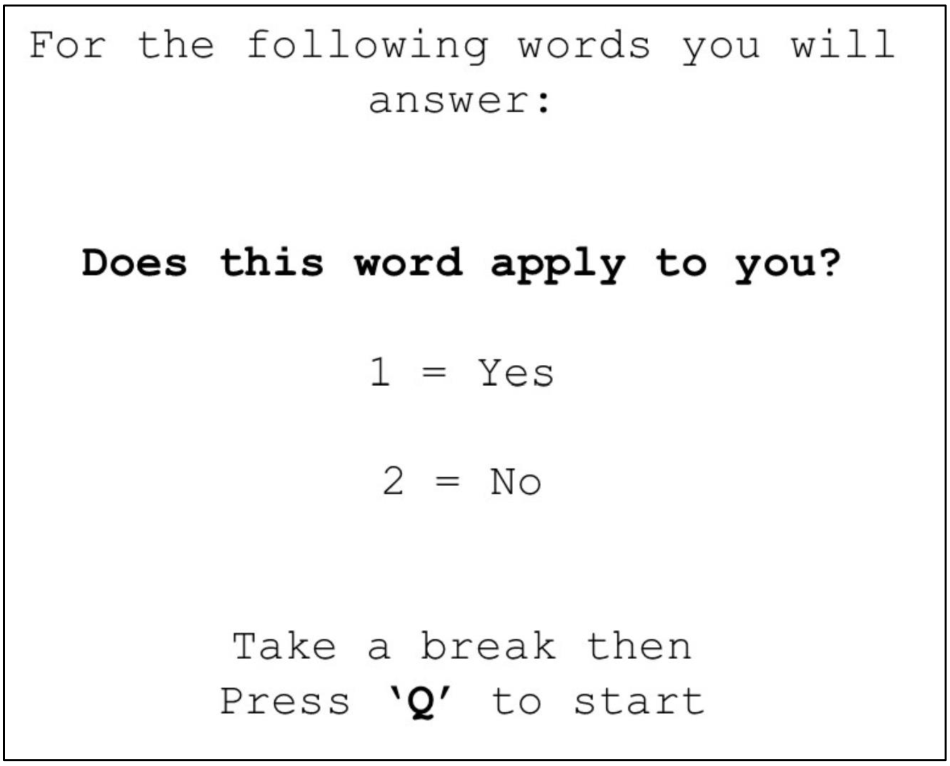

Figure 58 Example Block Opener, Where Participants are Shown the Question, they Will Need to Answer and the Buttons they will be Required to Press for a Series of Trait Adjectives.

Following each block instruction screen, participants were told to focus their attention on a fixation cross '+' presented in the centre of the screen for 1 second, and that, following this, a word would be presented in the centre of the screen (in 24pt Courier New font).

When the word was on the screen participants were instructed to press '1' on their computer keypad if the answer to the encoding question was YES and '2' if the answer was NO. They were advised to hover their index and middle finger over the keys and to press the keypad as fast as they could. They had up to five seconds to make this judgement. The word stayed on screen for five seconds even if the participant responded during this time, to ensure each word was presented for the same duration.

After five seconds, a fixation cross was presented, and the procedure repeated for a further 27 words. After all, 28 words had been presented in the block, the next task question instruction screen appeared, and the same procedure repeated for a further five blocks.

Each block took around 3 minutes to complete and therefore the encoding phase took approximately 17 minutes plus added break times.

5.2.3.3. Demographic Questionnaire

After completion of the encoding task, participants were automatically directed to a demographic questionnaire task within Gorilla. For this, participants were asked to answer a series of questions, gathering demographic information about themselves such as gender, age, highest level of education, sleep quality (Pittsburgh Sleep Quality Inventory; Buysse, Reynolds, Monk, Berman & Kupfer, 1989) and mood (Patient Health Questionnaire-9; Kroenke, Spitzer & Williams, 2001). These measures have been shown to affect memory performance (Miyata et al., 2013; Kizilbash & Vanderploeg, 2002), but the questionnaire also doubled as a short distractor prior to the recall task. This section was untimed, but participants took on average three minutes to complete this task.

5.2.3.4. Free Recall Task

After completion of the demographic task, participants were automatically directed to the free-recall task within Gorilla. Participants were instructed that they would be asked to ‘type as many words as you can remember from any of the six blocks from the previous task’ and that they should separate each word with a comma. They were told that they would be given a maximum of five minutes to do this, and that a timer would begin when they pressed the SPACE bar to begin the task.

Figure 59 Empty Free Recall Screen Shown to Participants. They are Able to Type Words Within the Empty Text Box, and the Timer in the Bottom Corner Counts Down for Five Minutes.

When they began the task, participants were presented with a blank text box in the centre of the screen and a timer in the bottom right-hand corner of the screen counting down from 300 seconds (Figure 59). They were able to freely type as many words as they could remember within this text box, and after five minutes they were advanced to the recognition task.

5.2.3.5. Recognition and Source Memory Task

After completing the five-minute free recall, participants were directed to complete the recognition task. Participants were instructed that they would again be shown a series of adjectives and they had to decide whether they had seen them before within any of the six blocks in the encoding phase, or whether they were new to the experiment.

They were presented with a fixation cross ‘+’ for 1 second, and instructed to focus their attention on this spot, and that following this a word would appear on screen in 24pt Courier New. They were asked to press ‘1’ on their computer keypad if they believed the word was old, that they believed the word appeared in the first task, or ‘2’ on their keyboard if they thought the word was NEW to the experiment. Again, participants were advised to hover their index and middle finger above keys 1 and 2 to press the button as fast and as accurately as possible, but that they would have up to three seconds to do this.

If they selected the word was OLD, they were taken to a second instruction screen to ask how confident they are in their decision and asked to press button ‘1’ if they were very confident, ‘2’ if they were somewhat confident and ‘3’ if they were not at all confident in their decision. There was no time limit on this confidence task, and so participants were instructed to take breaks on this screen if they wanted.

Following this decision, they were taken to a third screen and asked to decide in which task the word had been previously seen in. Participants were asked to press ‘1’ on the keypad if they thought the word was presented in the ‘Do you think this word is commonly used?’ task, ‘2’ if for the ‘Does this word apply to you?’ task, or ‘3’ for the ‘Do you remember a time when you were this word?’ task. Again, there was no time limit within this task.

Following this decision, another fixation cross ‘+’ was presented and the procedure repeated for 336 trait-adjectives. Participants were instructed to take frequent breaks on the confidence and source screens. The task took approximately 30 minutes to complete, plus any added break times.

5.2.3.6. Memory Questionnaire on Autobiographical Significance

Following the recognition task participants were directed to a follow-up memory questionnaire on Gorilla. They were presented again with the 56 adjectives that were presented within the two AS encoding blocks. Words were presented one-at-a-time and participants were asked again the question: '*Do you remember a time when you were this word?*' and asked to click either YES or NO. If they answered yes, they were taken to a second screen where they could type and disclose the memory. They were asked to select "next" once they had finished typing, or if they did not want to disclose the memory. If they click 'NO' they were directed to the next word. This procedure repeated for the 56 words. The task was completely untimed so participants could complete it at their own pace. On average it took participants fifteen minutes to complete.

5.2.3.7. Debrief

Following the memory follow-up questionnaire, participants were directed to the study debrief. The debrief information was presented digitally (Appendix V) and participants were asked to type in a blank text box if they wanted to withdraw their data.

5.3. Results

Participant responses to trait-adjectives within the encoding tasks, were examined in relation to their later recognition accuracy, recognition reaction time, source accuracy and episodic confidence within the recognition task, to investigate the effectiveness of the encoding techniques.

Participants achieved 54.82% accuracy (*SD* = 18.72) on the old-new recognition task, which was significantly above chance (50%), $t(68) = 2194.73$, $p < .001$. They also achieved 25.44% accuracy (*SD* = 11.83) in identifying the source of the encoding task, which was also significantly above chance (25%), $t\ (68) = 1737.29$, $p < .001$. Participants were able to free recall 7.73% (*SD* = 4.98) of the 168 presented words during the free-recall task.

Participants were significantly faster at making the uncommon-common judgement (*M* = 1484.48 ms, *SD* = 523.79) than the self-reference (*M* = 1653.02, *SD* = 473.71) or the AS judgements (*M* = 1590.06, *SD* = 481.40), $t\ (68) = 3.39$, $p = .001$ and $t\ (68) = 3.56$, $p = .001$ respectively. However, no difference in reaction time was present between self-reference and AS ($t\ (68) = 1.52$, $p = .132$).

We found no correlation between participants' sleep quality (PSQI; *M* = 5.96, *SD* = 2.10) nor their depression score (PHQ-9; *M* = 8.04, *SD* = 4.92) and their recognition memory performance within the episodic task (*M* = 54.82, *SD* = 18.72), $r\ (69) = .08$, $p = .53$ and $r\ (69) = .13$, $p = .28$, respectively, so these were not included as co-variates in the following analyses.

5.3.1. Effect of Type of Encoding on Subsequent Recognition Memory

In order to examine the effect of type of encoding on later memory performance, averages for episodic accuracy, episodic confidence, episodic reaction time, and source accuracy were calculated for each of the encoding tasks. Figure 60 shows the participants' mean accuracy and confidence levels within the episodic recognition and source memory task.

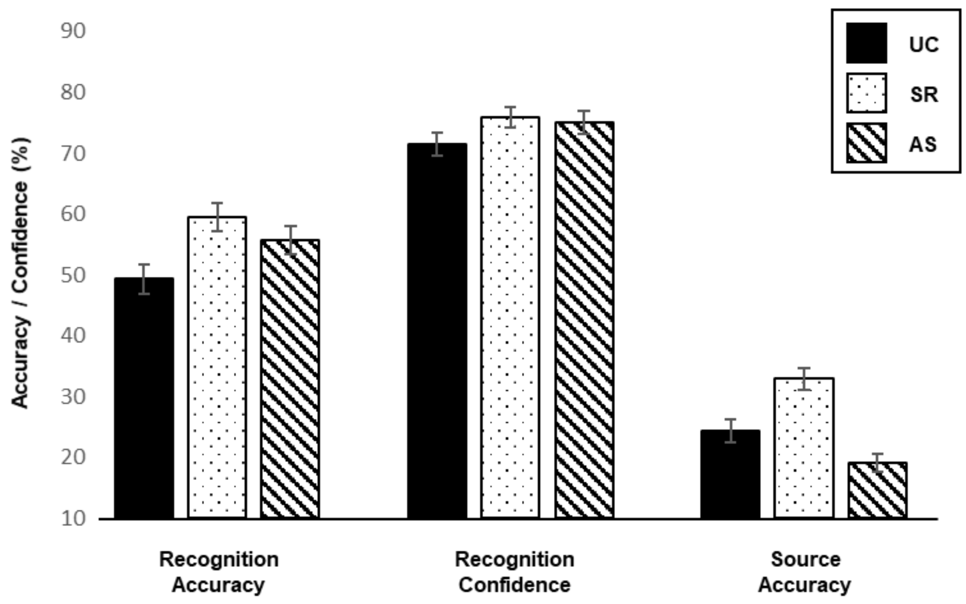

Figure 60 Mean Accuracy and Confidence Within the Recognition and Source Memory Task for Trait Adjectives Presented in the Word Frequency (UC), Self-Reference (SR) and Autobiographical Significance (AS) Encoding Tasks.

As is apparent on Figure 60, encoding through self-reference seems to produce the greatest accuracy within both the recognition and source memory tasks. Items encoded through AS appear to be recognised more accurately than those through the semantic commonness judgement, but the reverse was true for accuracy within the source memory task. Very little difference is seen between the self-reference and AS for confidence judgements within the episodic task, but these 2 conditions appeared to produce slightly higher confidence ratings than the semantic commonness judgement. Finally, as shown in Figure 61 below, reaction times between the three encoding conditions appeared more or less equivalent.

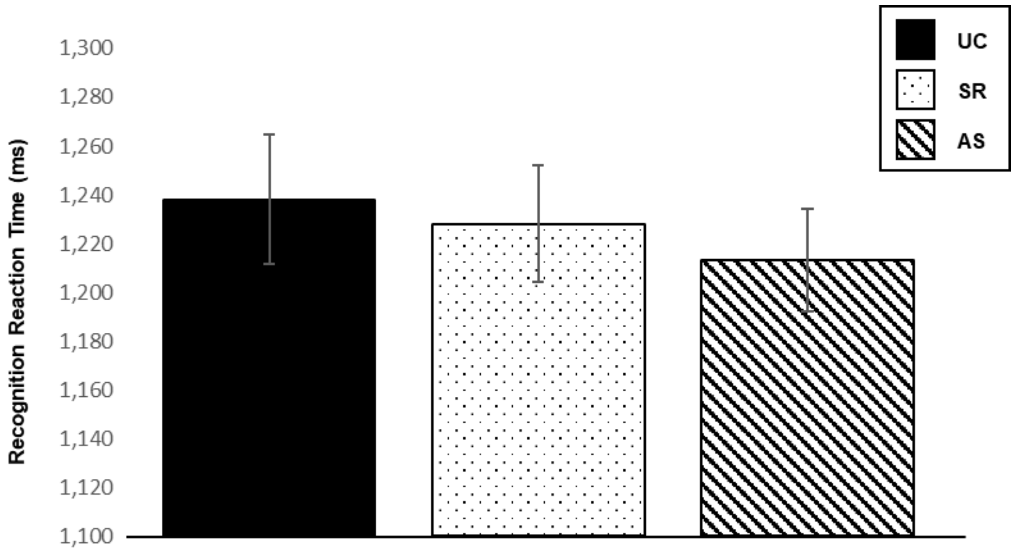

Figure 61 Mean Reaction Time for Traits Presented within the Word Frequency (UC), Self-Reference (SR) and Autobiographical Significance Encoding Task

A repeated measures ANOVA revealed a significant effect of method of encoding on task performance,participants' recognition accuracy *F* (2, 67) = 34.37, *p* <.001; recognition confidence *F* (2, 67) = .5.40, *p* = .007 and source accuracy *F* (2, 67) = 34.01, *p* <.001. ~~Wilks' Lambda = .38, *F* (8, 61) = 12.65, *p* <.001. Follow-up univariate analyses showed that method of encoding significantly affected recognition accuracy (*F* (2, 136) = 35.68, *p* <.001, recognition confidence (*F* (2, 136) = 6.39, *p* = .003) and source accuracy (*F* (2, 136) = 32.72, *p* <.001).~~

Examining recognition accuracy, paired samples t-tests showed encoding words through both self-reference and AS resulted in superior recognition accuracy compared to the subjective semantic uncommon/common condition (*t (*68) = -7.988, *p* <.001, *t (*68) = -5.734, *p* <.001, respectively), and that encoding trait adjectives through self-reference resulted in superior recognition accuracy to words encoded with AS (*t* (68) = 3.035, *p* = .003).

Paired samples t-tests on confidence ratings showed that both self-reference and AS encoding methods resulted in greater confidence within the recognition task compared to the uncommon-common judgement task (*t (*68) = -3.09, *p* =.003, *t* (68) = -2.80, *p* = .007, respectively). However, no difference in episodic confidence was observed between stimuli encoded through self-reference and those encoded through AS (*t* (68) = .70, *p* = .49).

Encoding trait-adjectives through self-reference resulted in the highest accuracy within the source memory task, compared to both AS (*t (*68) = 7.87, *p* <.001) and uncommon-common (*t* (68) = 5.52, *p* <.001). Within this task, encoding through the subjective semantic uncommon-common task resulted in superior accuracy as compared to encoding through AS (*t* (68) = 2.80, *p* = .007).

Taken together, in the recognition task both self-reference and AS methods of encoding resulted in greater levels of accuracy and confidence compared to the uncommon-common judgement. However, within the source accuracy task only items encoded through self-reference were more accurate than the uncommon-common judgement.

5.3.1.1. Effect of Encoding Task on Free Recall Performance

In addition to recognition memory, this study also examined participants' free recall for the presented trait adjectives. Words were marked at the participant level as either being recalled or not by participants. This resulted in a percentage recalled for each encoding method, presented in Figure 62 below.

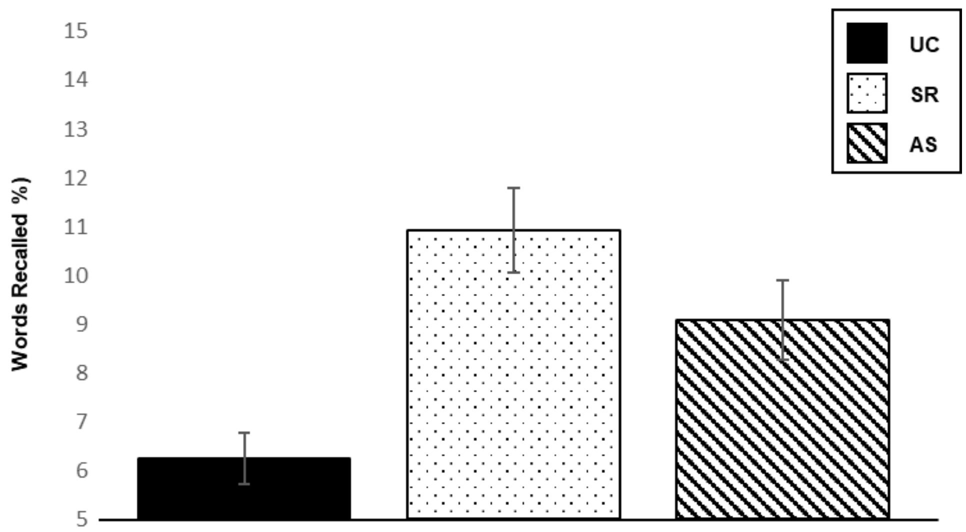

Figure 62 Mean Number of Words Recalled from Each of Methods of Encoding; Word Frequency Judgements (UC), Self-Reference (SR) and Autobiographical Significance (AS).

From Figure 62 it is clear that items that were encoded through self-reference were most likely to be recalled, followed by those encoded through AS. The uncommon-common judgement method of encoding resulted in the fewest words later recalled.

Paired samples t-tests showed that both self-reference encoding (t (60) = 5.55, p <.001) and AS encoding (t (60) = 3.38, p <.001) resulted in superior free recall performance to uncommon-common encoding. There was also no significant difference in the percentage of words recalled between the self-reference and AS encoding methods (t (60) = 1.96, p = .06).

5.3.2. Effect of Encoding Task Response on Subsequent Recognition Memory

When examining task differences, participants gave 'yes' responses during the AS task 71.09% of the time (*SD* = 13.88), compared to 54.57% for the self-reference (*SD* = 10.5) and 64.65% (*SD* = 11.86) for the common task. There was a significant difference between the percentages of ‘yes’ responses between both the AS and SR task, t (68) = 10.29, $p < .001$, and the SR and UC task, t (68) = 6.07, $p < .001$, and between the AS and UC task, t (68) = -3.89, $p < .001$, so it was of interest to examine what effect a ‘yes’ response within the encoding task would have on later recognition and source memory. We calculated averages for episodic accuracy, episodic confidence, episodic reaction time, and source accuracy for each of the encoding tasks, separately for when participants gave yes and no responses within the task.

A repeated measures ANOVA examining the effect of response and method of encoding on task performance revealed a significant effect of source accuracy F (2, 65) = 16.26, $p < .001$ ~~, revealed a main effect of response, Wilks’ Lambda = .65, *F* (4, 63) = 8.43, *p* <.005, and a significant interaction between participants’ response and method of encoding, Wilks’ Lambda = .75, *F* (8, 258) = 5.13, *p* <.005. Follow-up univariate analysis showed a significant effect of participant response on recognition accuracy (*F* (1, 66) = 21.02, *p* <.001), recognition reaction time (*F* (1, 66) = 9.78, *p* = .003) and source accuracy (*F* (1, 66) = 11.96, *p* = .001).~~

Paired samples t-tests revealed that participants were significantly more accurate within the recognition task for words they responded yes to within the encoding tasks (M = 57.29, SD = 19.52) compared to those they responded no to (M = 51.97, SD = 18.99), t (68) = 4.52, $p < .001$. However, no significant differences were observed within reaction times between those words associated with yes responses (M = 1210.73, SD = 211.01) compared to those they responded no to (M = 1254.41, SD = 237.08), t (68) = .07, p =.94. There was also no significant difference within source accuracy for words associated with yes responses (M = 26.65, SD = 11.93) and those associated with no responses (*M* = 24.65, *SD* = 13.57), *t* (68) = 1.90, *p* = .06.

A significant interaction effect of participant responses and method of encoding was also found for participants' source accuracy *F* (2, 132) = 17.18, *p* <.001. Means for this variable for yes and no responses across the three methods of encoding are displayed in Figure 63 below.

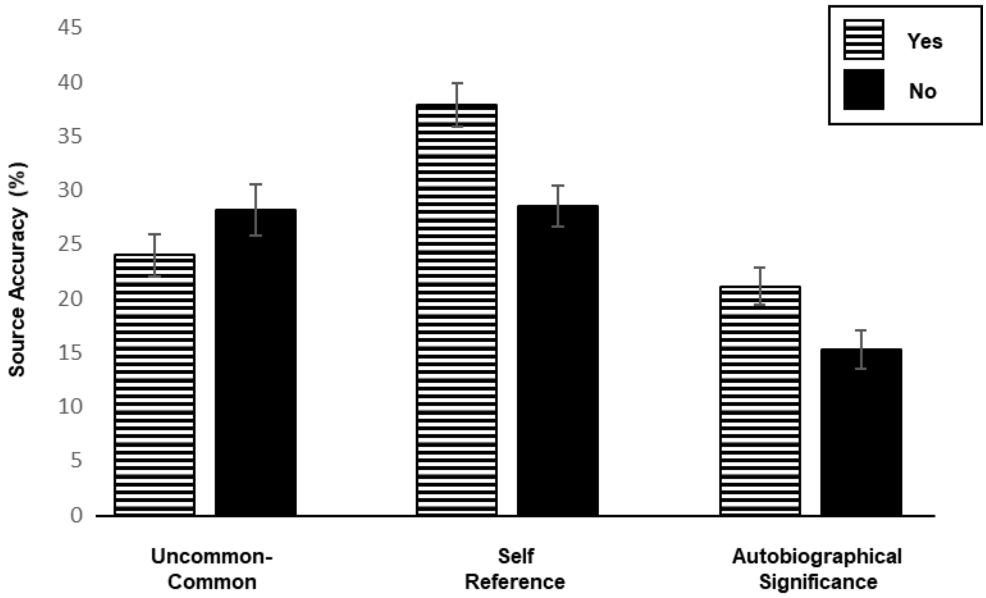

Figure 63 Average Accuracy within the Source Accuracy Task for Yes or No Responses to Each of the Encoding Tasks.

From Figure 63 it appears that responding yes during both the self-reference and AS encoding task resulted in superior source memory to responding no within the same tasks, whereas the opposite appears to be the case for the uncommon-common task.

Paired samples t-tests showed these trends to be significant, with yes responses within both the self-reference (*t* (68) = 5.72, *p* <.001) and AS (*t* (66) = 3.32, *p* = .001) encoding tasks resulting in superior performance in source memory than for words they responded no to. In contrast, words participants gave no responses to within the uncommon-common task were later associated with a greater source memory performance than for words participants had responded yes to (t (68) = 2.39, p = .02).

5.3.3. Real AS Memory

There was a discrepancy between when participants responded yes within the AS encoding task and their disclosing of memories within the final questionnaire. Participants disclosed memories for 65.4% of words (*SD* = 22.61) that they had provided a yes response to during the AS encoding task.

To examine if being able to disclose a memory made a difference to the effects of AS, we calculated averages for episodic accuracy, episodic confidence, episodic reaction time, and source accuracy for the words presented in the AS encoding task, comparing those they had associated memories for, and those they had no associated memory for. Means for recognition accuracy, recognition confidence and source accuracy are displayed in Figure 64 below.

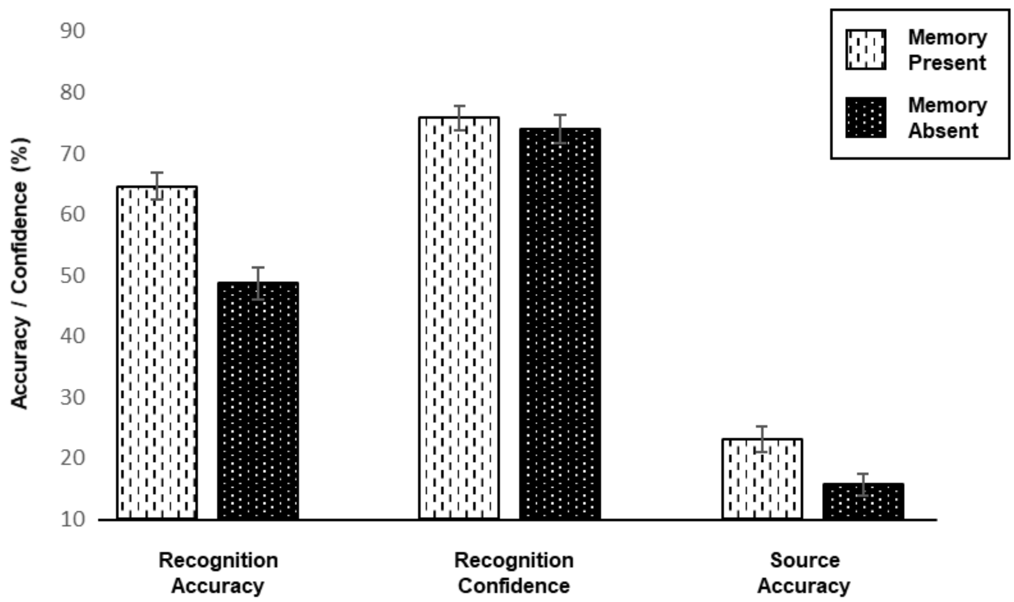

Figure 64 Mean Accuracy and Confidence Ratings within the Recognition and Source Memory Tasks for Trait Adjectives the Participants were Able to Disclose Memories for and those they were Unable to Disclose Memories for that had been Presented within the Autobiographical Significance Encoding Tasks

From Figure 64, we can observe some effect of an associated memory, whereby having a memory results in superior recognition accuracy and source accuracy for those trait adjectives compared to those that have no associated memory.

A repeated measures ANOVA examining the effect of AS revealed a main effect of associated memory on participants' recognition accuracy F (1, 64) = 62.05, p <.001 and source accuracy F (1, 64) = 12.76, p = .001. ~~Wilks' Lambda = .49, F (4, 61) = 15.56, p <.001. Follow-up univariate analysis demonstrated the effect of an associated memory was significant for recognition accuracy (F (1, 64) = 62.05, p <.001) and source accuracy (F (1, 64) = 12.76, p = .001).~~

This indicates that the association of a memory enhanced later recognition and source memory.

As an effect of associated memory was found, it was of interest to compare 'successful' AS encoding (i.e., traits processed during the AS task for which participants were able to disclose a relevant memory at the end of the experiment) against the other two encoding methods. Means for this comparison are displayed in Figure 65 below.

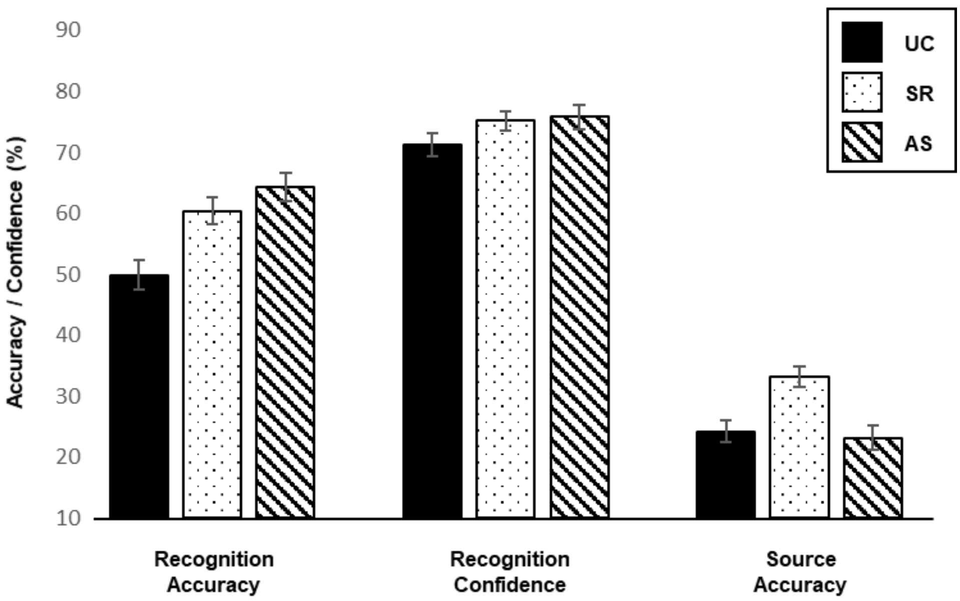

Figure 65 Mean Accuracy and Confidence within the Recognition and Source Memory Task for Traits Encoded Through Word Frequency Judgements (UC), Self-Reference (SR) and those with Successful Memory Disclosure Encoded with Autobiographical Significance (AS).

From Figure 65, it seems that after considering only words with successful later disclosure of memories for the AS encoding methods, that although differences appear marginal, encoding words through AS results in superior accuracy and confidence within the recognition task, compared with the uncommon-common and self-reference judgements. However, within source accuracy, self-reference encoding is the most successful method.

A repeated measures ANOVA examining the effect of method of encoding on later memory task performance, after considering AS encoding only with a successful memory retrieval, revealed a significant effect on participants' episodic accuracy $F(2, 64) = 57.28$, $p < .001$; episodic confidence $F(2, 64) = 4.822$, $p = .011$ and source accuracy $F(2, 64) = 18.080$, $p < .001$. ~~Wilks' Lambda = .43, $F(8, 254) = 16.67$, $p < .001$. Follow-up univariate analysis showed that method of encoding significantly affected participants' performance within recognition accuracy ($F(2, 130) = 47.88$, $p < .001$), recognition confidence ($F(2, 130) = 5.61$, $p = .005$), and source accuracy ($F(2, 130) = 13.25$, $p < .001$).~~

Within episodic accuracy, after including only AS with a successful memory retrieval, paired samples t-tests demonstrated that encoding through AS resulted in superior recognition accuracy to self-reference encoding ($t(65) = 2.32$, $p = .02$) and uncommon-common encoding ($t(65) = 9.13$, $p < .001$), and as reported before self-reference encoding also resulted in greater recognition accuracy than uncommon-common encoding ($t(68) = 7.99$, $p < .001$).

Both self-reference encoding ($t(68) = 3.09$, $p = .003$) and AS encoding ($t(65) = 2.80$, $p = .007$) resulted in greater recognition confidence than uncommon-common encoding, but there was no significant difference in recognition confidence between words encoded through self-reference and words encoded through AS ($t(65) = .48$, $p = .63$).

Finally, within source accuracy, words encoded though self-reference resulted in superior source accuracy to both words encoded through uncommon-common judgements ($t(68) = 5.52$, $p < .001$) and through AS ($t(65) = 4.21$, $p < .001$), but there was no difference in performance between words encoded through AS and those encoded through uncommon-common judgements (t (65) = .44, p = .66).

5.3.3.1. Real AS Memory on Free Recall Performance

Again, it was of interest to examine participants' free recall performance for traits studied in the AS task for which participants were later able to disclose a memory, against those encoded through self-reference and word frequency encoding methods. This resulted in a percentage recalled for each encoding method, presented in Figure 66 below.

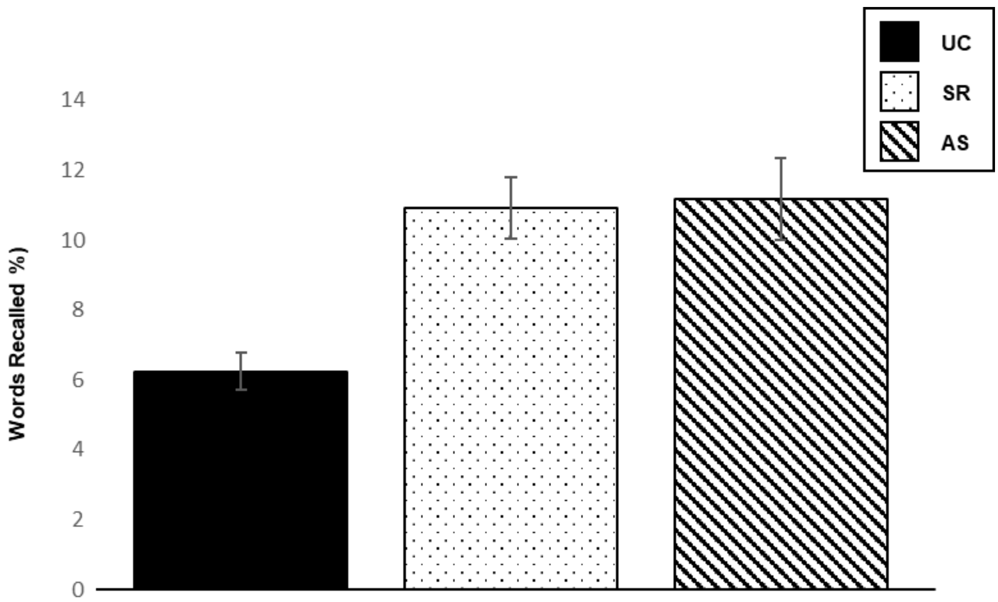

Figure 66 Mean Number of Words Recalled from Each of the Methods of Encoding; Word Frequency Judgements (UC), Self-Reference (SR) and Autobiographical Significance with a Successful Disclosure of an Associated Episodic Memory (AS).

From comparing Figure 62 for AS encoding before considering associated memories and Figure 66 above after considering only stimuli with associated memories, it is clear that successful retrieval increased participants' free recall performance.

Although, the difference in recall performance between trait words encoded through self-reference and AS remained non-significant (*t* (59) = 1.36, *p* = .18). This indicates that for free recall performance, both self-reference and AS are equally effective encoding methods.

5.3.4. Examining Valence

Previous research has indicated a significant effect of valence on the self-reference effect (D'Argembeau et al., 2005) so it was of interest to examine the impact of valence on AS also. Equal portions of positive and negative adjectives were used in this study, so we are able to clearly examine the effect of valence on task performance. To achieve this, we calculated averages for episodic accuracy, episodic confidence, episodic reaction time, and source accuracy separately for the positive and negative words in each encoding task.

A series of repeated measures ANOVAs examining the effect of valence on task performance found no significant effect of participants' recognition accuracy *F* (2, 67) = .26, *p* = .77; recognition confidence *F* (2, 67) = 1.72, *p* = .19; recognition reaction time *F* (2, 67) = 1.75, *p* = .18 and source accuracy *F* (2, 67) = 2.39, *p* = .10. Indicating the valence of the presented word, did not have an influence on participants' task performance.

~~A repeated measures ANOVA revealed a significant effect of valence on task performance, Wilks' Lambda = .80, *F* (4, 65) = 4.12, *p* = .005. Follow-up univariate tests showed valence significantly affected participants' confidence within the recognition task (*F* (1, 68) = 12.81, *p* <.001). Participants were significantly more~~

~~confident within the recognition task with words that were of positive valence (*M* = 75.76, *SD* = 13.35) compared to words that were of negative valence (*M* = 72.95, *SD* = 13.89), *t* (68) = 3.60, *p* = .001.~~

~~The repeated measures ANOVA also revealed a significant effect of the interaction between valence of stimuli and method of encoding on task performance, Wilks' Lambda = .887, *F* (8, 266) = 2.05, *p* = .04. However, follow-up univariate analysis found no task performance variable was significantly affected by this interaction (*p* >.1).~~

5.3.5. Examining Effect of Word Frequency

Equal portions of common and uncommon adjectives were used in this study, so we are able to examine the effect of valence on task performance. To achieve this, we calculated averages for episodic accuracy, episodic confidence, episodic reaction time, and source accuracy were calculated separately for the common and uncommon words within each encoding task.

A series of repeated measures ANOVAs examining the effect of word frequency and method of encoding revealed no significance effect on recognition accuracy *F* (2, 67) = 1.09, *p* = .34; recognition confidence *F* (2, 67) = .84, *p* = .43; recognition reaction time *F* (2, 67) = .14, *p* = .87 or source accuracy *F* (2, 67) = 2.3, *p* = .11. Indicating that word frequency and method of encoding did not influence participants' task performance.

~~A repeated measures ANOVA examining the effect of word frequency and method of encoding on task performance, revealed a significant main effect of word frequency, Wilks' Lambda = .49, *F* (4, 65) = 16.62, *p* <.001). Follow up univariate~~

analyses showed word frequency significantly affected participants' performance within participants' recognition accuracy (F (1, 68) = 35.29, p <.001), recognition confidence (F (1, 68) = 14.07, p <.001), recognition reaction time (F (1, 68) = 14.61, p <.001) and source accuracy (F (1, 68) = 28.13, p <.001). Mean accuracy, confidence, and reaction time in the recognition task for words considered common (high frequency) and uncommon (low frequency) are displayed in table x below

Table 4 Mean Accuracy, Confidence, and Reaction Time within the Recognition Task for Words Considered Common (High Frequency) and Uncommon (Low Frequency)

	Common		-	Uncommon	
	Mean	*SD*	-	Mean	*SD*
Recognition Accuracy (%)	52.15	*19.24*	-	57.48	*18.94*
Recognition Confidence (%)	72.81	*14.24*		75.73	*12.91*
Recognition Reaction Time (*ms*)	1169.51	*193.73*		1159.11	*193.71*
Source Accuracy (%)	23.71	*12.33*		27.18	*11.94*

Paired samples t-test showed that uncommon words were responded to with greater accuracy than common words (t (68) = 5.90, p <.001), they were also responded to more confidently within the recognition task (t (68) = 3.99, p <.001) and were associated with a greater source memory accuracy (t (68) = 5.31, p <.001). However, no significant difference was present between uncommon and common words within participants' recognition reaction time (t (68) = 1.14, p = .26).

The repeated measures ANOVA showed no significant effect of the interaction between word frequency and method of encoding on participants' task performance, Wilks' Lambda = .94, F (8, 266) = 1.14, p = .34.

5.4. Discussion

In this chapter participants encoded trait adjectives using three encoding techniques: self-reference judgements, AS judgements, and semantic word frequency judgements. We examined the efficacy of these encoding methods on later recognition memory, free recall, and source memory. The main purpose of this chapter was two-fold; firstly, to contrast the effect of self-reference with the effect of AS on later memory performance, and secondly to examine whether AS can be activated explicitly.

A wealth of literature has demonstrated the efficacy of the self-reference effect on later memory performance (Glisky & Marquine, 2009; Gutchess, Kensinger, Yoon, et al., 2007; Leshikar et al., 2015; Symons & Johnson, 1997) and our findings echoed the robust nature of this effect. We found that when individuals considered whether certain trait adjectives were reflective of their personality, they later demonstrated superior free recall performance, recognition accuracy, higher recognition confidence and greater source accuracy for those traits, compared to trait adjectives they made word frequency judgements on.

For the first time within this paradigm, we examined whether the effect of AS could be actively engaged by participants, by asking them to encode trait adjectives by considering if they had an associated episodic memory for the trait. Our findings indicated that when participants considered whether they had a memory for a personality trait, their later free recall performance, recognition accuracy and recognition confidence were greater for those traits, compared to the traits participants made word frequency judgements for, as observed for the self-reference effect. However, encoding traits through AS resulted in poorer source accuracy, compared to both traits encoded through self-reference, and traits encoded through word frequency judgements. This indicates that AS effects may have been influenced the more familiarity-based recognition memory, as tested in the previous three chapters, but could not extend to the more explicit source memory retrieval.

This may link to our discussion from the previous public events chapter (see section 4.4) whereby AS is able to act on familiarity pathways where it can enhance recognition of famous persons that individuals have episodic experiences of, even after general person knowledge has degraded (Westmacott et al., 2004; Snowden et al.,2004), but it does not seem to enhance memory retrieval beyond familiarity (Graham et al., 1997).

However, when we examined participants' free recall performance, they were able to remember more of the trait adjectives that they had encoded through self-reference and AS compared to the trait adjectives they had encoded through the word frequency judgements, and there was no significant difference in recall performance between the traits encoded through self-reference and AS. Indicating that AS was able to influence explicit memory retrieval within this task, which is more than a familiarity judgement.

Instead, it may be that similarities between the encoding tasks made the source memory task particularly difficult, evidenced by average accuracy less than chance (25.4%) within this task. Considering whether a trait is self-reflective and retrieving a memory of a time when you acted as a certain trait are quite similar in nature and may have been mixed by participants when tested. To better examine the efficacy of AS on explicit memory retrieval, it may be better to investigate against semantic word frequency judgements, and perhaps a differing method of self-reference such as considering if a trait reflects a best friend or close relative which would be notably different.

We were also interested in contrasting the self-reference effect with the effect of AS, as they both show later memory enhancement, have strong links to the episodic memory system and involve a level of self-reflection. Analysis examining the encoding method for trait adjectives showed that both self-reference and AS were superior to word frequency judgements in free recall, recognition accuracy and recognition confidence, but trait adjectives that were encoded through self-reference were responded to with greater accuracy both for recognition and source judgements than those encoded through AS. This indicates that overall self-reference may be a more effective encoding method than AS.

Interestingly, for both traits encoded through self-reference and traits encoded through AS, recognition accuracy was superior when they answer ‘yes’ during the encoding task, compared to traits they answered ‘no’ to. This is consistent with the effect of self-reference being greater when it is successful (Symons & Johnson, 1997), in that participants do consider the item to be related to them in some way. Whereas, for traits encoded through word frequency judgements, performance was actually better for traits they answered ‘no’ to, meaning the uncommon words were better remembered, which is also a generally consistent finding in the literature (Benjamin, 2003; Glanzer & Bowles, 1976; Gorman, 1961)

As within previous chapters, following the memory tasks participants were asked to disclose any memories they had for the trait adjectives presented during the AS encoding task. There was a level of discrepancy, in that participants only disclosed memories for around 65 per cent of the traits they had previously responded ‘yes’ to within the AS encoding task. When performance for trait adjectives from the AS encoding task with and without declarable memories were compared, those traits with disclosed episodic memories were associated with higher performance in free recall, recognition accuracy, and recognition confidence and source accuracy, compared to those with no disclosable memories. This indicates that the accessibility of the associated memory plays a key role in the later enhancement in memory performance.

When we examined participants' task performance for trait adjectives encoded through AS with a disclosable memory against those trait adjectives encoded through self-reference and word frequency judgements, we found that participants' recognition accuracy was greatest for the trait adjectives encoded through AS judgements. This indicates that, similar to what is observed with the self-reference effect (Symons & Johnson, 1997), the effect of AS is greatest when it is successful. In other words, task performance is higher when participants are able to actually retrieve and access the associated episodic memory, as compared to when they simply estimate that a memory must be available.

In summary, as expected we found robust memory enhancement when trait adjectives were encoded through self-reference across recognition, free recall and source memory compared to trait adjectives that had been encoded through word frequency judgements. Interestingly, we also found that explicit AS judgements also made for an effective encoding method, which resulted in superior recognition and recall memory compared to word frequency encoding, and that when successful AS was considered, in the form of declarable associated episodic memories, recognition memory performance surpassed traits encoded through self-reference, indicating that AS may also make an effective mnemonic strategy.

CHAPTER SIX

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General Discussion

6.1. Summary of Results

The present research investigated AS in young and older adults; particularly how related task performance for AS stimuli is often superior to that of stimuli the participants have knowledge of but no associated episodic memory. The thesis aimed to examine the underlying processes involved in AS, principally how it relates to having semantic knowledge for a stimulus, or whether it differs from the memory enhancement effect observed for self-referent stimuli (Symons & Johnson, 1997). The majority of prior research had focused on normed stimuli, predominantly famous faces, assumed to be high in prior knowledge or high in AS, and did not consider participants' own experience. In contrast, this thesis utilised participants' own experiences of the stimuli and the impact it had on their related task performance. Across four experimental chapters, we investigated the effect of modality on AS through contrasting the presentation of faces or names during experimental tasks, the effect of type of knowledge on AS, by examining the effect of AS on famous person knowledge and knowledge for public events and contrasted AS against both semantic prior knowledge and the self-reference effect, across young and older adults to determine the impact of healthy ageing on AS effects.

6.1.1. Chapter Two: Autobiographical Significant Knowledge of Famous Persons: Behavioural Correlates in Young and Older Adults

Within the first experimental chapter, participants encoded either famous face, or famous name stimuli through a semantic dead-or-alive judgment task. Their episodic memory for these stimuli was then tested through an old-new recognition task.

Performance across these semantic and episodic tasks was later linked to participants' prior experience and ratings for each stimulus from a follow-up questionnaire. Previous research was largely based on the likelihood of exposure (famous versus non-famous or pre-normed stimuli), whereas within this paradigm the effect of participants' own experience on task performance was examined.

Participants were more accurate and faster at responding in both the semantic and episodic tasks for stimuli they had prior knowledge of, compared to those unknown to them, and this performance advantage was further increased if the stimuli was associated with an episodic memory and therefore AS. This was in line with previous research whereby 'remember' responses were associated with faster semantic fame judgements, reading times and episodic recognition and recall, than stimuli associated with 'know' responses (Westmacott et al., 2004; Westmacott & Moscovitch, 2003). This indicates a level of separation between semantic prior knowledge and episodic AS, which will be discussed further below in *section 6.2.1*.

Significant age effects in both prior knowledge and AS were noted, wherein the young adults showed the greatest 'boost' in performance, in the form of a greater increase in accuracy or a greater decrease in reaction time. This was expected for the episodically driven AS effects, due to degradation in episodic processing in older adults (Nyberg et al., 1996; Park et al., 2002), but findings of age effects within the semantically driven prior knowledge effect were not anticipated. These age effects will be further discussed in *section 6.2.6*. Age related interactions with modality were also present, wherein young adult participants that viewed names showed the greatest 'boost' in performance for having prior knowledge of a stimuli than those participants that viewed faces. The reverse was true for older adults' participants, those that viewed faces showed a greater performance boost than those that viewed names. These modality effects will be further discussed in *section 6.2.4.*

6.1.2. *Chapter Three: The Neural Correlates of Autobiographically Significant Concepts within Older Adults*

Our second experimental chapter examined the underlying neural correlates of AS and prior knowledge in older adults. A prior ERP study (Renoult et al., 2015) in young adults, focusing on two ERP components associated to semantic (N400) and episodic (LPC) memory, respectively, examined the neural correlates of AS. In this third chapter, a group of older adult participants completed an adaption of this study (Renoult et al., 2015). EEG was recorded while participants encoded famous faces through a dead-or-alive semantic judgement task before having their episodic memory tested through an old-new recognition task. Their behavioural and electrophysiological responses to stimuli were then matched to their own prior experience and ratings for these stimuli.

Contrary to Renoult et al., (2015), this study found no significant behavioural difference for stimuli pre-rated as High or Low in AS, and behavioural effects of prior knowledge and of AS were also limited to semantic accuracy (increased for high as compared to low AS stimuli). The likely reason for the reduction in significant behavioural findings, compared to those observed within chapter two, was suggested as an easing of the task, wherein the semantic task contained four repetitions of each stimuli, which would have led to greater rehearsal making the episodic task easier (Seamon et al., 2002.).

The main purpose of this chapter was to investigate the underlying neural correlates of prior knowledge and AS in ageing, by examining the presence and magnitude of the N400 and LPC ERPs. Contrary to the findings of Renoult et al., (2015) no significant LPC effects of AS were found when comparing stimuli pre-rated high or low in AS, nor was this modulated by participants' own prior knowledge ratings, or their AS responses. However, a significant N400 effect of AS was observed during the semantic task, whereby participants' own ratings of AS stimuli were associated with a significantly more negative N400 deflection than those stimuli participants knew, but were not AS. This indicates that a level of semantic processing may be present within AS for older adults, contrary to expectations, these findings will be further discussed in *section 6.2.7.* AS modulating the N400 was not observed for the young participants tested in Renoult et al., (2015) and this may be reflective of age-related changes in processing, which will be further discussed in *section 6.2.6.*

6.1.3. *Chapter Four: Autobiographical Significant Concepts within Public Events and the Relationship to Flashbulb Memory*

Research on AS to date has exclusively examined its influence on famous person knowledge. Therefore, the focus of this chapter was to determine if these findings would extend beyond persons to public event knowledge. Older and young participants encoded public events through a semantic location judgement task, and their episodic memory for these events was then tested in an old-new recognition task. Performance on these tasks was later matched to their prior experience and ratings of the public event collected from a follow-up questionnaire.

We found participants were more accurate, gave higher confidence ratings and responded faster to stimuli they had prior knowledge of, compared to those unknown to them, and performance was further improved if events were awarded a ‘remember’ response and therefore AS to the participant. However, contrary to research with famous person stimuli (Renoult et al., 2015; Westmacott et al., 2004; Westmacott & Moscovitch, 2003) and findings from chapter two, the behavioural boosts observed for both prior knowledge and AS was exclusive to the semantic task performance. Possible reasons for differing findings between famous person and public event knowledge are discussed in *section 6.2.5.*

Interestingly within this study, contrary to findings from chapter two, no significant effect of disclosable AS, that is whether or not participants could retrieve and declare their associated memory, was found on task performance. However, when a public event was associated with a location memory (the participant could recall where they were when they learned of the event), participants responded to this event with higher accuracy in the recognition episodic task, compared to events they had prior knowledge of but no associated location memory. This reveals a degree of similarity between the performance boost of AS and that of flashbulb memories, and that AS within events may require additional spatial details. This will be discussed further in *section 6.2.3.*

The use of public events across the lifespan of participants also allowed the investigation of effects of AS over time. Public events are temporally fixed, more-so than famous persons, which meant that both the prevalence of AS responses to stimuli, and the effect of AS on task performance could be studied in relation to the date of the events. There were mixed findings relating to prevalence of AS responses, with young adults providing more ‘remember’ responses indicative of AS for the most recent compared to the dated events, in line with expectations, based on semanticisation theories (Moscovitch et al., 2016; Squire & Alvarez, 1995). However, young participants also gave more ‘know’ responses, indicative of prior knowledge, for the most recent time period contrary to predictions. Within the older adults, ‘know’ responses were relatively consistent across time periods, and their ‘remember’ responses were highest for both the most recent and the most dated stimuli. This indicates that participants’ subjective judgements of public event knowledge do not necessarily become more semantic over time. The effect of time on this process will be discussed further in section 6.2.2.

6.1.4. Chapter Five: Contrasting the Effect of Autobiographical Significance and Self-Reference on Experimental Memory Performance

Both effects of prior knowledge and AS involve a level of self-reflection through considering one’s own prior experiences, so it was of interest to compare these processes to the well-established self-reference effect (Klein, 2012a; Symons & Johnson, 1997). In this chapter participants encoded trait adjectives across three encoding methods; self-reference judgements (does this word apply to me?), AS judgements (can I think of a time when I was this word?) and semantic word frequency (how common is this word?). Their memory for these adjectives was then tested through free recall, an old-new recognition task, and a source memory task.

As expected, participants’ free recall, recognition and source memory for trait adjectives that had been self-referenced was superior to those that have been processed with the semantic word frequency judgement, consistent with robust findings obtained in self-reference studies (Durbin et al., 2017; Gutchess et al., 2007). We also found, that encoding words through AS judgements also resulted in superior free recall and recognition memory compared to traits encoded through semantic judgements, demonstrating for the first time that AS can be used actively to enhance task performance (in contrast to prior studies that typically investigated AS as an implicit effect, by collecting relevant ratings at the end of the experiment). Interestingly, unlike self-reference, encoding trait adjectives through AS judgements did not result in superior source accuracy, indicating a level of dissociation between AS and self-reference which will be discussed further in *section 6.2.8.*

6.2. How Current Results Inform the Thesis' Initial Aims

Eight main aims for the thesis were developed in chapter one, their outcomes are discussed in turn below.

6.2.1. Effects of Prior Knowledge versus Autobiographical Significance

There is considerable conceptual overlap between the influence of prior knowledge, which has been shown to boost recognition performance for famous over non-famous persons (Bellana et al., 2019) and AS which has been shown to improve performance in both semantic and episodic tasks (Renoult et al.,2015; Westmacott et al., 2004; Westmacott & Moscovitch, 2003), as both involve utilising one's own prior experience.

The majority of research on effects of prior knowledge focused on 'assumed' experience, based on the likelihood a participant would have been exposed to the stimuli, i.e. famous versus non-famous faces, or for famous faces from certain life periods of the participants (Bäckman et al., 1987; Backman & Herlitz, 1990; Bellana et al., 2019; Wahlin et al., 1993), but these studies did not distinguish whether the prior experience of the participant only resulted in general knowledge or also specific episodic memories.

Westmacott and Moscovitch (2003) attempted to tease these two concepts apart using the remember-know paradigm and reported a level of distinction in task performance between when participants provided a ‘know’ response to stimuli, compared to a ‘remember’ response, whereby participants’ semantic and episodic task performance was greatly improved for the latter.

However, there is a level of uncertainty surrounding the remember-know paradigm, particularly how representative it is of a semantic-episodic distinction (Migo et al., 2012), with a strain of researchers proposing it more likely represents how confident the participant is in their recognition judgement (Donaldson, 1996; Dunn, 2004; Wais et al., 2008). This was also evidenced in chapter four by the disparity between participants providing remember responses to events, and then being able to actually disclose episodic memories for those same events (58.54 per cent of the young adults, and 51.47 per cent of the older adults).

Within this thesis, by asking participants to fully disclose their prior experience, both through declaring if they had encountered the stimuli before, answering factual knowledge questions relating the stimuli, and disclosing any associated memories, we are able to differentiate prior knowledge and autobiographical significance in a more controlled and systematic way than prior studies.

Within our first experimental chapter, we demonstrated a performance boost for stimuli participants had prior knowledge (that they had encountered prior to the experiment) compared to those unknown to them prior to the experiment. We also demonstrated that when participants had associated memories for the stimuli, their performance within the semantic and episodic task was further improved compared to having prior knowledge alone. These findings were echoed within chapter three, where participants again performed better within the semantic task for AS stimuli compared to those, they had prior knowledge of but no-AS.

These findings are therefore consistent with results from the remember-know paradigm (Westmacott & Moscovitch, 2003) but the ambiguity of what the participants' prior experience was, has been removed. Therefore, this provides a clearer differentiation between having prior knowledge for a stimulus, and this stimulus being autobiographically significant.

It could be considered that even after accounting for participants' prior experience, AS stimuli could still be considered more familiar than stimuli the participant has only prior knowledge for. This was found to be the case, in both young and older adults: stimuli associated with an episodic memory were associated to higher familiarity ratings, factual knowledge ratings and emotional salience ratings than those associated with prior knowledge alone. However, we were also able to demonstrate an effect of AS on task performance even after controlling for these variables. This indicates that even after controlling for familiarity, effects of prior knowledge and of autobiographical significance are still divorceable.

6.2.2. Impact of Time on Effects of Prior Knowledge and of Autobiographical Significance

The impact of time on these processes were also an interest to this thesis. Several theoretical models including Consolidation Theory (Squire & Alvarez, 1995) and the

Transformation Hypothesis (Moscovitch et al., 2016) have proposed that memory may become more semantic over time. If this is the case, if we examined stimuli over time, we would find that dated stimuli would be more likely associated with prior knowledge responses and more recent stimuli would be more likely to be associated with autobiographical significance. I It would also be likely that the behavioural benefits of these processes on task performance would also be greater for these time periods.

This was first investigated within chapter two for famous person knowledge, where effects of time were explored only within older adults over a stimuli range of fifty-five years. We found that participants had high prior knowledge responses for stimuli within the most dated and most recent time periods, and that AS responses were also greater in the most dated period, compared to both the recent and intermediary periods. This indicates that dated stimuli were associated with both prior knowledge and AS responses and that the recent stimuli were associated primarily with prior knowledge responses, contrary to predictions based on semanticisation. In an extension of these analyses, the behavioural effects of AS were not found to be modulated by the time period of the stimuli. As to the behavioural effects of prior knowledge, they were also in the reverse direction compared to expectations. Stimuli most benefitted from prior knowledge, in terms of increased accuracy and faster reaction times within the episodic task, for the most recent stimuli periods compared to the intermediary and dated periods.

Consistently within chapter four examining public events, older adults gave a higher proportion of ‘remember’ responses indicative of AS to the most recent events and the most dated events, and their ‘know’ responses did not differ over time. There was also no impact of time on either the effect of prior knowledge or autobiographical significance on the older adult's task performance. However, the young adult participants in this study did follow a pattern predicted by semanticisation: they gave a higher proportion of 'remember' responses to the most recent public events than to the dated events. When the effect of prior knowledge on task performance was examined in young adults, this was found to be greatest for the most dated events.

In light of these findings, it appears that older adults participants' subjective judgements of famous person or of public event knowledge do not necessarily become more semantic over time, nor does it influence the effect of these processes on task performance. However, young adult participants do demonstrate trends in the direction of this knowledge becoming more semantic over time.

This evidence can be interpreted in the context of Multiple Trace Theory (Moscovitch et al., 2005) that proposes that every instance of retrieval lays a new trace in the hippocampus, and therefore even the most dated knowledge can contain a re-experience episodic memory, and therefore be influenced by autobiographical significance. In line with this, The Transformation Hypothesis also notes that even when information consolidates or assimilates with existing semantic knowledge over time, elements of the original experience can still be maintained (Nadel et al., 2012), and therefore AS for dated semantic concepts may be reflective of traces of the original experience, even despite a level of semantic consolidation.

Interestingly, there also appears to be age-related differences in the effect of time on these constructs, which we will discuss in greater detail in *section 6.2.6.*

6.2.3. What Types of Memories make a Stimulus Autobiographically Significant?

Including a follow-up questionnaire in each of these studies allowed us to further investigate what kind of memories are make AS stimuli, to examine the content of these memories, but also the effect of related variables including vividness, emotional salience and date.

In previous AS studies, unique events (with spatial and temporal details) were required for stimuli to be considered AS (Westmacott et al., 2004; Westmacott & Moscovitch, 2003), which ensured episodic involvement. Within this thesis, these restrictions were relaxed to allow more freedom within the associated memories. Participants were asked if they had any personal event memory related to the person pictured, for example when they watched, listened to or heard about the famous person, any memories provided here qualified the stimuli to be considered AS, irrespective if it was a singular or repeated memory being reported.

Examining the disclosed memories provided in chapter two revealed that the majority of memories (around sixty per cent) were unique events, as seen in the previous AS investigations (Renoult et al., 2015; Westmacott et al., 2004; Westmacott & Moscovitch, 2003). In addition to unique events, two other memory types were detected; repeated events where the memory details were taken from a series of episodes (i.e., we watched that movie every Christmas) and autobiographical facts, where a personal fact was given (i.e. he is my favourite actor), as classified by the personal semantic coding system (Renoult et al., 2020). Participants produced repeated events in around thirty per cent of cases, and around ten per cent of memories produced were classed as autobiographical facts. The latter two forms are considered more semantic than unique events on the continuum (Renoult et al., 2012), so it was of interest to examine whether the association of these memory types could enhance behavioural performance in the same manner demonstrated by unique events.

Interestingly we found no significant difference in the behavioural boost observed from the association of a unique event and the association of a repeated event, which indicates that the associated memory does not need to be wholly episodic for the AS effect to be present. Unfortunately, autobiographical facts were not considered in this analysis as too few were produced for a meaningful comparison. As these memories are more semantic in nature, it would be of interest to examine if the behavioural effect of AS were present in this case.

Interestingly, in chapter four, the variation in the memory type produced narrowed, with close to ninety-five per cent of participant memories being classified as unique events, and less than five per cent being coded as repeated events or autobiographical facts. This likely relates to the temporally fixed nature of public events, compared to famous persons. Events happen on a set date and therefore the majority of memories will fall around this period, from learning about the event, whereas memories for famous persons could fall at any time, and be updated with repeat exposure (i.e., same actor in different films, or new series returning).

Notably within chapter four, having an associated memory for a public event did not significantly improve task performance compared to having prior knowledge alone. Instead, the only significant effect of AS was found if the associated memory related to how the participant found out about the event, or more specifically if they could remember where they were when they found out about the event. These memories were intended to capture flashbulb memories (Brown & Kulik, 1977; Conway et al., 2009; Raw et al., 2020) which are known for improving associated event knowledge and memory source information over long periods of time (Curci et al., 2015; Hirst et al., 2015; Schmolck et al., 2000), which presented as an interesting conceptual overlap with AS. The association of location memories with public events within chapter four led to increased episodic accuracy compared to having only prior knowledge of the event. This indicates that for AS to be successful for public event knowledge, spatial or location details may be required within the associated memory. However, it is important to note these memories were only reported for around three per cent of the public events, which could have skewed averages. Equally due to their limited numbers, factors such as familiarity and factual knowledge were not controlled for which could have influenced participants' task performance.

Other factors of the associated memory were also considered, such as the date the memory occurred, the vividness of the associated memory and the emotion at the time of the memory, but none of these factors were found to influence AS and participants' task performance, indicating that the associated memory itself relates to the improved behavioural performance, and not any of these other factors.

6.2.4. Influence of Stimuli Modality on Effects of Prior Knowledge and Autobiographical Significance

Incidentally, studies examining the effect of prior knowledge on memory typically presented famous faces as stimuli (Bäckman et al., 1987; Backman & Herlitz, 1990; Bellana et al., 2019; Wahlin et al., 1993) whereas research focusing on AS presented participants with famous names (Renoult et al., 2015; Westmacott et al., 2004; Westmacott & Moscovitch, 2003). Although both research traditions examined the effect of these processes on famous person knowledge, a number of studies have demonstrated that individuals have better memory performance for names over faces (Burton et al., 2019; Clarke, 1934; Nielson et al., 2010) and different areas of activation were present for these modalities (MacKenzie & Donaldson, 2009; Nielson et al., 2010) suggesting differing underlying processes. For these reasons, direct comparisons between prior knowledge and AS drawn across these modalities may not be valid.

Within chapter two, half of the participants were presented with famous faces, and half of the participants were presented with the same famous persons presented as names, to examine the effect of modality on AS. We found no direct effect of modality on task performance, nor any direct effect of modality on AS, but interestingly, significant age by modality effects were observed.

Young adults that viewed famous faces showed superior recognition accuracy compared to those that viewed names, whereas the reverse was true for older adults, those that viewed famous names were significantly faster at responding within the semantic and episodic task than those that viewed famous faces. These modality effects extended to the impact of AS on task performance, young adults that viewed famous names showed the greatest benefit of associated AS within semantic reaction time, compared to those that viewed famous faces, whereas again the reverse was presented in older adults, those that viewed faces showed the greatest decrease in reaction time from AS, than those that viewed names.

These age-related modality effects observed are interesting, as older adults demonstrate superior memory performance for names consistent with the prior literature (Burton et al., 2019; Clarke, 1934; Nielson et al., 2010), whereas young adults show superior performance for faces. Improved performance for faces over names may represent a pictorial superiority effect (Durso & O'Sullivan, 1983; Nelson et al., 1976), where images are better remembered than text. However, this does not explain the age related differences, as young adults have previously demonstrated superior performance for names over faces (Burton et al., 2019; Nielson et al., 2010), and older adults have previously demonstrated the pictorial superiority effect (Nyberg et al., 1996; Park et al., 2002), and other studies have reported the reverse age effect; weaker performance for faces within young adults, and weaker performance for names within the older adults (Schweich et al., 1992).

When examining the effects of AS, it seems that the modality effect is reversed once more, young adults that viewed famous names show the greatest improvement between stimuli associated with AS and those associated with prior knowledge compared to those that viewed faces, whereas older adults that viewed famous names showed greater improvements in semantic reaction time from the association of AS, than those that viewed famous faces.

This could reflect that episodic involvement effects face and name information differently in young and older adults, but it is more likely that due to the noted age by modality effects on performance resulting in superior performance for names than faces in the young adults and faces than names in the older adults. The possible performance boosts from the association of AS were smaller for these modalities because they responded quicker without AS for these modalities, the effects of associated AS on the 'weaker' modality appear greater. Additionally, it is important to note, that these modality effects are drawn across subjects, as participants viewed either faces or names, and therefore an element of individual difference will be present. Participants that viewed one modality may have a greater recognition memory than those that viewed the other modality, or they could be more influenced by AS. To better examine the effects of modality on performance, a within subject's design would be more apt, where participants would view an equal number of faces and names, and their performance on these, as well as the effect of AS on their performance could be examined within subjects.

In summary, our results suggest that young and older adults show different performance advantages for face and name modalities, and between-subjects analysis shows that AS is differently affected by these modalities. Although, firm conclusions cannot be drawn due to individual variance (use of a between-subject design), these findings emphasise the importance of considering modality in effects of AS and of prior knowledge, and, more generally, that conclusions should not be drawn across modalities when age is considered.

6.2.5. Influence of Type of Knowledge on Autobiographical Significance

In an extension of stimuli modality, we were interested in whether autobiographical significance would differ with the type of knowledge it was associated to. To date the literature examining AS has been largely focused on famous person knowledge (Denkova et al., 2006; Renoult et al., 2015; Westmacott et al., 2004; Westmacott & Moscovitch, 2003), demonstrating that these semantic concepts, also contain episodic elements, and these episodic elements appear to provide a task performance benefit.

Research examining AS within semantic dementia patients demonstrated a level of preservation of knowledge of people who were personally relevant to them including family members or neighbours (Giovannetti et al., 2006; Snowden et al., 1996), despite a severe degeneration in their anterior temporal lobes and an inability to identify famous persons. However, in a study where patients' knowledge was tested around the sport they played frequently, patients showed some level of preserved knowledge for people they play with frequently but performed poorly when tested on the rules of the game or on knowledge of sporting terms (Graham et al., 1997). This indicates that the resilience created from AS may not extend beyond personal knowledge in these patients. Graham et al. (1997) concluded that person recognition systems are unique, involving perceptual units activated by the presentation of name or face. These perceptual units would in turn activate multi-modal person-identity nodes which can support familiarity judgements (Bredart et al., 1997). It is likely that person recognition is a special case in which AS can benefit recognition judgements, but this influence may not extend to other types of knowledge including sporting terms and rules, and therefore may not extend to event knowledge.

However, within chapter four, we found some significant effects of AS on participants' semantic performance between events they provided 'know' responses for and those they provided 'remember' responses for: participants were significantly faster at responding in the semantic task and significantly more confident for the remembered events compared to the known. Previous research has utilised the Remember-Know paradigm to distinguish between AS stimuli and prior knowledge (Westmacott et al., 2004; Westmacott & Moscovitch, 2003), which would indicate that AS influence knowledge of public events.

However, there was considerable disparity between providing a remember response, and being able to disclose an episodic memory. Participants disclosed episodic memories for only fifty per cent of the events they'd provided a remember response to (58.54 per cent in young adults and 51.47 per cent in older adults), indicating remember responses may not always represent genuine AS. When AS for public events was investigated comparing events associated with a disclosed episodic memory against those associated with prior knowledge only, no significant difference in any of the task performance variables were found.

These findings would indicate that the observed behavioural effects seen for AS for famous person knowledge, were not extended to public event knowledge in the same manner. This provides support for the proposal by Graham and colleagues (1997) that AS might be unique via its influence on person recognition nodes.

However, it is worth noting that behavioural effects were observed in the episodic task if specific location memories were associated to the events. This was an interesting finding, as results from chapter two indicated the memory type, date, emotion or vividness did not influence the effect of AS on famous person performance, whereas chapter four results suggest that famous events are unaffected by AS unless a specific type of memory is associated. This therefore could represent a variation in AS effects by type of knowledge. Although again it is worth noting that these location memories in chapter four were associated with less than three per cent of the associated events and therefore may have skewed the results.

Results relating to AS and type of knowledge are thus inconclusive. It is not clear if AS is exclusive to person knowledge, as it does not affect event knowledge in the same manner, or if AS varies by type of knowledge. Further investigation of this area is required by examining AS within other forms of semantic knowledge, such as place knowledge (e.g., cinema, school etc.). From this, we could confirm whether the behavioural effects of AS are observed for other types of knowledge that person knowledge, or what variations are present across knowledge types.

6.2.6. Effects of Autobiographical Significance in Healthy Ageing

The limited prior research surrounding AS has focused on either young (Renoult et al., 2015) or older adults (Westmacott & Moscovitch, 2003) separately, so it is difficult to draw clear conclusions on how AS effects may differ in young and older adults.

Based on patient studies (Westmacott et al., 2004) and results from an ERP investigation (Renoult et al., 2015), AS is determined to be largely driven by episodic processing. As episodic processing is typically reduced in healthy older adults (Danckert & Craik, 2013; Fraundorf et al., 2019; Nyberg et al., 1996; Park et al., 2002), it is anticipated that AS may also be less common in older adults, and this would materialise as a reduced effect of AS on participants' task performance.

Within chapter two, significant age effects of AS were observed for famous person knowledge, whereby the difference in performance between AS stimuli and stimuli participant had only prior knowledge of was significantly larger in young adults than in older adults for both semantic and episodic accuracy. This indicates that the effect of AS on performance was somewhat reduced in older adults, in line with expectations based on underlying episodic memory functions.

However, when factual knowledge and familiarity of stimuli was controlled at the participant level, the observed age effects of AS were eliminated. The association of AS still significantly improved performance compared to prior knowledge alone, but there was no significant difference in the boost in performance between young and older adults. This indicates either that the use of factual knowledge and familiarity were overused by the young adults increasing their behavioural performance or used to a disadvantage by the older adults resulting in a decrease in their behavioural performance. Similar to findings of an overreliance on the semantic system by older adults (Kan et al., 2009), and those demonstrating that older adults show difficulty rejecting unfamiliar faces in recognition studies (Boutet et al., 2015; Searcy et al., 1999).

In line with this, when, the underlying neural correlates of AS were examined in an ERP investigation of older adults in chapter three, we observed modulation of the N400 for AS, an ERP component typically associated with semantic processing (Hagoort et al., 2004; Heinze et al., 1998; Kutas & Federmeier, 2011; Rabovsky et al., 2012; Vilberg et al., 2006). In contrast, prior investigations in young adults (Renoult et al., 2015) noted that the LPC, associated with episodic recollection, (Voss & Paller, 2008; Wilding & Rugg, 1996), was modulated by AS. This could indicate that older participants are using semantic instead of episodic processing for AS stimuli, or as we were unable to control for factual knowledge and familiarity during the ERP investigation, it could again reflect that these variables may have affected AS effects in the older adults.

However, it is important to note here the modality changes observed between young and older adults in section 6.2.4, and particularly the caution towards drawing conclusions across modalities. The young adults viewed famous names within the previous ERP investigation (Renoult et al., 2015) and the older adults viewed famous faces within chapter three.

It is important to reiterate here, the slight variations in methodology between the young and older adults within Chapter Two and Chapter Four, which may have influenced our findings. In both these chapters the young adults completed the follow-up questionnaire immediately following the old-new recognition task under lab conditions, whereas the older adults were permitted to complete the questionnaire at home using an online link. This was an ethical consideration to limit the experimental strain and fatigue for the older adults caused by length computer tasks.

However, this resulted in two limitations which could have affected our findings. Firstly, older adults were debriefed prior to leaving the lab (this was a requirement of our ethics protocol), which meant they knew the aim of the experiment prior to completing the final questionnaire. This could have resulted in them producing more associated memories than they would have if the aim was unknown to them. Secondly, there was variation in the time between the old-new recognition task and the follow-up questionnaire, whereby the young adults completed the latter immediately following the former, whereas the older adults completed the questionnaire either hours later in the afternoon following their session, or the following day. This delay could also have influenced memories produced, whereby young adults benefitted from the recent cues from completing the dead-alive and old-new tasks, making the retrieval process easier, whereas the older adults would be retrieving the associated memories hours after the memories had been cued when they were no longer fresh in their minds.

However, averages for prior knowledge responses and associated memories produced were largely consistent between the young and older adults. Moreover, it was felt that, as the experimental design focused on the implicit effect these underlying episodic memories had on previous dead-alive and old-new judgements, the effects of the delay in completing the final questionnaire or of knowing the true aim of the study would have had a limited influence on the experimental findings.

In summary, the effect of AS on task performance appears reduced within our sample of older adults, in line with expectations of it being predominantly driven by episodic processing. However, interesting findings have emerged in terms of the level of semantic processing involved in older adults, materialising in the potential overuse of factual knowledge and familiarity of stimuli, and the modulation of the N400 by AS. Further investigation of the neural correlates of AS before and after the control of factual knowledge and familiarity would provide a clearer understanding of how AS is affected by healthy ageing.

6.2.7. Neural Correlates of Autobiographical Significance

Evidence from patient studies (Westmacott et al., 2004) demonstrated AS may be underpinned by episodic processing, as the effect on behavioural performance was found to be present within semantic dementia patients, and absent in patients with Alzheimers disease and amnesia. This proposal was later supported by an ERP investigation (Renoult et al., 2015) which found that the LPC, typically associated with episodic processing (Wilding & Rugg, 1996; Voss & Paller, 2008), was modulated by both the normed stimuli considered high or low in AS, and also when using participants' own AS ratings. Stimuli associated with higher AS levels were linked to a greater LPC amplitude than those associated with lower AS levels, leading to the supporting conclusion that AS is largely underpinned by episodic processing.

Using a very similar paradigm as this ERP study (Renoult et al., 2015), in chapter three we examined the neural correlates of AS in older adults. Contrary to previous findings in young adults, we observed no LPC modulation for AS in either the semantic or the episodic task, and instead observed N400 modulations, typically associated with semantic processing (Hagoort et al., 2004; Heinze et al., 1998; Kutas & Federmeier, 2011; Rabovsky et al., 2012; Vilberg et al., 2006). Famous person stimuli the participants had an associated memory for, and therefore AS were associated with a more negative deflection within the N400 ERP compared to stimuli the participant had only prior knowledge of. This would indicate that within this older adult sample, AS was modulated by underlying semantic processing contrary to previous findings (Renoult et al., 2015) and our understanding from patient studies (Westmacott et al., 2004).

Conclusions could be drawn that the underlying neural correlates differ between young and older adults, but it is worth noting here the age-related differences discussed in section 6.2.4. previously, whereby young adults and older adults perform differently for names and faces. The first ERP investigation in young adults utilised famous names as stimuli, whereas the investigation within chapter three on older adults utilised famous faces. This change in stimuli was chosen as older adults demonstrated a greater effect of AS with famous faces within chapter two.

Research has previously indicated different neural processing for names and faces (MacKenzie & Donaldson, 2009; Nielson et al., 2010). Of note, is an ERP investigation that revealed recognition of face stimuli was associated with anterior frontal old/new effects, whereas remembering names elicited mid frontal and left parietal old-new effects (MacKenzie & Donaldson, 2009). This is important, as the differences observed within the investigation on older adults within chapter three and the prior ERP investigation on young adults (Renoult et al., 2015), may not reflect age related changes in the neural correlates of AS, but may instead be related to the different modalities used. If this is the case, to examine age related changes in the neural correlates of AS, the same paradigm and the same modality would need to be used in young and older adults to create a more valid between subjects analysis.

It is also worth noting that limited behavioural effects of AS were observed within chapter three, where AS stimuli resulted in superior performance only within semantic accuracy, compared to those observed within chapter two, where AS significantly affected participants' accuracy and speed of response across both semantic and episodic tasks. We proposed this difference in performance may relate to an easing of the behavioural task, as repetitions of stimuli were included within the semantic task, to ensure that when AS stimuli were found for participants, from the follow-up questionnaire, that enough trials were available for these stimuli, to boost number of trials available for the ERP analysis. This increased repetition led to increased rehearsal and therefore better performance within the episodic task, which was close to ceiling within this task (ninety-five per cent accuracy for unknown stimuli) compared to chapter two (seventy-nine per cent accuracy for unknown stimuli). This ceiling effect within the episodic task would prevent any effect of AS on task performance being observed (ninety-seven per cent accuracy for AS stimuli). This may have also influenced the underlying processing measured within ERPs, and therefore limited our findings. We therefore suggest an alteration to the paradigm in chapter three is required, to effectively measure neural correlates of AS within older adults. Potentially incorporating a pre-recording interview like that used with Denkova and colleagues (2006), to determine a larger set of stimuli that are considered AS to the participant prior to the task, this would provide a greater number of AS trials for the analysis, without having to have high repetitions. This method would reduce the ceiling effects within the episodic task, which would in turn reveal any effects of AS within participants' behavioural and electrophysiological responses.

In summary, age effects within the underlying neural correlates were noted between young and older adults. Whereby the younger adults demonstrated modulation within the LPC for stimuli High or Low in AS (Renoult et al., 2015), whereas our findings demonstrated modulation within the N400 for stimuli high or low in AS within the older adults. This could reflect changes in processes due to healthy ageing, whereby AS in young adults is underpinned by episodic processing, whereas in older adults semantic processing is involved. However, the reduced behavioural effects observed, and the noted age differences in processing face or name modalities, provide a level of caution in interpreting these findings.

6.2.8. Contrasting Autobiographical Significance and Self-Reference

To date all literature directly examining the effect of AS on memory performance has contrasted AS with prior knowledge of the stimuli (Denkova et al.,2006; Renoult et al., 2015; Westmacott et al., 2004; Westmacott & Moscovitch, 2003). In this literature, and within chapter two of this thesis, a boost in task performance for AS stimuli compared to stimuli the participant has only prior knowledge of was observed. This boost in performance draws considerable parallels with the well-established self-reference effect (Symons & Johnson, 1997), as AS depends on one's experience of the stimuli. So, the final aim of this thesis was to determine if the behavioural benefits of AS were distinct from those associated to self-reference, or if AS is an extension of this process.

Our findings from chapter five, demonstrated that trait adjectives encoded through self-reference and AS methods, were better remembered in both the free recall and recognition tasks than the trait adjectives that were encoded through semantic word frequency judgements. This indicates that both methods can produce memory improvements. However, the self-reference effect resulted in superior memory performance than AS in the source memory task, indicating a level of dissociation between these processes. Therefore, self-reference appeared as the most successful method of encoding in this comparison.

One marked difference between the literature on AS and investigations of self-reference is that to date all research on AS has examined its implicit effects on behavioural performance, in that participants are not asked during the experimental tasks to consider their prior experience, and instead are only asked for this information after the tasks have been completed. In contrast, traditionally self-reference has been studied as an explicit encoding method, where participants actively consider whether the stimuli are relevant to themselves. Prior to the investigation presented in chapter five, it was not known whether the behavioural boost associated with AS could be actively utilised by the participant in a task, indicating the possibility of AS being used as a mnemonic strategy. Participants considering their own memories for traits resulted in superior later memory for these traits, as assessed with tests of free recall and recognition.

Prior to this investigation, AS had only been seen to successfully influence person recognition, so the effect of AS on later memory performance for trait adjectives was a notable finding. In addition to this, a significant behavioural effect was found on free recall, which is traditionally considered a measure of episodic recollection (Tulving, 1985) whereas the previous episodic effects have been observed during recognition judgements, which can be accomplished through recollection or familiarity judgements (Henson et al., 1999; Sauvage et al., 2008; Yonelinas et al., 2005). This may then indicate that active AS is able to enhance more than just familiarity judgements and may benefit episodic memory retrieval in the same manner as self-reference. However, some would also consider elements of free recall familiarity-based (Hamilton & Rajaram, 2003; McCabe et al., 2011; Mcdermott, 2006; Mickes et al., 2013), whereby participants consider all the trait adjectives they know and use familiarity to recall the ones they think they've encountered recently. Instead, the source memory task may be more reflective of recollection processes.

Encoding items through self-reference resulted in superior source memory performance than in the semantic encoding task, whereas source memory performance was better for traits encoded through semantic word frequency judgements than for those encoded through AS. This could indicate that AS was not able to improve participants' episodic retrieval of the source details, whereas self-reference was successful in this respect. Although it may be that the self-reference and AS methods were too similar, both involving considering one's experience in relation to the traits, which could have affected participants' performance. To better consider if AS could benefit source memory performance, it would be recommended to compare AS only against a semantic judgement, or to compared AS against an alternative method of self-reference, such as considering a close friend's personality (Maki & McCaul, 1985).

In summary, it was possible to actively utilise AS at encoding to improve later memory performance, and it achieved similar results to the well-established self-reference effect within measures of recognition memory and free recall. However, there was a clear dissociation between the methods of encoding within episodic retrieval of source details, indicating the methods are divorceable. Further research is required to examine whether AS can be effectively used to enhance further episodic retrieval, such as for the source details of the memory.

6.3. Theoretical Outcomes and Future Directions

Investigations of AS provide direct insights into the interaction between semantic and episodic memory. Prior research on AS highlighted the involvement of episodic processing to concepts generally considered semantic, such as famous person knowledge (Renoult et al., 2015; Westmacott et al., 2004; Westmacott & Moscovitch, 2003). We have extended this research by determining *how* episodic memory involvement can lead to associated task performance. We were able to show the superior effect of having an associated memory for a concept compared to having only prior knowledge, and that, for famous person knowledge, the association of any type of memory can lead to enhanced task performance in semantic and episodic tasks. Crucially, this means participants' prior experience must be accounted for or acknowledged in studies using famous person stimuli, as even when memories are not actively retrieved or required, such as in semantic tasks (e.g. fame judgement, dead or alive judgement), the episodic elements associated to these concepts can still influence performance.

We have also examined the effects of these interactions between semantic and episodic memory for public event knowledge. Participants disclosed AS for a number of public events, again indicating an underlying episodic element associated to these concepts. However, contrary to what we observed for famous person knowledge, this episodic element only influenced behavioural performance if spatial details were present within the associated memory. This indicates that the interactions between semantic and episodic memory and their effect on performance, may differ between different forms of knowledge. Prior research on AS in semantic dementia patients revealed that the beneficial effects of AS in preserving their semantic knowledge was limited to personally significant person knowledge (Snowden et al., 1994; 1996), such as neighbours, friends and sporting partners and could not extend to terminology or rules of a sport they frequently play (Graham et al., 1997). It was therefore predicted that AS may exclusively be able to influence the unique person perceptual units within the brain, which are capable of supporting familiarity judgements (Bredart et al., 1997). However, findings that AS can influence event knowledge providing certain details are present within the memory is important, as it suggests that AS may be able to extend beyond famous person knowledge, at least in certain conditions. It would therefore be of interest to extend this line of research to other forms of semantic knowledge (knowledge of places, animals, objects etc.), to examine firstly if AS influences performance when processing these concepts, and whether similar mechanisms are at play.

This could mean that AS could further benefit semantic dementia patients, if any associated AS boost in performance can palliate for an impaired or partially impaired knowledge base. For example, semantic dementia patients often show deficits within specificity of knowledge rather than general categories, for example being able to identify something as an animal, but not more specifically as a chicken (Hodges et al., 1995; Patterson et al., 2007), so potentially the association of a specific episodic memory through AS could help these patients retrieve more specific knowledge.

Interesting age effects were also observed for AS: despite older adults producing an equal number of AS responses, the effect of AS on task performance was still reduced within these participants compared to young adults. This was an interesting finding, as it suggested that the episodic element was still present for older adults for famous person knowledge, but that it did not influence performance as much as observed within the young adults. This could represent an early demonstration of episodic degradation within the older adults, typical of healthy ageing consistent with the reduced effects of AS within Alzheimer’s and amnesia patients (Westmacott et al., 2004). Interestingly, this reduction in AS effects was observed in older adults, even though their performance at the recognition tests were very similar to those of young adults.

Alternatively, the reduction of AS effects in ageing could represent a greater interference of the semantic elements within older adults’ knowledge. In line with this proposal, when factual knowledge and familiarity were controlled between AS and non-AS stimuli at the participant level, the observed age effects were eliminated, indicating factual knowledge and familiarity contribute to AS but the effect is not restricted to this, and the contribution of these variables vary between young and older adults. There is evidence to suggest that at times older adults can become over reliant on factual knowledge and familiarity variables, causing them to interfere with performance on memory tasks (Boutet et al., 2015; Castel, 2005; Kan et al., 2009; Searcy et al., 1999), therefore interference of these elements within this study are likely.

Interestingly, the neural correlates observed for AS in older adults, also pointed towards a semantic involvement, demonstrating larger N400 amplitudes for AS than non-AS stimuli. The N400 is typically associated to semantic processing (Kutas & Federmeier, 2011) and a number of studies have reported its amplitude to be larger for stimuli that were associated with more factual knowledge (Gratton et al., 2009;

Rabovsky & McRae, 2012; Rahman & Sommer, 2008) . Whereas, in younger adults, the LPC, typically associated to episodic recollection processes (Voss & Palmer, 2008), was found to differ between AS and non-AS stimuli, and the N400 was modulated only for number of facts associated to the concepts. This would indicate a greater level of semantic processing in the older adults than the young adults for AS stimuli. However, due to restrictions in the number of trials available for the ERP analysis, examining the effect of controlling for familiarity and factual knowledge was not possible. It would therefore be of interest to examine in future studies in older adults whether, when factual knowledge and familiarity are controlled (as they were in chapter two), the effects of AS on behavioural performance would still link to semantic processing through the presence of the N400, or whether similar modulation within the LPC as found for younger adults would be present. This would provide greater insight into the nature of AS in older adults, whether it is predominantly semantic driven, or whether like younger adults, it is underpinned by episodic processing, but the influence of factual knowledge and familiarity elements are greater.

An important consideration is the high quantity of analyses run throughout this thesis, where over 100 ANOVAs and t-tests were completed examining a number of variables including age, modality, and time, and therefore a possibility arises that some findings may be due to chance. This is particularly relevant when considering the findings of a robust effect of AS on famous persons within chapter two consistent with previous research into AS, but our limited findings for the effects of AS in chapters three and four. Our recommendation would therefore be to run further experiments to replicate the findings in chapter two, and to further investigate the effect of AS using EEG and within public events, utilising the previously discussed study alterations. This would then provide a higher level of reliability to these findings, demonstrating that they were then unlikely to be due to chance.

A further line of interest for this thesis was developed when contrasting the effect of AS against the well-established self-reference effect (Symons & Johnson, 1997). As the self-reference effect has consistently been examined actively, where the participant consciously considers whether an item relates to themselves, in order to directly contrast these two processes, AS had to be actively engaged by participants during the encoding task. Prior to this investigation AS had been exclusively examined as an implicit effect on task performance, whereby participants were only asked for their AS responses to stimuli after all tasks had been completed, and their prior task performance was linked to these AS responses (Renoult et al., 2015; Westmacott & Moscovitch, 2003; Westmacott et al., 2004). Our findings demonstrated that when participants consciously considered whether a trait adjective was AS during encoding, their later memory for these traits, tested through recognition and free recall, was improved compared to traits that were encoded through word frequency judgements, mirroring performance observed for self-reference judgements. This allowed to establish that AS can be actively engaged to improve later memory performance.

Encoding items through self-reference was shown to also improve performance in a source memory task, where participants were asked to remember in which encoding task the word had been presented in. In contrast, source memory performance for traits encoded through AS were worse than those encoded through word frequency judgements. We proposed this failing of AS to improve source memory could relate to task difficulty where the self-reference and AS tasks were similar leading to overlap and confusion, average performance within this task was twenty-five per cent which was below chance, and the average for self-reference was just over the chance threshold (thirty-three per cent). To clarify these issues, it would be useful in future studies to examine source memory for AS encoding, either against only word frequency judgements, or to compare AS to other forms of source information such as colour of text, or background image. This would provide a greater insight on whether AS can benefit encoding of specific episodic details, or whether it may be limited to improve familiarity-based judgements.

Although, this direction of research was investigated only for trait adjectives, AS has demonstrated a potential practical use as a mnemonic or memory-training strategy, whereby individuals could consider an associated memory for any items they would like to later remember. Further research with more naturalistic items would be useful, such as shopping lists, to determine if everyday items could also benefit from this strategy.

6.4. Concluding Remarks

In summary, the research presented within this thesis investigated the phenomenon of AS, particularly the beneficial effect found on task performance, compared to having prior knowledge alone. This was robustly found within famous person knowledge, irrespective of the type of associated memory present, but restricted findings for public event knowledge led to the conclusion that AS may vary by type of knowledge. Interesting age effects were also observed, indicating AS within older adults may be more influenced by semantic processing, familiarity, and factual knowledge than within their young counterparts. Finally, we demonstrated the use of

AS to actively improve later memory as a mnemonic strategy, and future research was suggested to better understand the mechanisms and limitations of this process.

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Appendices

Appendix A: Famous Person Stimuli List

Stimuli List for the Young Adults used in Chapter Two

1. Adele

2. Agyness Deyn
3. Alan Rickman
4. Alastair Cook
5. Alex Higgins
6. Alicia Keys
7. Alvin Stardust
8. Amy Adams
9. Amy Winehouse
10. Andrew Sachs
11. Angela Merkel
12. B B King
13. Barack Obama
14. Benedict Cumberbatch
15. Bettie Page
16. Betty Driver
17. Betty Ford
18. Bill Gates
19. Bill Tarmey
20. Billy Connolly
21. Bobbi Kristina Brown
22. Brad Pitt
23. Bradley Cooper
24. Brittany Murphy
25. Bruno Mars
26. Chris Robshaw
27. Christian Bale
28. Christopher Lee
29. Chyna/Joanie Laurel
30. Cilla Black
31. Claudio Ranieri
32. Clive Dunn
33. Cory Monteith
34. Dalian Atkinson
35. David Bowie
36. David Gest
37. Desmond Tutu
38. Dilma Rouseff
39. Drake
40. Duffy
41. Dwayne Rock Johnson
42. Ed Sheeran
43. Ed Stewart/Crackerjack
44. Eddie Fatu
45. Eddie Redmayne
46. Edie Adams
47. Elizabeth Taylor

48. Ellen DeGeneres
49. Ellie Goulding
50. Emeli Sande
51. Fidel Castro
52. Floyd Mayweather
53. Gareth Bale
54. Gary Coleman
55. Gary Oldman58
56. Gary Speed
57. Gene Wilder
58. Geoffrey Hughes
59. George Martin
60. George Rr Martin
61. Glenn Frey
62. Greg James
63. Guy Babylon
64. Heath Ledger
65. Howard Marks
66. Idris Elba
67. Jade Goody
68. Jake Brockman
69. James Bay
70. Tinie Tempah
71. Jamie Vardy
72. Jean Dujardin
73. Jeff Bridges
74. Jess Glynne
75. Jimmy Hill
76. Jimmy Saville
77. Joan Rivers
78. Joe Cocker
79. Johan Cruyff
80. John Legend
81. Johnny Depp
82. Jonah Lomu
83. Justin Bieber
84. Justin Timberlake
85. Kate Winslet
86. Keith Emerson
87. Kerry Katona
88. Lena Horne
89. Leonard Cohen
90. Leonardo DiCaprio
91. Lukas Graham
92. Maggie Jones
93. Margaret Osborne Dupont

94. Margaret Thatcher
95. Mark Ruffalo
96. Matt Smith
97. Matthew McConaughey
98. Meghan Trainor
99. Michael Clarke Duncan
100. Michael Jackson
101. Michelle Obama
102. Mike Posner
103. Miranda Hart
104. Muhammad Ali
105. Nancy Reagan
106. Natalie Cole
107. Natalie Portman
108. Nate Dogg
109. Nelson Mandela
110. Nicole Kidman
111. Olly Murs
112. Patrick Swayze
113. Paul Daniels
114. Paul Walker
115. Pete Burns
116. Peter Kay
117. Pharrell Williams
118. Philip Seymour Hoffman
119. Prince
120. Randy Orton
121. Randy Savage
122. Richie Benaud
123. Robin Williams
124. Ronnie Corbett
125. Rylan Clark
126. Scott Parker
127. Serena Williams
128. Shane Richie
129. Shimon Peres
130. Stephanie McMahon
131. Stephen Gately
132. Stephen King
133. Steve Davis
134. Steve Jobs
135. Terry Pratchett
136. Terry Wogan
137. The Weeknd
138. Jason Derulo
139. Toby Jones

140. Victoria Wood
141. Vladimir Putin
142. Whitney Houston
143. Will I Am
144. Zayn

Stimuli List for the Older Adults used in Chapter Two

1. Adele
2. Alan Shearer
3. Alex Higgins
4. Alfred Hitchcock
5. Amy Winehouse
6. Angela Merkel
7. Audrey Hepburn
8. Hugh Heffner
9. Barbra Streisand
10. Benedict Cumberbatch
11. Bill Shankly
12. Bob Marley
13. Bob Paisley
14. Bobby Moore
15. Bonnie Tyler
16. Brad Pitt
17. Brian Jones
18. Buster Merryfield
19. Caroline Princess of Hanover
20. Cecil Parker
21. Cilla Black
22. Clive Dunn
23. David Bowie
24. David Essex
25. David Soul
26. David Walliams
27. Denzel Washington
28. Donatella Versace
29. Duke Ellington
30. Dustin Hoffman
31. Edith Piaf
32. Ella Fitzgerald
33. Ellie Goulding
34. Elvis Presley
35. Eminem
36. Emma Thompson
37. Eric Clapton

38. Ernie Wise
39. Floyd Mayweather
40. Frank Bruno
41. Frank Lampard
42. Frank Shorter
43. Frank Sinatra
44. Fred Astaire
45. Freddie Mercury
46. Gene Wilder
47. George Best
48. George Foreman
49. George W Bush
50. Gianfranco Zola
51. Gianni Versace
52. Gorgeous George Wagner
53. Grace Kelly
54. Hilary Clinton
55. Ian Botham
56. Idris Elba
57. Ingrid Bergman
58. Jack Hawkins
59. Jack Nicholson
60. Jacqueline Kennedy Onassis
61. Jade Goody
62. Jamie Vardy
63. Jason Donovan
64. Jayne Mansfield
65. Jesse Owens
66. Jim Morrison
67. Jimi Hendrix
68. Jimmy Hill
69. Jodie Foster
70. John Candy
71. John Lennon
72. John Lithgow
73. John Thaw
74. John Wayne
75. Johnny Cash
76. Johnny Depp
77. Jon Bon Jovu
78. Jon Voight
79. Judy Garland
80. Julie Andrews
81. Justin Bieber
82. Justin Timberlake
83. Karen Carpenter

84. Kerry Katona
85. Leonardo DiCaprio
86. Liberace
87. Luciana Pavarotti
88. Lucille Ball
89. Lyndon B Johnson
90. Margaret Thatcher
91. Marilyn Monroe
92. Martin Luther King
93. Matthew McConaughey
94. Michael Caine
95. Michael Jackson
96. Michelle Obama
97. Mick Jagger
98. Mickey Wright
99. Mika
100. Mike Reid
101. Miles Davis
102. Muhammad Ali
103. Nancy Reagan
104. Nat King Cole
105. Nick Hornby
106. Patrick Swayze
107. Paul McCartney
108. Paul Merton
109. Peter Sellers
110. Phil Collins
111. Phil Lynott
112. Prince
113. Prince Philip
114. Queen Elizabeth
115. Ray Charles
116. Rick Astley
117. Ricky Tomlinson
118. Roald Dahl
119. Robbie Williams
120. Robin Williams
121. Rod Stewart
122. Ronald Reagan
123. Ronnie Barker
124. Shirley Bassey
125. Sonny Liston
126. Sophia Loren
127. Stan Laurel
128. Steve Davis
129. Steve Perryman

130. Steve Prefontaine
131. Steven Spielberg
132. Stevie Wonder
133. Sting
134. Sugar Ray Robinson
135. Susan Sarandon
136. Terry Wogan
137. Tom Hanks
138. Tommy Cooper
139. Toni Braxton
140. Usher
141. Will I Am
142. William Hurt
143. William Roache
144. Winston Churchill

Stimuli List used for Chapter Three

1. Amy Winehouse
2. Angela Merkel
3. Audrey Hepburn
4. Barbra Streisand
5. Benedict Cumberbatch
6. Brad Pitt
7. Buster Merryfield
8. Cecil Parker
9. Cilla Black
10. Clive Dunn
11. David Bowie
12. David Essex
13. David Walliams
14. Dustin Hoffman
15. Elvis Presley
16. Ernie Wise
17. Frank Sinatra
18. Ian Botham
19. Idris Elba
20. Ingrid Bergman
21. Jack Hawkins
22. Jack Nicholson
23. John Lennon
24. Johnny Depp
25. Judy Garland
26. Julie Andrews
27. Kerry Katona

28. Leonardo DiCaprio
29. Liberace
30. Luciana Pavarotti
31. Lyndon B Johnson
32. Margaret Thatcher
33. Marilyn Monroe
34. Michael Caine
35. Michelle Obama
36. Mick Jagger
37. Mike Reid
38. Muhammad Ali
39. Nancy Reagan
40. Nat King Cole
41. Paul McCartney
42. Paul Merton
43. Peter Sellers
44. Phil Collins
45. Prince Philip
46. Queen Elizabeth
47. Ricky Tomlinson
48. Robbie Williams
49. Robin Williams
50. Rod Stewart
51. Ronald Reagan
52. Ronnie Barker
53. Shirley Bassey
54. Steve Davis
55. Stevie Wonder
56. Sting
57. Terry Wogan
58. Tommy Cooper
59. Will I Am
60. Winston Churchill

Appendix B: SONA Advert for Chapter Two

8 credits

The aim of this investigation is to examine how factual information is stored and whether the personal significance of this information can affect your judgements. This is a behavioural study involving three computer-based tasks. In each of these tasks, you will be asked to make judgements on a series of famous faces presented, these may be factual or personal in nature. The study will last no longer than 2 hours.

Anyone may sign up to take part in this study, however we will only be using data from individuals that are aged 18-30. The data from other participants will be discarded.

Appendix C: Paid Participant Advert for Chapter Two

Study Title:	**Dead or Alive: Does personal significance affect our judgements?**
Who can take part:	Participants need to be **65-80 years old**, have normal or corrected-to-normal vision, and have **lived in the UK for the majority of their life**.
Location:	02.111B, Lawrence Stenhouse Building, UEA
Compensation/reward for participating:	£20
Approximate time required:	2.5 hours
What participants will do:	Participants will complete three computer-based tasks examining their knowledge of famous faces.
How to take part:	Please email the researcher, Rachel Lambert (Rachel.J.Lambert@uea.ac.uk) for further information.
Additional details:	

Appendix D: Information Sheet for Chapter Two

School of Psychology

University of East Anglia

Dead or Alive: Does personal significance affect our judgements?

Student-researcher, principal investigator: Rachel Lambert, PhD Candidate, School of Psychology, University of East Anglia, rachel.j.lambert@uea.ac.uk;

Supervisor: Dr. Louis Renoult, PhD; School of Psychology, University of East Anglia; 01603 591713, l.renoult@uea.ac.uk

Participant Information Sheet

Thank you for your interest in this study. Before you decide whether to take part, please read the following information carefully (this sheet is for you to keep). You may ask me any questions if you would like more information.

What is this research looking at?

The aim of this investigation is to examine how factual information is stored in the brain, and whether the personal significance of this information can affect your judgements. Age-related differences within this process are also being examined.

Do I have to take part?

It is up to you to decide to join the study. We will describe the study and go through this information sheet. If you agree to take part, we will then ask you to sign a consent form. You are free to withdraw at any time, without giving a reason. This would not affect you in any way.

What will happen if I agree to take part?

If you agree to take part, you will be asked to complete three tasks. In each of these tasks, you will be asked to make judgements on a series of famous faces presented, these may be factual or personal in nature. We will also ask you to fill out a few questionnaires about yourself. The whole study will last no longer than 120 minutes.

Are there any problems with taking part?

You may experience fatigue. We will give you frequent breaks, and you can request as many as you wish. If you experience any irritation or inconvenience during the study, you can choose to stop at any time. You can also choose to skip any questions if you feel uncomfortable with providing an answer.

Will it help me if I take part?

You will not directly benefit from taking part in this study, however your participation will benefit the programme of research and improve knowledge in the field.

Appendix E: Example Famous Person Questionnaire for Chapter Two

ADELE 24.04

Do you recognise this famous face?

- ○ Yes
- ○ No

How familiar are you with this famous face?

	You rarely see or hear about this famous person		You see or hear about this famous person daily	
	0	1	2	3	4
Familiarity					

Do you have any emotional reaction or opinions relating to this famous face?

	No emotional response or opinions			Strong emotional response or opinions
	0	1	2	3	4
Emotional / Opinion Response					

What is the name of the person pictured?

What area(s) does the person pictured work within?

- ☐ Screen, Film & TV
- ☐ Music
- ☐ Sports
- ☐ Other. Please detail.

How old is the person pictured now?

	18	24	30	36	41	47	53	59	65	71	77	82	88	94	100	Not Applicable
AGE																☐

What nationality is the person pictured?

- ○ American
- ○

British

○ Canadian

○ European

○ Other

Can you name something the person pictured is famous for? For example, a film, song or award. If yes, please detail below.

Do you believe the person pictured is dead or alive?

○ Dead

○ Alive

What was the cause of the individual's death?

- ○ Natural Causes (health conditions, old age etc.)
- ○ Unnatural Causes (accident, murder, suicide etc.)
- ○ Other

Do you know any additional information surrounding their death? if yes, please detail below.

When did the person pictured die?

	2008	2009	2010	2010	2011	2012	2013	2014	2014	2015	2016
Year of Death											

Do you have a personal event memory related to the person pictured? For example, remembering a conversation with someone about them.

- ○ Yes
- ○ No

If you are happy to disclose this memory, please detail below.

Roughly when did you experience this memory?

	2016	2013	2011	2008	2006	2003	2000	1998	1995	1993	1990
Year of Memory											

How vivid is the memory?

	Not at all vivid 0	1	2	3	Very vivid 4
Vividness					

What were you feeling at the time?

	0	1	2	3	4
	Very Unhappy	Somewhat Unhappy	Indifferent	Somewhat Happy	Very Unhappy
Emotion					

Demographics 24.04

You will now be asked a series of questions about yourself.

What is your gender?

- ○ Male
- ○ Female
- ○ Other
- ○ Prefer not to say

What is you date of birth? (dd/mm/yyyy)

What are your interests? please tick all that apply.

☐ Film & Television
☐ Music
☐ Politics
☐ Sports

Do you keep up to date with celebrity news?

	Never	Rarely	Occasionally	Quite often	Very Often
	0	1	2	3	4
Keep up-to-date					

How do you get your news? please select all that apply.

☐ Newspaper - Please state.
☐ Magazines
☐ News based internet sites
☐ Social Media
☐ Other - Please state.

Do you consider yourself to be right or left handed?

○ Right
○ Left
○ Ambidextrous

Which hand do you prefer to use when writing?

○ Right
○ Left
○ No Preference

Which hand do you prefer to use when using a knife?

- ○ Right
- ○ Left
- ○ No Preference

Which hand do you prefer to use when using a toothbrush?

- ○ Right
- ○ Left
- ○ No Preference

Do you believe you have a memory problem?

- ○ Yes
- ○ Sometimes
- ○ No

How is your memory for faces?

	Very Poor			Very Good		
	0	1	2	3	4	
Face Memory						

Please tick the statement you believe best applies to you.

- ○ I remember faces better than names
- ○ I remember names better than faces
- ○ I remember faces and names equally well
- ○ I am equally poor at remembering faces and names

Now you will be asked about your sleep quality. To answer these questions, please think generally about your sleep over the past month.

What time have you usually gone to bed?

How long (in minutes) has it taken you to fall asleep each night?

What time have you usually gotten up in the morning?

How many hours of actual sleep did you get at night?

How many hours did you spend in bed each night?

During the past month, how often have you had trouble sleeping because you...

	Not during the past month	Less than once a week	Once or twice a week	Three or more times a week
Cannot get to sleep within 30 minutes	○	○	○	○
Wake up in the middle of the night or early morning	○	○	○	○
Have to get up to use the bathroom	○	○	○	○
Cannot breathe comfortably	○	○	○	○
Cough or Snore loudly	○	○	○	○
Feel too cold	○	○	○	○
Feel too hot	○	○	○	○
Have bad dreams	○	○	○	○
Have pain	○	○	○	○
Other reason. Please describe below, and indicate how often this has disrupted	○	○	○	○

	Not during the past month	Less than once a week	Once or twice a week	Three or more times a week
your sleep.				

During the past month, how often have you taken medication to help you sleep?

- ○ Not during the past month
- ○ Less than once a week
- ○ Once or twice a week
- ○ Three or more times a week

During the past month, how often have you had trouble staying awake while driving, eating meals or engaging in social activity?

- ○ Not during the past month
- ○ Less than once a week
- ○ Once or twice a week
- ○ Three or more times a week

During the past month, how often have you had a problem keeping up enthusiasms to get things done?

- ○ Not during the past month
- ○ Less than once a week
- ○ Once or twice a week
- ○ Three or more times a week

During the past month, how would you rate your sleep quality overall?

- ○ Very good
- ○ Fairly Good
- ○ Fairly Bad
- ○ Very Bad

Now you will be asked a series of questions regarding your mood over the past two weeks.

	Not at all	Several days	More than half the days	Nearly every day
	○	○	○	○

	Not at all	Several days	More than half the days	Nearly every day
Little interest or pleasure in doing things				
Feeling down, depressed or hopeless	○	○	○	○
Trouble falling or staying asleep, or sleeping too much	○	○	○	○
Feeling tired or having little energy	○	○	○	○
Poor appetite or overeating	○	○	○	○
Feeling bad about yourself - or that you are a failure or have let yourself or your family down	○	○	○	○
Trouble concentrating on things, such as reading the newspaper or watching television	○	○	○	○
Moving or speaking so slowly that other people could have notice? or the opposite - being so fidgety or restless that you have been moving around a lot more than usual	○	○	○	○
Thoughts that you would be better off dead or hurting yourself in some way	○	○	○	○

If you check off any problems, how difficult have these problems made it for you to do your work, take care of things at home, or get along with other people?

○ Not difficult at all

○ Somewhat difficult

○ Very difficult

○ Extremely difficult

○ Not applicable - I did not check off any problems.

Appendix F: Debrief for Chapter Two

Debrief form

School of Psychology

University of East Anglia

Debrief Form

Dead or Alive: Does personal significance affect our judgements?

Student-researcher, principal investigator: Rachel Lambert, PhD Candidate, School of Psychology, University of East Anglia, Rachel.j.lambert@uea.ac.uk

Supervisor: Dr Louis Renoult, PhD; School of Psychology, University of East Anglia; 01603 591713**,** l.renoult@uea.ac.uk

Thank you for participating in this study. Your time and efforts are greatly appreciated.

The purpose of this study is to better understand how memory is stored in older and young adults, particularly the interaction between semantic memory (our general factual knowledge of the world) and episodic memory (our ability to remember unique events).

For this reason, we were investigating autobiographically significant concepts, these are semantic concepts (items which are typically related to factual knowledge, in this case famous faces), which have become associated/linked with an autobiographical or personal event memory (such as remembering a specific conversation you had about Michael Jackson's music). This association has been shown to result in better recall memory for these concepts, compared to those with no associated event memory.

This demonstrates that the two memory systems are interacting with one another, so this study aimed to examine this interaction by testing the relationships between episodic recognition, semantic knowledge, and personal memories for famous faces, and particularly whether this changes with age.

It is hoped the current study will contribute to the understanding of the interaction between the two memory systems, and influence current theories surrounding memory loss. With additional research, it may be possible to develop rehabilitation techniques surrounding this concept, to improve semantic memory.

If you have any questions regarding this study please feel free to ask or contact the researcher or supervisor of this study now, or at a later date. If you wish to withdraw your data, please inform the researcher now. Due to the anonymised nature of the data, withdrawal after you leave the lab will not be possible.

General Sources of Support

1. Seeking help or information for emotional difficulties or memory concerns

The first step in accessing help is to discuss the problem with your GP. They will be able to advise you on access to local resources and refer you on if appropriate.

2. Useful web sites

The Alzheimer's Society (www.alzheimers.org.uk) provides information on dementia and a directory of help available locally. The website offers an online forum

The Wellbeing Service (www.wellbeingnands.co.uk/) provide a range of support for people with common mental health and emotional issues, such as low mood, depression or stress. They offer local workshops, self-help workbooks and the opportunity to refer yourself for sessions with local therapists.

Mind website (http://www.mind.org.uk/) is supported by a leading mental health charity in England and Wales and also provides high-quality information and advice about mental health issues.

If you would like to receive a report of the main findings of the study (or a summary of the findings) when it is completed, please contact the researcher, however individual feedback on your results cannot be given.

Researcher Contact details:

Dr. Louis Renoult, l.renoult@uea.ac.uk, Phone 01603 59**1713**

Rachel Lambert, rachel.j.lambert@uea.ac.uk,

Do contact us if you have any worries or concerns about this research.

School of Psychology Ethics Committee: ethics.psychology@uea.ac.uk; Phone 01603 597146
Head of School Professor Kenny Coventry: k.coventry@uea.ac.uk; Phone 01603 597145

Thank you again for your participation!

Appendix G: Means and *p* values before and after controlling for factual knowledge and familiarity at the participant level

Means and *p* values taken from an independent measures t-test within each subject for factual knowledge and familiarity ratings for stimuli associated with and stimuli associated without AS, before the control of these factors at the participant level.

	Before control													
	Familiarity							Factual Knowledge						
Subject	AS			No-AS				AS			No-AS			
	N	*M*	*SD*	*N*	*M*	*SD*	*p* -value	*N*	*M*	*SD*	*N*	*M*	*SD*	*p* -value
101	24	1.3750	0.92372	31	0.9677	0.91228	0.108	24	91.6667	12.03859	31	87.0968	15.93370	0.247
102	12	2.4167	0.79296	39	2.2821	0.68628	0.569	12	98.6111	4.81125	39	92.7350	10.32716	0.064
103	33	2.1515	0.79535	63	1.6032	0.70801	0.0001	33	95.4545	9.56767	63	85.1852	17.86326	0.0001
104	31	2.6129	1.14535	22	1.5	0.80178		31	74.7312	16.59483	22	46.2121	22.37949	
105	28	1.4643	0.79266	21	0.9524	0.80475	0.031	28	81.8452	15.22357	21	70.6349	23.36591	0.048
106	12	2.7500	0.86603	63	2.4286	0.77697	0.201	12	97.2222	6.48749	63	88.8889	11.87977	0.021
107	34	2.9706	1.14111	37	2.2432	1.49825	0.025	34	87.2549	14.24818	37	70.7207	25.04792	0.001
108	34	2.2059	1.38781	55	1.6000	1.25610	0.037	34	86.7647	13.47114	55	79.3939	21.44800	0.05
109	7	1.5714	0.53452	51	0.9608	0.99922	0.12	7	95.2381	8.13250	51	83.9869	18.01567	0.111
110	37	1.5946	0.83198	49	1.1837	0.92811	0.037	37	91.8919	12.80289	49	78.5714	29.46278	0.012
111	27	1.4815	1.34079	55	1.0364	1.33283	0.16	27	91.6667	11.55625	55	80.7576	21.92350	0.018
112	21	1.2381	0.76842	52	1.2885	0.84799	0.814	21	91.6667	12.36033	52	88.9423	15.54398	0.476
114	28	3.0000	1.12217	55	1.7455	1.20521	0.0001	28	93.4524	10.4815	55	84.6970	19.82197	0.032
115	9	1.7778	1.09291	36	1.1667	1.08233	0.138	9	94.4444	8.33333	36	88.4259	19.03190	0.362
116	54	2.2037	0.76182	14	0.9286	0.73005	0.0001	54	90.8951	16.37068	14	60.119	25.77404	0.0001
117	19	1.6842	0.82007	46	0.5435	0.68982	0.0001	19	86.8421	11.88804	46	51.8116	28.59428	0.0001
118	29	1.3103	0.92980	49	0.8776	0.85714	0.04	29	92.5287	9.53919	49	83.3333	21.04064	0.03
119	37	2.4054	0.59905	35	1.8	0.67737	0.0001	37	91.8919	10.10869	35	65.0000	28.64021	0.0001
120	28	2.7500	1.32288	45	0.6889	1.08339	0.0001	28	78.5714	17.03732	45	44.8148	23.25263	0.0001
121	15	2.2000	0.86189	58	1.4138	0.67628	0.0001	15	96.6667	9.34353	58	94.1092	14.39222	0.41
122	27	1.9630	0.64935	41	1.3171	0.68699	0.0001	27	85.4938	15.25996	41	57.3171	27.33506	0.0001
123	21	2.6190	0.92066	50	1.9800	0.95810	0.012	21	92.4603	11.15072	50	79.6667	22.09031	0.014
124	13	3.3846	0.76795	61	2.3279	1.20722	0.004	13	96.1538	7.30882	61	68.9891	26.18184	0.0001
125	18	2.1667	0.85749	39	2.0256	0.74294	0.528	18	92.5926	10.26165	39	88.8889	18.46972	0.431
126	21	2.8571	0.65465	34	2.4706	0.74814	0.056	21	96.0317	7.27393	34	88.9706	14.02268	0.038
127	13	2.0000	1.15470	60	1.2500	1.00212	0.02	13	90.3846	13.96347	60	79.0278	22.52283	0.086
301	16	1.0625	0.57373	51	0.7255	0.69261	0.053	16	73.7500	14.08309	51	63.1373	18.49218	0.039
302	25	2.6000	1.11803	53	1.9811	0.99015	0.023	25	80.8000	9.09212	53	71.3208	17.32470	0.012
303	43	2.9302	0.98550	24	2.2083	1.06237	0.009	43	77.6744	10.87531	24	69.1667	16.65942	0.014
304	20	1.9000	0.71818	29	1.3103	0.54139	0.004	20	78.0000	8.94427	29	75.1724	12.71127	0.395
305	25	2.4000	0.76376	38	1.5263	0.89252	0.001	25	71.2000	16.41138	38	70.5263	15.93015	0.873
306	39	3.1282	0.76707	51	2.5882	0.92036	0.003	39	77.4359	8.18148	51	76.8627	9.27150	0.761
307	34	2.5294	1.13445	34	1.4706	0.99195	0.001	34	75.2941	8.61123	34	69.4118	14.12953	0.042
308	41	3.4634	0.86884	27	2.1852	1.14479	0.001	41	76.5854	9.90196	27	67.4074	14.83048	0.007
309	11	2.1818	0.75076	57	1.3158	0.94789	0.006	11	78.1818	10.78720	57	67.0175	17.92493	0.051
310	31	2.5161	0.67680	33	2.1818	0.68258	0.054	31	78.0645	7.92437	33	63.0303	17.40777	0.001
311	14	2.5000	0.94054	35	1.5429	0.85209	0.003	14	80.0000	7.84465	35	75.4286	8.52086	0.084
312	20	2.7000	0.47016	61	2.1148	0.77671	0.002	20	77.0000	9.78721	61	74.7541	12.59716	0.469
313	1	1.0000		56	1.0714	0.84975	0.934	1	100.0000		56	65.0000	19.16436	0.076
314	14	2.5000	0.65044	42	1.4048	0.82815	0.001	14	77.1429	7.26273	42	66.6667	14.42671	0.012
315	17	1.7059	0.91956	59	1.3051	0.93319	0.122	17	76.4706	12.71868	59	72.8814	17.32557	0.43
316	8	2.0000	0.53452	28	1.2500	0.88715	0.03	8	75.0000	9.25820	28	57.8571	29.48410	0.117
317	19	1.8947	0.87526	51	1.7647	0.90749	0.592	19	76.8421	13.76494	51	77.6471	12.42389	0.816
318	51	2.6275	0.63121	13	2.3077	0.63043	0.108	51	78.8235	10.88982	13	69.2308	13.20451	0.009
319	27	3.0370	1.12597	41	2.2195	1.01272	0.003	27	79.2593	10.35000	41	70.7317	12.72601	0.005
320	29	2.2759	0.84077	44	1.4318	0.75937	0.001	29	71.0345	10.12240	44	66.8182	16.67371	0.227
321	37	3.1892	1.04981	26	2.2308	1.30561	0.002	37	71.3514	16.69367	26	54.6154	18.38059	0.001
322	12	1.9167	0.99620	62	1.1129	0.85132	0.02	12	78.3333	5.77350	62	70.0000	16.88922	0.097
323	26	2.9615	0.59872	48	2.5208	0.77156	0.014	26	81.5385	7.84465	48	74.5833	11.47770	0.007
324	26	1.2692	0.60383	20	0.8500	0.93330	0.072	26	77.6923	10.31802	20	72.0000	10.05249	0.067
325	28	1.9643	0.83808	40	1.7000	0.93918	0.237	28	73.5714	15.44747	40	69.5000	14.31334	0.268
208	6	1.3333	0.8165	126	1.3889	0.669	0.876	6	90	10.95445	126	88.8889	16.30814	0.869
209	6	2.5	1.04881	113	1.5752	0.97106	0.084	6	86.6667	16.32993	113	72.5664	19.67498	0.088
210	23	2.9565	0.47465	103	2.2913	0.78754	0.001	23	95.6522	8.43482	103	87.5728	17.73807	0.001
212	2	2	0.57735	64	0.989	0.83659	0.271	2	90.7692	15.525	64	75.6044	26.63368	0.352
213	13	1.6667	0.57735	91	0.8214	0.67403	0.0011	13	86.6667	11.54701	91	85.3571	20.61787	0.048
214	3	2.3077	1.37747	112	0.7297	0.71282	0.122	3	98.4615	5.547	112	84.8649	19.29978	0.913
215	13	1.5882	0.77914	111	0.9054	0.76156	0.001	13	91.7647	12.11708	111	78.3784	25.15851	0.013
218	51	2.05	1.14593	74	0.8776	1.00786	0.001	51	94	13.13893	74	77.3469	22.72884	0.001
219	77	1.8947	1.04853	12	1.1515	0.87039	0.127	77	88.4211	12.13954	12	80	18.02776	0.064
222	98	1.3333	1.30268	20	1.1071	0.55923	0.001	98	91.6667	13.37116	20	90.3571	15.8784	0.002
225	19	0.3077	0.48038	33	0.1293	0.4478	0.008	19	90.7692	10.37749	33	82.931	21.79019	0.076
226	5	2	0.9759	60	1.2973	0.85576	0.275	6	93.6364	11.35801	50	90.8108	12.46988	0.213
234	2	1.48	1.08474	64	0.7802	0.87942	0.051	2	96.8	7.48331	64	85.7143	16.94061	0.342
235	12	2	.	112	0.2857	0.58168	0.262	12	100	.	112	70.9091	19.34329	0.784
236	7	1.2857	0.95119	100	0.54	0.62636	0.084	7	94.2857	15.11858	100	77.6	24.16776	0.075
237	21	2.4762	0.67964	88	1.3977	0.8515	0.001	21	95	8.88523	88	85.9091	16.65308	0.001
238	33	2.6667	0.92421	101	1.8416	1.20609	0.001	33	95.1515	10.03781	101	89.1089	15.88074	0.001
239	31	1.3871	0.76059	88	0.5341	0.6772	0.001	31	92.2581	14.30843	88	70.9091	24.05149	0.001
240	11	1.1818	1.16775	54	0.3704	0.83092	0.048	11	94.5455	9.34199	54	88.1481	16.26132	0.213
242	8	1.75	1.10716	41	0.619	0.80518	0.141	8	84.375	19.49979	41	72.8571	22.31059	0.318

Means and *p* values taken from an independent measures t-test within each subject for factual knowledge and familiarity ratings for stimuli associated with and stimuli associated without AS, after the control of these factors at the participant level.

	After Control													
	Familiarity							Factual Knowledge						
Subject	AS			No-AS				AS			No-AS			
	N	*M*	*SD*	*N*	*M*	*SD*	*p* -value	*N*	*M*	*SD*	*N*	*M*	*SD*	*p* -value
101	20	1.15	0.81273	27	1.0741	0.91676	0.77	24	75.0000	36.11576	31	80.1075	32.32341	0.583
102	11	2.2727	0.64667	33	2.4545	0.56408	0.377	11	98.4848	5.02519	33	95.9596	6.94760	0.274
103	28	1.9643	0.74447	47	1.7660	0.66636	0.237	28	94.0476	10.35808	47	93.2624	8.08288	0.716
104	8	1.6250	1.06066	26	2.1538	0.92487	0.181	8	72.9167	12.40040	26	62.5000	16.02949	0.102
105	26	1.3462	0.68948	19	1.0526	0.77986	0.189	26	80.7692	15.23323	19	74.5614	20.87472	0.255
106	12	2.4167	0.51493	47	2.7234	0.79951	0.213	12	95.8333	7.53778	47	93.9716	7.71279	0.457
107	32	2.9063	1.14608	28	2.6786	1.33482	0.48	32	86.4583	14.31688	28	80.3571	16.54497	0.131
108 -	-	-		-	-	- -		-	-	-	-	-	- -	
109	8	1.7500	0.70711	38	1.2105	0.93456	0.131	8	95.8333	7.71517	38	90.3509	12.02574	0.225
110	-	-	-	-	-	- -		-	-	- -		-	-	
111	27	0.9259	1.26873	49	1.4694	1.37086	0.094	27	87.0370	12.30257	49	89.4558	13.36969	0.44
112	21	1.2381	0.76842	52	1.2885	0.84799	0.814	21	88.4921	20.49326	52	88.9423	15.54398	0.919
114	25	2.8800	1.12990	34	2.4706	0.89562	0.126	25	92.6667	10.84401	34	93.8725	9.24526	0.647
115	9	1.0000	1.32288	36	1.3611	1.04616	0.385	9	96.2963	7.34931	36	87.9630	18.94483	0.205
116 -	-	-	-	-	-	-	-	-	-	-	-	-	-	
117 -	-	-	-	-	-	-	-	-	-	-	-	-	-	
118	28	1.3571	0.91142	40	1.0500	0.84580	0.158	28	92.8571	9.54583	40	90.2083	13.46192	0.374
119	-	-	-	-	-	-	-	-	-	-	-	-	-	-
120														
121														
122	25	1.8800	0.60000	20	1.7500	0.55012	0.458	25	84.3333	15.27525	20	80.8333	14.33211	0.437
123	21	2.6190	0.92066	41	2.2439	0.83007	0.11	21	92.4603	11.15072	41	86.5854	16.65396	0.151
124 -	-	-	-	-	-	-	-	-	-	-	-	-	-	
125	18	2.1667	0.85749	39	2.0256	0.74294	0.528	18	92.5926	10.26165	39	88.8889	18.46972	0.431
126 -	-	-	-	-	-	-	-	-	-	-	-	-	-	
127	13	1.8462	0.9871	43	1.7442	0.87541	0.722	13	89.1026	11.97249	43	88.5659	13.24166	0.896
301	40	0.9250	0.52563	16	1.0625	0.57373	0.393	40	69.0000	14.98717	16	73.7500	14.08309	0.281
302	42	2.3095	0.71527	25	2.6000	1.11803	0.199	42	76.6667	12.42866	25	80.8000	9.09212	0.153
303	20	2.5000	0.88852	41	2.8780	0.97967	0.15	20	74.0000	11.42481	41	76.5854	9.90196	0.367
304	18	1.5000	0.61835	17	1.7059	0.58787	0.321	18	78.8889	8.32352	17	77.6471	9.70143	0.687
305	22	2.1818	0.39477	22	2.3636	0.65795	0.273	22	74.5455	11.00964	22	71.8182	17.08142	0.532
306	43	2.8837	0.66222	39	3.1282	0.76707	0.125	43	77.2093	9.34156	39	77.4359	8.18148	0.908
307	24	1.8333	0.91683	28	2.2500	1.04083	0.135	24	74.1667	11.00066	28	75.0000	8.81917	0.763
308	23	2.6087	0.94094	18	2.7778	0.94281	0.572	23	71.3043	13.24742	18	71.1111	12.31398	0.962
309	33	1.8788	0.78093	11	2.1818	0.75076	0.267	33	75.7576	13.92621	11	78.1818	10.78720	0.602
310	23	2.4348	0.58977	21	2.2857	0.71714	0.454	23	70.4348	14.60954	21	76.1905	8.04748	0.118
311	45	2.5111	0.50553	18	2.6667	0.48507	0.194	45	77.3333	10.09050	18	76.6667	10.28992	0.622
312	11	2.1818	0.40452	14	2.5000	0.65044	0.17	11	78.1818	6.03023	14	77.1429	7.26273	0.706
313	16	1.7500	0.77460	8	2.0000	0.53452	0.423	16	73.7500	21.56386	8	75.0000	9.25820	0.878
314	51	1.7647	0.90749	19	1.8947	0.87526	0.592	51	77.6471	12.42389	19	76.8421	13.76494	0.816
315	13	2.3077	0.63043	29	2.2069	0.41225	0.54	13	69.2308	13.20451	29	74.4828	10.55131	0.176
316	24	2.5417	0.50898	16	2.3750	1.02470	0.499	24	72.5000	11.51558	16	78.7500	13.60147	0.126
317	18	2.2222	0.42779	27	2.1481	0.71810	0.696	18	72.2222	12.15370	27	71.1111	10.12739	0.741
318	18	2.9444	0.72536	24	2.7500	1.07339	0.511	18	58.8889	17.45208	24	65.0000	16.93979	0.26
319	46	1.4565	0.68982	11	1.7273	0.78625	0.26	46	76.0870	9.06232	11	78.1818	6.03023	0.471
320 -	-	-	-	-	-	-	-	-	-	-	-	-	-	
321	37	2.8378	0.50075	24	2.8750	0.53670	0.309	37	77.2973	8.38274	24	80.0000	5.89768	0.302
322 -	-	-	-	-	-	-	-	-	-	-	-	-	-	
323	15	1.1333	0.91548	26	1.2692	0.60383	0.57	15	76.0000	8.28079	26	77.6923	10.31802	0.591
324	39	1.7436	0.90954	28	1.9643	0.83808	0.315	39	69.7436	14.41622	28	73.5714	15.44747	0.308
325 -	-	-	-	-	-	-		-	-	-	-	-	- -	
208	126	1.3889	0.66900	6	1.3333	0.81650	0.876	126	88.8889	16.30814	6	90.0000	10.95445	0.869
209	80	2.0375	0.70160	6	2.5000	1.04881	0.137	80	78.5000	18.76571	6	86.6667	16.32993	0.303
210	66	2.7273	0.48184	21	2.8571	0.35857	0.259	66	95.1515	9.32200	21	95.2381	8.72872	0.97
212	18	2.0000	.00000[b]	2	2.0000	.00000[b] -		18	95.3704	7.68148	2	100.0000	0.00000	0.015
213	38	1.7105	0.65380	13	2.0000	0.57735	0.163	38	93.1579	12.54296	13	90.7692	15.52500	0.58
214	70	1.2143	0.47831	3	1.6667	0.57735	0.115	70	92.5714	11.87931	3	86.6667	11.54701	0.402
215	18	1.7222	0.82644	13	2.3077	1.37747	0.277	18	98.8889	4.71405	13	98.4615	5.54700	0.135
218	49	1.7347	0.72960	20	2.0500	1.14593	0.176	49	88.5714	14.71960	20	94.0000	13.13893	0.157
219	24	1.5417	0.65801	19	1.8947	1.04853		24	84.1667	14.42120	19	88.4211	12.13954	
222	98	1.3333	1.30268	20	1.1071	0.55923	0.262	98	91.6667	13.37116	20	90.3571	15.8784	0.784
225	19	0.3077	0.48038	33	0.1293	0.4478	0.179	19	90.7692	10.37749	33	82.931	21.79019	0.204
226	6 -	-		50 -	-	-		6 -	-		50 -	-	-	
234	2	1.375	0.96965	64	1.2593	0.82839	0.591	2	96.6667	7.61387	64	93.7037	9.37606	0.178
235	12 -	-		112 -	-	-		12 -	-		112 -	-	-	
236	7	1.2857	0.95119	100	1.0889	0.46818	0.382	7	94.2857	15.11858	100	85.3333	18.29058	0.225
237	21	2.5	0.67259	88	2.2857	0.51856	0.182	21	94.2857	9.2582	88	92.5714	10.9391	0.551
238	33	2.6667	0.92421	101	2.7719	0.62728	0.522	33	95.1515	10.03781	101	95.7895	9.05289	0.758
239	31	1.3871	0.76059	88	1.2903	0.46141	0.547	31	92.2581	14.30843	88	86.4516	14.95513	0.124
240	11	1.1818	1.16775	54	1.4286	1.08941	0.591	11	94.5455	9.34199	54	95.7143	8.51631	0.747
242	-	-		-	-	-		-	-		-	-	-	

Appendix H: Means and *p* values before and after controlling for emotional salience at the participant level

Means and *p* values taken from an independent measures t-test within each subject for emotional salience ratings for stimuli associated with and stimuli associated without AS, before and after the control of this factor at the participant level.

	Before control Emotional Salience							After Control Emotional Salience						
Subject	AS			No-AS				AS			No-AS			
	N	*M*	*SD*	*N*	*M*	*SD*	*p* -value	*N*	*M*	*SD*	*N*	*M*	*SD*	*p* -value
101	23	1.5652	1.12112	30	0.5333	0.73030	0.0001	24	-2.6250	20.55705	24	0.6667	0.76139	0.437
102	12	2.5833	0.79296	39	2.4103	0.81815	0.522	12	2.5833	0.79296	39	2.4103	0.81815	0.522
103	33	2.0909	0.94748	63	1.2381	0.55979	0.0001	20	1.4500	0.60481	33	1.5455	0.56408	0.564
104	31	2.7097	1.16027	18	1.1667	1.09813		21	2.0952	0.88909	14	1.5000	1.01905	0.076
105	28	1.7857	1.06657	21	0.9524	1.02353	0.008	21	1.3333	0.79582	21	0.9524	1.02353	0.186
106	12	2.1667	0.71774	63	1.6984	0.90936	0.097	12	2.1667	0.71774	63	1.6984	0.90936	0.097
107	34	2.6765	0.87803	37	1.5676	1.30257	0.0001	28	2.3929	0.68526	28	2.0714	1.08623	0.191
108	34	1.7059	0.93839	55	0.3273	0.61024	0.0001	27	1.3704	0.74152	14	1.2857	0.46881	0.7
109	7	2.0000	0.81650	51	0.902	0.96447	0.006	7	2	0.8165	29	1.5862	0.73277	0.198
110	37	1.2973	1.24421	49	0.8367	1.16094	0.081	37	1.2973	1.24421	49	0.8367	1.16094	0.081
111	27	2.1852	1.03912	55	1.2364	1.24668	0.001	27	2.1852	1.03912	34	2.0000	0.98473	0.479
112	21	1.7619	1.09109	52	0.6538	0.98786	0.0001	21	1.7619	1.09109	22	1.5455	0.96250	0.494
114	28	2.6786	1.36228	55	0.7818	1.06616	0.0001	20	2.1500	1.26803	20	1.9000	0.96791	0.488
115	9	1.1111	0.78174	36	0.8333	1.02817	0.454	9	1.1111	0.78174	36	0.8333	1.02817	0.454
116	53	2.4717	1.04888	14	1.2857	1.20439	0.0001	44	2.1591	0.86113	10	1.8000	1.03280	0.256
117	19	1	0.66667	46	0.1957	0.61894	0.0001	19	1.0000	0.66667	15	0.6000	0.98561	0.168
118	29	1.4483	1.27016	49	0.4694	0.98111	0.0001	29	1.4483	1.27016	22	1.0455	1.25270	0.265
119	37	2.5676	0.92917	35	1.8286	0.74698	0.0001	31	2.2903	0.73908	30	1.9667	0.71840	0.088
120	28	1.9286	1.35888	45	0.2444	0.52896	0.0001	18	1.0556	0.72536	11	1.0000	0.63246	0.836
121	15	2.5333	1.0601	58	1.5172	0.97767	0.001	12	2.1667	0.83485	43	1.8140	0.93238	0.242
122	27	1.6296	0.83887	41	0.7317	0.67173	0.0001	22	1.3182	0.56790	21	1.1905	0.51177	0.444
123	21	2.381	1.2836	50	1.3	1.07381	0.001	21	2.3810	1.28360	20	2.2500	1.01955	0.72
124	13	3.3077	0.94733	61	1.2131	0.91496	0.0001	9	3.0000	1.00000	17	2.4118	0.71229	0.094
125	18	2	1.13759	39	1.5897	0.81815	0.127	18	2.0000	1.13759	39	1.5897	0.81815	0.127
126	21	2.5238	1.03049	34	1.7059	1.29168	0.017	21	2.5238	1.03049	27	2.1481	1.06351	0.225
127	13	2.6154	1.50214	60	1.4333	1.51116	0.013	13	2.6154	1.50214	36	2.3889	1.22539	0.593
301	16	0.6250	0.71880	51	0.1569	0.36729	0.022	21	0.3810	0.49761	16	0.6250	0.71880	0.23
302	25	2.1600	1.10604	53	1.4717	1.08493	0.011	33	2.1818	0.63514	25	2.1600	1.10604	0.925
303	43	3.2093	1.10320	24	2.5417	1.21509	0.025	24	2.5417	1.21509	18	2.1111	0.90025	0.214
304	20	0.5000	0.76089	29	0.0000	0.00000	0.008	25	1.4000	0.70711	25	1.8000	0.86603	0.239
305	25	1.8000	0.86603	38	0.9737	0.85383	0.001	25	1.8000	0.86603	39	3.2308	0.93080	0.221
306	39	3.2308	0.93080	51	2.4902	1.18950	0.002	24	0.9583	0.99909	27	1.3704	1.04323	0.157
307	34	1.7647	1.23236	34	0.6765	0.94454	0.001	16	1.6875	0.79320	16	1.6875	0.60208	0.001
308	41	2.7073	0.98092	27	1.0000	1.03775	0.001	14	2.0714	0.91687	11	2.2727	1.19087	0.637
309	11	2.2727	1.19087	57	0.5088	1.00219	0.001	27	0.2593	0.65590	28	0.4643	0.50787	0.2
310	31	0.6129	0.66720	33	0.2121	0.59987	0.014	14	1.1429	0.36314	13	1.6154	1.12090	0.168
311	14	1.7857	1.25137	35	0.4571	0.61083	0.001	47	2.3830	0.49137	19	2.5263	0.61178	0.371
312	20	2.6000	0.68056	61	2.0656	0.72730	0.005	22	2.4091	1.05375	14	2.2857	0.99449	0.729
313	1	2.0000		56	1.2679	1.19835	0.547	59	0.8644	1.12123	17	1.2353	0.90342	0.215
314	14	2.2857	0.99449	42	1.2619	1.43237	0.016	28	1.0357	0.88117	8	1.6250	0.51755	0.082
315	17	1.2353	0.90342	59	0.8644	1.12123	0.215	51	0.4902	0.94599	19	0.4737	0.84119	0.947
316	8	1.6250	0.51755	28	1.0357	0.88117	0.082	13	2.6154	0.76795	46	3.0217	0.80247	0.109
317	19	0.4737	0.84119	51	0.4902	0.94599	0.947	21	2.0476	0.74001	17	2.5294	1.17886	0.133
318	51	3.1176	0.81602	13	2.6154	0.76795	0.051	24	0.5833	1.01795	29	1.0000	1.13389	0.169
319	27	3.0741	1.17427	41	1.1463	1.10817	0.001	21	1.2381	1.41084	27	1.8889	1.60128	0.148
320	29	1.0000	1.13389	44	0.3182	0.80037	0.007	62	1.6290	1.40530	12	2.5000	1.73205	0.123
321	37	2.4595	1.65990	26	1.0000	1.35647	0.001	24	2.1250	1.26190	16	2.6250	1.31022	0.234
322	12	2.5000	1.73205	62	1.6290	1.40530	0.063	-	-	-	-	-	-	-
323	26	3.1538	1.22286	48	1.3333	1.43413	0.001		-	-	-	-	-	-
324	26	0.8846	1.07059	20	0.6000	0.99472	0.362	20	0.6000	0.99472	26	0.8846	1.07059	0.362
325	28	2.3571	1.54475	40	1.5750	1.55064	0.044	30	2.1000	1.44676	28	2.3571	1.54475	0.515
208	6	0.5	0.83666	126	0.3175	0.56073	0.448	43	0.9535	1.25268	21	1.6190	1.35927	0.057
209	6	2.6667	1.50555	113	0.9469	1.25954	0.002	44	0.1818	0.49522	12	0.3333	0.65134	0.285
210	23	2.2609	0.91539	103	1.2427	0.97484	0.001	50	1.7600	1.25454	22	1.7727	1.37778	0.969
212	2	2.3846	1.1209	64	0.4835	0.77978	0.134	77	3.0000	1.11213	9	3.2222	1.39443	0.655
213	13	2	1	91	0.2768	0.61819	0.001	126	0.3175	0.56073	6	0.5000	0.83666	0.448
214	3	2.0769	1.38212	112	0.0991	0.3556	0.095	80	1.2750	1.34987	6	2.6667	1.50555	0.073
215	13	1.6275	0.8476	111	0.9189	0.7896	0.001	66	1.5606	0.91364	21	2.1429	0.85356	0.011
218	74	2.3	1.26074	51	1.1122	1.31512	0.001	18	2.2778	1.17851	2	3.0000	1.41421	0.957
219	77	1.6316	1.49854	12	0.697	1.10354	0.026	38	1.0263	0.85383	13	2.3846	1.12090	0.001
222	98	0.5833	0.51493	20	0.0714	0.2587	0.001	70	0.4286	0.73369	3	2.0000	1.00000	0.109
225	19	1.2308	1.01274	33	0.3966	0.7087	0.013	18	0.4444	0.70479	13	2.0769	1.38212	0.024
226	5	1.1818	1.36753	60	0.3378	0.57996	0.016	49	2.1633	1.06745	20	2.3000	1.26074	0.649
234	2	2.04	1.51327	64	0.5604	0.96849	0.001	24	0.7917	1.14129	19	1.6316	1.49854	0.051
235	12	2 .		112	0.1688	0.47024	0.001		-	-		-	-	-
236	7	1	1.1547	100	0.17	0.56951	0.107	7	1.0000	1.15470	100	1.8889	0.60093	0.136
237	21	2.2857	0.78376	88	1.0227	0.75775	0.001	21	2.2857	0.78376	88	2.2222	0.42779	0.761
238	33	2.6667	0.98953	101	1.5347	1.29278	0.001	33	2.6667	0.98953	101	2.5	0.8528	0.404
239	33	1.5161	0.81121	88	0.5341	0.6772	0.001	33	1.4667	0.77608	88	1.2813	0.4568	0.253
240	11	0.9091	1.13618	54	0.2037	0.56233	0.07	11	0.9091	1.13618	54	0.7857	0.89258	0.764
242	8	2.1563	1.24717	41	0.5595	0.9487	0.316		-	-		-	-	-

Appendix I: Email advertisement for Chapter Three

Dead or Alive – Does Personal Significance Affect our Judgements?

This study is examining how factual information is stored in the brain and whether the personal significance of this information can affect your judgements. It involves completing two computer-based tasks in the EEG lab within the School of Psychology, and then the third task, a large internet questionnaire, can be completed either with myself, or in the comfort of your home.

The tasks involve making judgements on a series of famous faces, these may be factual or personal in nature. Your brain activity will be recorded during these tasks using electroencephalography (EEG). EEG is a safe non-invasive technique that measures the electrical activity of the brain using electrodes placed on the scalp.

The lab session should take approximately 2 hours, and the Survey at home is expected to take 1 hour to 1 hour 30 minutes, and you will be compensated £30 for your time.

If you are interested in taking part in this specific project, you can contact myself via email Rachel.j.lambert@uea.ac.uk

Appendix J: Information Sheet for Chapter Three

School of Psychology

Dead or Alive: Does personal significance affect our judgements?

Student-researcher, principal investigator: Rachel Lambert, PhD Candidate, School of Psychology, University of East Anglia, rachel.j.lambert@uea.ac.uk;

Supervisor: Dr Louis Renoult, PhD; School of Psychology, University of East Anglia; 01603 591713**,** l.renoult@uea.ac.uk

Participant Information Sheet

Thank you for your interest in this study. Before you decide whether to take part, please read the following information carefully (this sheet is for you to keep). You may ask me any questions if you would like more information.

What is this research looking at?

The aim of this investigation is to examine how factual information is stored in the brain, and whether the personal significance of this information can affect your judgements. Age-related differences within this process are also being examined.

Do I have to take part?

It is up to you to decide to join the study. We will describe the study and go through this information sheet. If you agree to take part, we will then ask you to sign a consent form. You are free to withdraw at any time, without giving a reason. This would not affect you in any way.

What will happen if I agree to take part?

If you agree to take part, the procedure will entail recording your brain activity using electroencephalography (EEG). EEG is a safe and non-invasive technique that measures the electrical activity of the brain using electrodes placed on the scalp. Your brain activity will be recorded during three short tasks. In each of these tasks, you will be asked to make judgements on a series of famous faces presented, these may be factual or personal in nature. We will also ask you to fill out a few questionnaires about yourself. The whole study will last approximately 2 hours.

EEG – head measurement and gel use

EEG involves measuring your head, and fitting the appropriate cap. This cap will be placed onto your head and electrodes will be attached to it. Some electrodes will also be placed onto your face to record your eye movements. To record accurately, we need to put a water-based gel onto your hair under each electrode, to effectively conduct the signal. To do this, we use blunt syringes which will make contact with your scalp but should never hurt. This gel is easy to wash out after the experiment, and we have shower facilities and private space for you to do this. We will keep you informed at each stage of the set-up and ask you for feedback. If at any point you feel uncomfortable, we will stop immediately.

EEG – Movement and Blinking
The EEG recording can be disrupted if you move or blink excessively. So, you will be invited to find a comfortable position in your chair, to limit movement as much as possible and, to minimise eye-blinks and face movements. Your experimenter will give you clear instructions about when the best times to move and blink are, and when it is best to keep as still as possible. You will be given breaks between tasks, and water will be available whenever you need it, but please feel free to ask for additional breaks if required.

EEG- Brain measurement
EEG only allows us to record naturally occurring neural activity within your brain. It does not stimulate any part of your brain, nor allow us to "read your mind". If you wish to receive more information about EEG before you decide to take part, please feel free to ask us.

Are there any problems with taking part?
The placement of the EEG cap is not painful, although there may be minor discomfort. Some people find that their skin may be slightly reddened after the electrodes are removed. This reddening will disappear within a few hours. If you experience any irritation or inconvenience during the study, you can choose to stop at any time.

You may experience fatigue. We will give you frequent breaks, and you can request as many as you wish. You can also choose to skip any questions if you feel uncomfortable with providing an answer.

Will it help me if I take part?
You will not directly benefit from taking part in this EEG study. However, if you are interested in how EEG works, this is a great opportunity to experience and learn something about it. Furthermore, your participation will benefit the programme of research and improve knowledge in the field.

How will you store the information that I give you?
All information which you provide during the study will be stored in accordance with the 1998 Data Protection Act and kept strictly confidential. In order to ensure confidentiality, your name, phone number and email address will be filed separately from the experimental data. All electronic and hard copies will be identified with a numeric code and will not contain your name or any other identifying information. The list linking the numeric code with your name, phone number and email address will be stored on a password protected computer. All electronic data will be kept on a password-protected computer and the paper information will be stored in a locked filing cabinet. Only Dr Louis Renoult and Rachel Lambert will have access to this data. We adhere to the ethics committee's protocols on data storage

How will the data be used?
The information obtained from this study will be presented at scientific conferences, in scientific journals, and in Rachel Lambert's PhD thesis, but your name will never appear in any public document. Only group data will be presented.

What happens if I agree to take part, but change my mind later?
You have the right to withdraw at any time during the study, and your data will be immediately destroyed. However, due to the data being anonymised, withdrawal after leaving the lab will not be possible.

How do I know that this research is safe for me to take part in?
All research in the University is looked at by an independent group of people, called a Research Ethics Committee, to protect your safety, rights, wellbeing, and dignity. This research was approved by the Psychology Research Ethics Committee at the University of East Anglia on 18-01-2017

You are under no obligation to agree to take part in this research.

If you do agree you can **withdraw at any time without giving a reason.**

Researcher Contact details:

Dr Louis Renoult, l.renoult@uea.ac.uk, Phone 01603 59**1713**

Rachel Lambert, Rachel.j.lambert@uea.ac.uk

Do also contact us if you have any worries or concerns about this research.

School of Psychology Ethics Committee: ethics.psychology@uea.ac.uk; Phone 01603 597146

Head of School Professor Kenny Coventry: k.coventry@uea.ac.uk; Phone 01603 597145

Appendix K: Example Questionnaire for Chapter Three

EXAMPLE

Do you recognise this famous person?

- ◯ Yes
- ◯ No

How familiar are you with this famous person?

	You rarely see or hear about this famous person			You see or hear about this famous person daily
	0	1	2	3	4
Familiarity ()					

Do you have any emotional reaction or opinions relating to this famous person?

	No emotional response or opinions			Strong emotional response or opinions
	0	1	2	3	4
Emotional / Opinion Response ()					

What is the name of the person pictured?

____

_

What area(s) does the person pictured work within?

☐ Screen, Film & TV

☐ Music

☐ Sports

☐ Other. Please detail.

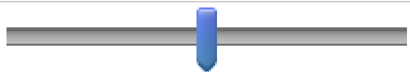
____

How old is the person pictured now?

- Please note - if you believe this famous person to be dead, please select 'not applicable' -

Not Applicable

18 25 32 39 47 54 61 68 75 82 89 97 100

AGE ()	

What nationality is the person pictured?

○ American

○ British

○ European

○ Other

Can you name something the person pictured is famous for? For example, a film, song or award. If yes, please detail below.

____

Is the person pictured dead or alive?

○ Dead

- Alive

What was the cause of the individual's death?

- ◯ Natural Causes (health conditions, old age etc.)
- ◯ Unnatural Causes (accident, murder, suicide etc.)

Do you know any additional information surrounding their death? if yes, please detail below.

____

____

____

____

____

When did the person pictured die?

	1961	2016
Year of Death ()		

Do you have a personal event memory related to the person pictured?

For example, a particular episode in which you watched, listened to, or heard about the famous person, or if seeing the person's face triggers some other specific memory.

e.g. recalling a time you sang along to their album in the car.

- ◯ Yes
- ◯ No

If you are happy to disclose this memory, please detail below.

_

_

_

Roughly when did you experience this memory?

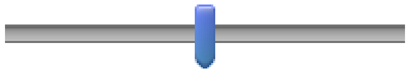
1935

2018

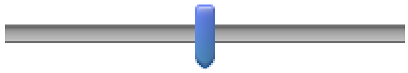
Year of Memory ()

How vivid is the memory?

Not at all vivid				Very vivid
0	1	2	3	4

Vividness ()	

What were you feeling at the time?

	Very Unhappy	Somewhat Unhappy	Indifferent	Somewhat Happy	Very Unhappy
	0	1	2	3	4
Emotion ()					

Appendix L: Email Sent to Participants to Complete Questionnaire in Chapter Three

Hello,

Thank you for meeting me, for and your time in completing the first two tasks in the Dead or Alive Study.

Please find below the link to the third and final task, an internet questionnaire, as we discussed in our session. Clicking on this link will direct you to the website 'Qualtrics' where you can work through the questions for each of the famous people.

The link will direct you to the survey introduction page, and you can click through to view the example questions and answers we viewed together in our session, it would be a good idea to re-read these responses to refresh your mind before beginning the task. You will then be asked for your participant ID which for you is: 420

The questionnaire will begin on the following page. You can navigate through the questionnaire using the next arrows at the bottom of the page. It should take around 1-1.5 hours to complete but is completely untimed and can be undertaken at your own pace.

https://ueapsych.eu.qualtrics.com/jfe/form/SV_1FcO30GEpq7gHkN?Q_DL=a9wHwDcGNxC8Z25_1FcO30GEpq7gHkN_MLRP_6XY9YA74LorSzqt&Q_CHL=gl

If the questionnaire crashes at any point, or you would like to stop, and come back to it at a later point, you can close the browser and click on the link again and it will open the survey where you last left off. The link will remain active for two weeks from your first activity.

If at any point the link stops working, you need longer to complete, would like to end your participation before completing the full questionnaire, or you have any other queries please don't hesitate to email me.

Thank you again for your participation, I can't give any information on individual results due to anonymization, but if you are interested in the research results in general, let me know, and I can send out a summary once the work is completed.

I hope you will take part in research at UEA again soon.

Best wishes,

Rachel

Appendix M: Debrief for Chapter Three

Debrief form

School of Psychology

Debrief Form

Dead or Alive: Does personal significance affect our judgements?

Student-researcher, principal investigator: Rachel Lambert, PhD Candidate, School of Psychology, University of East Anglia, Rachel.j.lambert@uea.ac.uk

Supervisor: Dr Louis Renoult, PhD; School of Psychology, University of East Anglia; 01603 591713**,** l.renoult@uea.ac.uk

Thank you for participating in this study. Your time and efforts are greatly appreciated.

The purpose of this study is to better understand how memory is stored in older and young adults, particularly the interaction between semantic memory (our general factual knowledge of the world) and episodic memory (our ability to remember unique events).

For this reason, we were investigating autobiographically significant concepts, these are semantic concepts (items which are typically related to factual knowledge, in this case famous faces), which have become associated/linked with an autobiographical or personal event memory (such as remembering a specific conversation you had about Michael Jackson's music). This association has been shown to result in better recall memory for these concepts, compared to those with no associated event memory.

This demonstrates that the two memory systems are interacting with one another, so this study aimed to examine this interaction by testing the relationships between episodic recognition, semantic knowledge, and personal memories for famous faces, and particularly whether this changes with age.

It is hoped the current study will contribute to the understanding of the interaction between the two memory systems, and influence current theories surrounding memory loss. With additional research, it may be possible to develop rehabilitation techniques surrounding this concept, to improve semantic memory.

If you have any questions regarding this study please feel free to ask or contact the researcher or supervisor of this study now, or at a later date. If you wish to withdraw your data, please inform the researcher now. Due to the anonymised nature of the data, withdrawal after you leave the lab will not be possible.

General Sources of Support

1. Seeking help or information for emotional difficulties or memory concerns

The first step in accessing help is to discuss the problem with your GP. They will be able to advise you on access to local resources and refer you on if appropriate.

2. Useful web sites

The Alzheimer's Society (www.alzheimers.org.uk) provides information on dementia and a directory of help available locally. The website offers an online forum

The Wellbeing Service (www.wellbeingnands.co.uk/) provide a range of support for people with common mental health and emotional issues, such as low mood, depression or stress. They offer local workshops, self-help workbooks and the opportunity to refer yourself for sessions with local therapists.

Mind website (http://www.mind.org.uk/) is supported by a leading mental health charity in England and Wales and also provides high-quality information and advice about mental health issues.

If you would like to receive a report of the main findings of the study (or a summary of the findings) when it is completed, please contact the researcher, however individual feedback on your results cannot be given.

Researcher Contact details:

Dr. Louis Renoult, l.renoult@uea.ac.uk, Phone 01603 59**1713**

Rachel Lambert, rachel.j.lambert@uea.ac.uk,

Do contact us if you have any worries or concerns about this research.

School of Psychology Ethics Committee: ethics.psychology@uea.ac.uk; Phone 01603 597146
Head of School Professor Kenny Coventry: k.coventry@uea.ac.uk; Phone 01603 597145

Thank you again for your participation!

Appendix N: World Events Stimuli List for Chapter Four

Event Stimuli List for the Older Adults

1. Daily Mail Publishes Loch Ness Monster Image
2. Driving Test Becomes Compulsory
3. Edward Viii Announces Abdication
4. Coronation of King George VII
5. Hitler Breaks Treaty of Versailles
6. Italy Invades Ethiopia
7. Adolf Hitler Declares Himself Fuhrer
8. German Troops Occupy France
9. Joseph Stalin Becomes Premier of The Soviet Union
10. Japanese Warplanes Attack Darwin, Australia
11. United Kingdom Declares War on Germany
12. River Thames Freezes
13. Old Trafford Stadium Damaged in Air Raid
14. Dunkirk Evacuation
15. D-Day Normandy Landings
16. General Charles De Gaulle Walks the Champs Elysees
17. India Gains Independence from Great Britain
18. Television License Introduced
19. End of War Victory Parade in London
20. Wedding of Princess Elizabeth
21. Free Milk Provided in UK State Schools
22. Mahatma Gandhi Assassinated
23. NATO Treaty Signed in Washington
24. South Africa Begins Implementing Apartheid
25. Princess Elizabeth Gives Birth to A Son
26. George Vi Dies
27. Funeral of King George Vi
28. Queen's First Christmas Message
29. Us Explodes Castle Bravo
30. Rosa Parks Is Arrested
31. Ussr Launches Sputnik 2 With A Dog
32. Coronation of Queen Elizabeth II
33. Princess Margaret Announces She Won’t Marry Group Captain Townsend
34. Nuclear Reactor at Windscale Catches Fire
35. First Televised Royal Christmas Message
36. First Radio Broadcast from Space
37. First Person to Orbit Earth
38. Cuban Missile Crisis
39. Miners Killed in Six Bells Colliery Explosion
40. Princess Margaret Marries Antony Armstrong-Jones
41. Notting Hill Race Riots
42. Fire Breaks Out on Southend Pier

43. Martin Luther King Jr. Delivers "I Have A Dream Speech"
44. First Person to Walk in Space
45. Violence Between Mods and Rockers at Clacton Beach
46. Aberdeen Schools Closed for Typhoid
47. Meteorite Shower Falls in Leicestershire
48. London Zoo Golden Eagle Recaptured After Thirteen Days
49. State Funeral of Winston Churchill
50. First Moon Landing
51. Us Senator Robert F. Kennedy Shot
52. Martin Luther King Jr. Assassinated
53. Bobby Moore Arrested in Bogota
54. Prime Minister Harold Wilson Is Hit in The Face by Egg
55. Blue Peter Buried A Time Capsule
56. First Decimal Coins Issued in Britain
57. People Killed in Moorgate Tube Crash.
58. John Curry Wins Britain's First Gold Medal in Skating
59. The Princess Royal Marries Captain Mark Phillips
60. Sex Pistols Swear Live on Tv
61. Richard Nixon Resigns as Us President
62. Two Boeing 747s Collide at Tenerife Airport
63. First Extra-terrestrial Message Sent from Earth into Space
64. John Lennon Shot
65. Argentine Troops Seize the Falkland Islands
66. Ronald Reagan Inaugurated
67. U.S. Army Sergeant Walks English Channel in Water Shoes
68. The Marlborough Diamond Is Stolen
69. Siege at Iranian Embassy in London
70. Brixton Riots
71. Pesticide Plant Leaks Toxic Compounds in Bhopal India
72. Heysel Stadium Disaster at The European Cup Final
73. Chernobyl Nuclear Power Station Reactor Explodes
74. Libyan Embassy Siege
75. Gas Explosion at A Block of Flats in Putney
76. Rioting Erupts Overnight in Prisons Across Britain
77. Band Aid Formed in Notting Hill
78. Piper Alpha Oil Rig in The North Sea Explodes
79. Chinese Soldiers Are Blocked by Citizens in Tiananmen Square
80. British Hostages in Iraq Are Paraded on Tv
81. The Queen Describes This Year as An Annus Horribilis
82. Pleasure Cruiser and Barge Collide in River Thames
83. Edwina Currie States Britain's Egg Production Is Salmonella Infected
84. Three Gay Rights Activists Invade the BBC Studios During the News
85. Irish Republican Army Declares A Ceasefire
86. Tutsi's Slaughtered by Hutu In the Kibuye Stadium
87. Nelson Mandela Becomes South Africa's 1st Black President
88. Princess of Wales Killed in A Car Crash

89. First UK National Lottery Draw
90. Labour Announces Tobacco Sponsorship Ban
91. The Queen Makes Broadcast in Tribute to Diana
92. Two Hijacked Planes Crash into The World Trade Towers
93. Monica Lewinsky Scandal
94. Inconclusive Election Between George W. Bush and Al Gore
95. Jill Dando Shot on Her Doorstep
96. Holly Wells and Jessica Chapman Go Missing
97. Steve Redgrave Wins His Fifth Olympic Gold Medal
98. Total Solar Eclipse in Cornwall
99. Space Shuttle Columbia Disintegrates During Re-entry to Earth
100. Concorde Makes Its Final Commercial Flights
101. Hurricane Katrina Forms Over the Bahamas
102. A Party of Chinese Cockle Pickers Drowned by Tides
103. Fathers4Justice Member Dressed as Batman Breaches Buckingham Palace
104. Madeleine McCann Reported Missing
105. Richard Hammond Crashes Whilst Filming for Top Gear
106. Osama Bin Laden Killed by Us Special Forces
107. Beijing Olympics
108. Barack Obama Inauguration
109. Prince William And Catherine Middleton Married
110. Cloud of Volcanic Ash Caused the Closure of UK Airspace
111. UK Holds Olympics
112. Russell Brand Pranks Andrew Sachs
113. Malaysia Airlines Flight 370 Disappears
114. Donald Trump Is Elected President of The United States
115. Gay Nightclub Shooting in Orlando
116. Serious Collision on The Smiler Ride at Alton Towers
117. Eu Referendum Held
118. Fire Engulfs Grenfell Tower
119. Wedding of Prince Harry And Meghan Markle
120. Summit Between Kim Jong-Un And President Donald Trump
121. Finsbury Park Mosque Attack
122. Earthquake in Japan, Triggers A Tsunami
123. A Fire in The Roof of York Minster
124. Mass Stabbing in Russell Square
125. Alexander Litvinenko Poisoned
126. Zola Budd Collides with Mary Decker In The 3000 Meters Olympic Final
127. Benazir Bhutto Named 1st Female Prime Minister of a Muslim Country
128. Gold Bars Are Taken from The Brink's-Mat Vault
129. British Astronaut Tim Peake Boards International Space Station
130. Duchess of Cambridge Gives Birth to A Boy
131. Duchess of Cambridge Gives Birth to A Daughter
132. Mining Accident in Chile
133. Haiti Earthquake
134. Emmanuel Macron Wins France's Presidential Election

135. Argentine Soldiers Fly White Flags in Falkland
136. Saddam Hussein Is Captured
137. Former Russian Double Agent and Daughter Are Poisoned
138. Helicopter Crashes at A Nature Reserve in Cley Next the Sea
139. Germans Begin Demolishing the Berlin Wall
140. 6.5 Million People Hold Hands Across America
141. George W. Bush Declares War on Terror
142. Lee Rigby Is Killed
143. Martin Luther King Jr Killer Is Arrested Leaving Heathrow Airport
144. Leicester City's Owner Killed in Helicopter
145. 5 Day London Riots Began
146. Ira Bomb Kills Lord Mountbatten And Family
147. London Landmarks Lit in The Colours of The French National Flag
148. Manchester Arena Attack
149. Margaret Thatcher Visits Ronald Reagan
150. Birth of Princess Anne
151. Nelson Mandela Released After 27 Years Imprisonment
152. Nigel Mansell Gains The 26th Grand Prix Win of His Racing Career
153. Twin Terror Attacks in Norway
154. Operation Desert Storm Begins
155. Pan Am Flight 103 Explodes Over the Town of Lockerbie
156. Paris Agreement on Climate Change Signed
157. First Ever Inter-Korea Summit
158. Princess Elizabeth Gives Birth to A Daughter
159. Sex Pistols Swear Live on Tv
160. Robert Mugabe's Resignation
161. Ryanair Flight 296 Catches Fire
162. Hit-And-Run Terrorist Attack on London Bridge
163. Sid Vicious Found Dead
164. Refuse Lorry Crashes into People in George Square
165. Gatwick Airport Experience Flight Disruption Due to Drones
166. Abba Win Eurovision Song Contest
167. Leave.EU Is Fined for Breaching Electoral Law
168. The Euro Currency Is Launched
169. Coordinated Terrorist Attacks in Paris
170. Princess of Wales Gives Birth to Her Second Son
171. UK Wins Eurovision With Brotherhood of Man
172. Irish Setter Dies from Poisoning at Crufts
173. Tiananmen Square Massacre
174. Torvill And Dean Win A Gold Medal for Ice Skating
175. Jeremy Clarkson Suspended from Top Gear
176. Ronald Reagan Visits UK
177. President Donald Trump Visits UK
178. Julian Assange Is Granted Political Asylum by Ecuador
179. Wrecking Cranes Tear Down the Brandenburg Gate
180. Woolworths Announces UK Stores Closure

Event Stimuli List for the Young Adults

1. Gold Bars Are Taken from The Brink-Mat Vault
2. Torvill And Dean Win A Gold Medal for Ice Skating
3. Siege Outside the Libyan Embassy in London
4. A Fire in The Roof of York Minster
5. Zola Budd Collides with Mary Decker In The 3000 Meter Olympic Final
6. Princess of Wales Gives Birth to Her Second Son.
7. Band Aid Formed in Notting Hill
8. Pesticide Plant Leaks Toxic Compounds in Bhopal India
9. Gas Explosion at A Block of Flats in Putney
10. Heysel Stadium Disaster at The European Cup Final
11. 8.1 Earthquake in Mexico City
12. The Prince and Princess of Wales Visit Ronald Reagan
13. Ferdinand Marcos Wins Rigged Presidential Election
14. Chernobyl Nuclear Power Station Reactor Explodes
15. Rioting Erupts Overnight in Prisons Across Britain.
16. 6.5 Million People Hold Hands Across America
17. Black Monday Wall Street Crash
18. U.S. President Ronald Reagan Visits The UK
19. Nelson Mandela Concert at Wembley Stadium
20. Three Gay Rights Activists Invade the BBC Studios During the News
21. Piper Alpha Oil Rig in The North Sea Explodes
22. Benazir Bhutto Named 1st Female Prime Minister of a Muslim Country
23. Edwina Currie States Britain's Egg Production Is Salmonella Infected
24. Pan Am Flight 103 Explodes Over the Town of Lockerbie
25. Chinese Soldiers Are Blocked by Citizens in Tiananmen Square
26. Princess of Wales Opens the Landmark Aids Centre
27. Pleasure Cruiser and Barge Collide in River Thames
28. Princess Royal and Captain Mark Phillips Separate
29. Nelson Mandela Released After 27 Year Imprisonment
30. British Hostages in Iraq Are Paraded on Tv
31. Nigel Mansell Gains The 26th Grand Prix Win of His Racing Career
32. Intimate Photographs of The Duchess of York Are Published
33. The Church of England Approves Female Priests
34. The Queen Describes This Year as An Annus Horribilis
35. Murder Of 2-Year-Old James Bulger
36. Nelson Mandela Awarded the Nobel Peace Prize
37. Torvill And Dean Win British Ice-Dancing Championship
38. Rwandan Genocide Begins
39. Tutsis Slaughtered by Hutu In the Kibuye Stadium
40. Nelson Mandela Becomes South Africa's 1st Black President
41. Irish Republican Army Declares A Ceasefire
42. First UK National Lottery Draw
43. Fred West Hanged in His Prison Cell
44. Chris Evans Resigns from BBC Radio 1

45. Oklahoma City Bombing
46. Frank Bruno Wins World Heavyweight Championship.
47. Labour Announces Tobacco Sponsorship Ban
48. Princess of Wales Killed in A Car Crash in Paris
49. The Queen Makes Broadcast in Tribute to Diana
50. Princes of Wales Funeral
51. Hong Kong Begins Slaughtering Chickens to Prevent Bird Flu
52. Good Friday Agreement for Northern Ireland Is Signed
53. Monica Lewinsky Scandal
54. The Euro Currency Is Launched
55. Glenn Hoddle Suggests Disabled People Are Paying for Sins
56. Columbine High School Massacre
57. Jill Dando Shot on Her Doorstep
58. Solar Eclipse
59. Norfolk Farmer Tony Martin Charged with Murder of Burglar
60. First Ever Inter-Korea Summit
61. Queen Mother Celebrates Her Hundredth Birthday
62. Steve Redgrave Wins His Fifth Olympic Gold Medal
63. Inconclusive Election Between George W. Bush and Al Gore
64. Foot and Mouth Crisis Begins
65. Two Hijacked Planes Crash into The World Trade Towers
66. George W. Bush Declares War on Terror
67. Ryanair Flight 296 Catches Fire
68. Holly Wells and Jessica Chapman Go Missing
69. Space Shuttle Columbia Disintegrates During Re-entry to Earth
70. Million People Around the World Protest Against Iraq War
71. UK Join in The Invasion of Iraq
72. Concorde Makes Its Final Commercial Flights
73. Saddam Hussein Is Captured
74. A Party of Chinese Cockle Pickers Drowned by Tides
75. Fathers4Justice Member Dressed as Batman Breaches Buckingham Palace
76. Prince Harry Wears Nazi Military Uniform
77. Four Bombs Exploded on London Transport
78. Hurricane Katrina Forms Over the Bahamas
79. Angela Merkel Becomes First Female Chancellor
80. Whale Discovered Swimming in River Thames
81. Richard Hammond Crashes Whilst Filming for Top Gear
82. Alexander Litvinenko Poisoned
83. Madeleine McCann Reported Missing
84. Tony Blair Stepped Down as Prime Minister
85. Smoking Ban in All Enclosed Public Places in England
86. Inquest into The Death of Diana Concluded Accidental Death
87. Karen Matthews Arrested for Faking Daughters Kidnapping
88. Beijing Olympics
89. Russell Brand Pranks Andrew Sachs
90. Woolworths Announced UK Stores Closure

91. Barack Obama Inauguration
92. Haiti Earthquake
93. Tony Blair Appeared at The Iraq Inquiry
94. Cloud of Volcanic Ash Caused the Closure of UK Airspace
95. Mining Accident in Chile
96. Earthquake in Japan Triggers A Tsunami
97. Prince William And Catherine Middleton Married
98. Osama Bin Laden Killed by Us Special Forces
99. 5 Day London Riots Began
100. Diamond Jubilee of Elizabeth II
101. UK Holds Olympics
102. Julian Assange Is Granted Political Asylum by Ecuador
103. Malaysia Airlines Flight 370 Disappears
104. Jeremy Clarkson Suspended from Top Gear
105. Serious Collision on The Smiler Ride at Alton Towers
106. Coordinated Terrorist Attacks in Paris
107. Gay Nightclub Shooting in Orlando
108. Eu Referendum Held
109. Mass Stabbing in Russell Square
110. Donald Trump Is Elected President of The United States
111. Emmanuel Macron Wins France's Presidential Election
112. Manchester Arena Attack
113. Fire Engulfs Grenfell Tower
114. Leave.EU Is Fined for Breaching Electoral Law
115. Wedding of Prince Harry And Meghan Markle
116. Summit Between Kim Jong-Un And President Donald Trump
117. President Donald Trump Visits UK
118. Leicester City's Owner Killed in Helicopter
119. Gatwick Airport Experience Flight Disruption Due to Drones
120. Robert Mugabe's Resignation
121. Paris Agreement on Climate Change Signed
122. Operation Desert Storm Begins
123. Germans Begin Demolishing the Berlin Wall
124. Tiananmen Square Massacre
125. Twin Terror Attacks in Norway
126. Wrecking Cranes Tear Down the Brandenburg Gate
127. Russia Formally Annexes Crimea
128. Hurricane Irma
129. Reunification of East and West Germany
130. Malaysia Airlines Flight 17 Is Shot Down Over Eastern Ukraine
131. Jimmy Carter Five-Day Visit with Fidel Castro
132. Los Angeles Police Officers Severely Beat Rodney King
133. Microsoft Chairman Bill Gates Steps Aside
134. Deepwater Horizon Drilling Rig Explodes
135. Egyptian Revolution
136. U.S. Invasion of Afghanistan

137. Earthquake Strikes Java, Indonesia
138. Kim Jong-Un Appointed Supreme Leader of North Korea
139. China Ends Their One-Child Policy
140. Apple CEO Steve Jobs Announces The iPhone
141. Fidel Castro Resigns from The Communist Party
142. Edward Heath And Hostages Leave Baghdad
143. President George W. Bush Makes A State Visit to London
144. "Medicare" Free Healthcare Launched
145. Pablo Escobar Surrenders to Police
146. Nevado Del Ruiz Volcano Erupts
147. Terry Nichols Found Guilty of Murder for Oklahoma City Bombing.
148. Eruption of The Mount Pinatubo Volcano
149. Pro-Democracy Protests in Nepal
150. Lee Rigby Is Killed
151. Refuse Lorry Crashes in Glasgow's George Square
152. British Astronaut Tim Peake Boards Space Station
153. Duchess of Cambridge Gives Birth to A Boy
154. London Landmarks Lit in The Colours of The French National Flag
155. Hit-And-Run Terrorist Attack on London Bridge
156. Finsbury Park Mosque Attack
157. Former Russian Double Agent and Daughter Are Poisoned
158. Helicopter Crashes at A Nature Reserve in Cley Next the Sea
159. Irish Setter Dies at Crufts From Poisoning
160. Duchess of Cambridge Gives Birth to A Daughter
161. Terrorist Driver Kills Four on Westminster Bridge
162. Andy Murray Wins the Men's Singles at Wimbledon
163. Rolf Harris Is Sentenced to Prison
164. Miners' Strike Begins
165. Tommy Cooper Collapses and Dies on Stage
166. Ding-Dong! The Witch Is Dead Charts at Number 10
167. Scotland Votes No to Independence
168. First Polymer Banknote Enters Circulation
169. The Oxford Circus Fire Traps Passengers on London Underground
170. Ceramic Poppies Laid at The Tower of London
171. The United Kingdom Invokes Article 50
172. Pedestrians Hit by Car Outside Houses of Parliament
173. Red Rain Falls in the UK
174. Sir Alex Ferguson Announces His Retirement
175. Omagh Bombing in Northern Ireland
176. University Boat Race Interrupted by Swimmer
177. Blast and Fire at Parsons Green Station
178. Duchess of Cambridge Gives Birth to Third Child
179. General Election Results in Hung Parliament
180. Russell Brand Pranks Andrew Sachs

Appendix O: Example Events Questionnaire for Chapter Four

Example Events - OA

Start of Block: Default Question Block

Q1 Alexander Litvinenko poisoned

Q2 What is your prior knowledge of this event?

◯ **Remember** - I can recollect a particular image from the TV, radio or newspaper coverage of this event or I remember a personal experience such as my thoughts and emotions, or the specific moment in which I found out about the event. (1)

◯ **Know** - This event is familiar to me or I know some factual information about this event, but I cannot recall any news coverage of this event nor do I have an associated personal experience. (2)

◯ **Don't know** - This event is completely unfamiliar to me. (3)

Skip To: End of Block If What is your prior knowledge of this event? = Don't know - This event is completely <u>unfamiliar</u> to me.

Q3 Alexander Litvinenko poisoned

Q4 How did you learn about this event?

- ◯ First-hand experience - personally witnessed the event (1)
- ◯ Saw the media coverage - on the day/around the time of the event. e.g. Newspaper, TV or radio (2)
- ◯ Second-hand experience - told about the event by another person such as a friend or relative. (3)
- ◯ Later or historical media coverage (4)
- ◯ Other - please state (5) ____________________

Q5 How familiar are you with this event?

	I don't know much about this event			I followed the coverage of this event closely	
	0	1	2	3	4
Familiarity ()					

Q6 What are your emotions or opinions towards this event?

	I feel very negatively about this event	I feel somewhat negatively about this event	I feel indifferent about this event	I feel somewhat positively about this event	I feel very positively about this event
	-2	-1	0	1	2
Associated emotions ()					

Q20 Alexander Litvinenko poisoned

Q7 Briefly describe this event

____

Q8
Can you name any persons of interest within this event?
If yes, please detail below.

Q10 In which country did the event occur?

Q11 In which time period did the event occur?

- ○ 1933 - 1937 (1)
- ○ 1938 - 1942 (2)
- ○ 1943 - 1947 (3)
- ○ 1948 - 1952 (4)
- ○ 1953 - 1957 (5)
- ○ 1958 - 1962 (6)
- ○ 1963 - 1967 (7)
- ○ 1968 - 1972 (8)
- ○ 1973 - 1977 (9)
- ○ 1978 - 1982 (10)
- ○ 1983 - 1987 (11)
- ○ 1988 - 1992 (12)
- ○ 1993 - 1997 (13)
- ○ 1998 - 2002 (14)
- ○ 2003 - 2007 (15)
- ○ 2008 - 2012 (16)
- ○ 2013 - 2018 (17)

Q13 Do you know the specific date of this event? DD / MM / YYYY

____

_

Q14 **Do you have a personal memory related to this event?**
For example, a particular episode in which you watched, listened to or heard about this event, or if reading it triggers another specific memory.

- ◯ Yes (1)
- ◯ No (2)

Skip To: End of Block If Do you have a personal memory related to this event? For example, a particular episode in which y... = No

Q18 Alexander Litvinenko poisoned

Q15 If you are happy to disclose this memory, please detail below.

____

____

____

____

____

Q17 How vivid/clear is this memory?

	Not at all vivid/clear				Very vivid/clear
	0	1	2	3	4
Vividness ()					

Q19 What were you feeling at the time of this memory?

	I felt very negative	I felt somewhat negative	I felt indifferent	I felt somewhat positive	I felt very positive
	-2	-1	0	1	2
Memory Emotion ()					

Q16
When did you experience this memory?

- ○ At the time of the event (1)
- ○ Within a week of the event (2)
- ○ Within a year of the event (3)
- ○ More recently - Indicate year of memory if known (4) ____

Q21
Where did you experience this memory?
Please disclose as many details as you can.

____

____

____

____

____

End of Block: Default Question Block

Appendix P: SONA Advertisement for Chapter Four

8 credits

The aim of this investigation is to examine how factual information is stored and whether the personal significance of this information can affect your judgements. This is a behavioural study involving three computer-based tasks. In each of these tasks, you will be asked to make judgements on a series of public events presented, these may be factual or personal in nature. The study will last no longer than 2 hours.

Anyone may sign up to take part in this study, however we will only be using data from individuals that are aged 18-30. The data from other participants will be discarded.

Appendix Q: Paid Participant Panel Email for Chapter Four

Study Title:	**Autobiographical significance within world events**
Who can take part:	Participants need to: • Be 65 years or older • Have normal or corrected-to-normal vision • Be an English native speaker (or have learnt English very early)
Location:	Lawrence Stenhouse Building, UEA
Compensation/reward for participating:	£24
Approximate time required:	3 Hours
What participants will do:	Participants will complete two computer-based tasks with myself at UEA, testing factual judgements on a series of world events. These two tasks should take approximately 40 minutes. Participants will then be asked to complete a large internet questionnaire, which can be completed in the comfort of their own home, which tests factual knowledge and memory for the previously presented events. This part is self-paced but typically takes approximately 2 hours to complete.
How to take part:	Please email the researcher, Rachel Lambert (Rachel.J.Lambert@uea.ac.uk) for further information.
Additional details:	

Appendix R: Information Sheet for Chapter Four

School of Psychology

University of East Anglia

‘Autobiographical significance within world events’

<u>Participant Information Sheet</u>

Thank you for your interest in this study. Before you decide whether to take part, please read the following information carefully (this sheet is for you to keep). You may ask me any questions if you would like more information.

What is this research looking at?
The aim of this investigation is to examine how factual information is stored in the brain, and whether the personal significance of this information can affect your judgements. Age-related differences within this process are also being examined.

Do I have to take part?
It is up to you to decide to join the study. We will describe the study and go through this information sheet. If you agree to take part, we will then ask you to sign a consent form. You are free to withdraw at any time, without giving a reason. This would not affect you in any way.

What will happen if I agree to take part?
If you agree to take part, you will be asked to complete three tasks. In each of these tasks, you will be asked to make judgements on a series of world events, these may be factual or personal in nature. We will also ask you to fill out a questionnaire about yourself. The whole study will last no longer than 120 minutes.

Are there any problems with taking part?
You may experience fatigue. We will give you frequent breaks, and you can request as many as you wish. If you experience any irritation or inconvenience during the study, you can choose to stop at any time. You can also choose to skip any questions if you feel uncomfortable with providing an answer.

Will it help me if I take part?
You will not directly benefit from taking part in this study; however, your participation will benefit the programme of research and improve knowledge in the field.

How will you store the information that I give you?
All information which you provide during the study will be stored in accordance with the 2018 General Data Protection Regulation and kept strictly confidential. The chief investigator will be the custodian of the anonymous research data. Any identifiable data will be stored separately in a

password protected file and will be securely disposed of as soon as it is no longer necessary, and within 5 years. All anonymized results will be stored indefinitely in order to comply with open practice standards. If you have electronic data make sure participants know it will be on a password protected computer. Where are you going to store paper information – it should be stored in a locked storage area – preferably in an academic's filing cabinet in a locked office. Make it clear that data won't be linked to anyone's name. You could also let participants know that only you and the research team will have access to the data. You must adhere to the ethics committee's protocols on data storage.

How will the data be used?
The information obtained from this study will be presented at scientific conferences, in scientific journals, and in Rachel Lambert's PhD thesis, but your name will never appear in any public document. Only group data will be presented.

What happens if I agree to take part, but change my mind later?
You have the right to withdraw at any time during the study, and your data will be immediately destroyed. However, due to the data being anonymised, withdrawal after leaving the lab will not be possible.

How do I know that this research is safe for me to take part in?
All research in the University is looked at by an independent group of people, called a Research Ethics Committee, to protect your safety, rights, wellbeing, and dignity. This research was approved by the Psychology Research Ethics Committee at the University of East Anglia on 1st March 2018.

You are under no obligation to agree to take part in this research.

If you do agree you can **withdraw at any time without giving a reason.**

Researcher Contact details:

Dr Louis Renoult, l.renoult@uea.ac.uk , Phone 01603 591713
Rachel Lambert, Rachel.j.lambert@uea.ac.uk

Do also contact us if you have any worries or concerns about this research.

School of Psychology Ethics Committee:
ethics.psychology@uea.ac.uk; Phone 01603 597146
Head of School Professor Kenny Coventry:
k.coventry@uea.ac.uk; Phone 01603 597145

Appendix S: Debrief for Chapter Four

Debrief form

School of Psychology

Debrief Form

Autobiographical significance within world events

Student-researcher, principal investigator: Rachel Lambert, PhD Candidate, School of Psychology, University of East Anglia, Rachel.j.lambert@uea.ac.uk

Supervisor: Dr Louis Renoult, PhD; School of Psychology, University of East Anglia; 01603 591713**,** l.renoult@uea.ac.uk

Thank you for participating in this study. Your time and efforts are greatly appreciated.

The purpose of this study is to better understand how memory is stored in older and young adults, particularly the interaction between semantic memory (our general factual knowledge of the world) and episodic memory (our ability to remember unique events).

For this reason, we were investigating autobiographically significant concepts, these are semantic concepts (items which are typically related to factual knowledge, in this case public events), which have become associated/linked with an autobiographical or personal event memory (such as remembering a specific conversation you had about the event, or remembering where you were when you found out about the event). This association has been shown to result in better recall memory for these concepts, compared to those with no associated event memory.

This demonstrates that the two memory systems are interacting with one another, so this study aimed to examine this interaction by testing the relationships between episodic recognition, semantic knowledge, and personal memories for world events, and particularly whether this changes with age.

It is hoped the current study will contribute to the understanding of the interaction between the two memory systems, and influence current theories surrounding memory loss. With additional research, it may be possible to develop rehabilitation techniques surrounding this concept, to improve semantic memory.

If you have any questions regarding this study please feel free to ask or contact the researcher or supervisor of this study now, or at a later date. If you wish to withdraw your data, please inform the researcher now. Due to the anonymised nature of the data, withdrawal after you leave the lab will not be possible.

General Sources of Support

1. Seeking help or information for emotional difficulties or memory concerns

The first step in accessing help is to discuss the problem with your GP. They will be able to advise you on access to local resources and refer you on if appropriate.

2. Useful web sites

The Alzheimer's Society (www.alzheimers.org.uk) provides information on dementia and a directory of help available locally. The website offers an online forum

The Wellbeing Service (www.wellbeingnands.co.uk/) provide a range of support for people with common mental health and emotional issues, such as low mood, depression or stress. They offer local workshops, self-help workbooks and the opportunity to refer yourself for sessions with local therapists.

Mind website (http://www.mind.org.uk/) is supported by a leading mental health charity in England and Wales and also provides high-quality information and advice about mental health issues.

If you would like to receive a report of the main findings of the study (or a summary of the findings) when it is completed, please contact the researcher, however individual feedback on your results cannot be given.

Researcher Contact details:

Dr. Louis Renoult, l.renoult@uea.ac.uk, Phone 01603 59**1713**

Rachel Lambert, rachel.j.lambert@uea.ac.uk,

Do contact us if you have any worries or concerns about this research.

School of Psychology Ethics Committee: ethics.psychology@uea.ac.uk; Phone 01603 597146
Head of School Professor Kenny Coventry: k.coventry@uea.ac.uk; Phone 01603 597145

Thank you again for your participation!

Appendix T: Adjective Stimuli List for Chapter Five

1. Petty
2. Dominating
3. Frustrated
4. Unhappy
5. Crude
6. Tense
7. Bold
8. Daring
9. Religious
10. Artistic
11. Literary
12. Competent
13. Experienced
14. Curious
15. Unconfident
16. Unoriginal
17. Ungraceful
18. Dissatisfied
19. Forceful
20. Impulsive
21. Listless
22. Coarse
23. Comical
24. Realist
25. Cordial
26. Forgiving
27. Honourable
28. Considerate
29. Annoying
30. Distressed
31. Worrying
32. Dependent
33. Corrupt
34. Clumsy
35. Objective
36. Convincing
37. Proper
38. Popular
39. Optimistic
40. Amusing
41. Progressive
42. Indifferent
43. Preoccupied
44. Forgetful

45. Conforming
46. Feeble
47. Solemn
48. Painstaking
49. Obedient
50. Inquisitive
51. Agreeable
52. Courageous
53. Resourceful
54. Unselfish
55. Respectful
56. Greedy
57. Gloomy
58. Angry
59. Stubborn
60. Tough
61. Ordinary
62. Detached
63. Proud
64. Serious
65. Steady
66. Gracious
67. Composed
68. Sensible
69. Logical
70. Worrier
71. Agitated
72. Irreligious
73. Clownish
74. Immature
75. Restless
76. Excitable
77. Talkative
78. Untiring
79. Sociable
80. Prompt
81. Versatile
82. Unprejudiced
83. Joyful
84. Irritating
85. Careless
86. Depressed
87. Demanding
88. Wicked
89. Theatrical
90. Persistent

91. Excited
92. Definite
93. Informal
94. Charming
95. Eager
96. Humble
97. Ethical
98. Obstinate
99. Unemotional
100. Withdrawing
101. Outdated
102. Wordy
103. Obnoxious
104. Inoffensive
105. Thrifty
106. Affectionate
107. Vivacious
108. Inventive
109. Astute
110. Genial
111. Magnanimous
112. Shallow
113. Sloppy
114. Lonely
115. Disturbed
116. Eccentric
117. Average
118. Weary
119. Normal
120. Anxious
121. Refined
122. Able
123. Entertaining
124. Sympathetic
125. Polished
126. Melancholy
127. Sarcastic
128. Overcautious
129. Scornful
130. Daydreamer
131. Bashful
132. Prudent
133. Nonchalant
134. Wilful
135. Studious
136. Cultured

137. Appreciative
138. Eloquent
139. Sincere
140. Jealous
141. Dull
142. Selfish
143. Rude
144. Radical
145. Conventional
146. Conservative
147. Sceptical
148. Quick
149. Positive
150. Tidy
151. Sheltered
152. Generous
153. Neat
154. Unhealthy
155. Unstudied
156. Inhibited
157. Frivolous
158. Extravagant
159. Lonesome
160. Suave
161. Persuasive
162. Exuberant
163. Skilful
164. Attentive
165. Admirable
166. Earnest
167. Easy-going
168. Unpleasant
169. Weak
170. Useless
171. Guilty
172. Silent
173. Nasty
174. Blunt
175. Sentimental
176. Careful
177. Thorough
178. Modern
179. Poised
180. Creative
181. Constructive
182. Headstrong

183. Submissive
184. Immodest
185. Conformist
186. Fatigued
187. Changeable
188. Shrewd
189. Satirical
190. Candid
191. Amicable
192. Congenial
193. Cooperative
194. Courteous
195. Truthful
196. Boring
197. Cruel
198. Moody
199. Apprehensive
200. Resigned
201. Naive
202. Deliberate
203. Mathematical
204. Aggressive
205. Scientific
206. Upright
207. Frank
208. Animated
209. Accurate
210. Mediocre
211. Frugal
212. Timid
213. Meek
214. Opportunist
215. Immoral
216. Defiant
217. Meditative
218. Discreet
219. Proficient
220. Wholesome
221. Literate
222. Humorous
223. Thankful
224. Offensive
225. Volatile
226. Cynical
227. Unpopular
228. Stern

229. Strict
230. Cautious
231. Fearless
232. Fashionable
233. Precise
234. Practical
235. Adventurous
236. Respectable
237. Productive
238. Uncultured
239. Unromantic
240. Passive
241. Uneasy
242. Opinionated
243. Choosy
244. Methodical
245. Moralistic
246. Idealistic
247. Diligent
248. Punctual
249. Spirited
250. Tactful
251. Dependable
252. Arrogant
253. Vain
254. Rash
255. Withdrawn
256. Messy
257. Unlucky
258. Forward
259. Moderate
260. Disciplined
261. Consistent
262. Rational
263. Modest
264. Energetic
265. Capable
266. Unobservant
267. Indecisive
268. Unskilled
269. Undecided
270. Disorganised
271. Prideful
272. Egotistic
273. Systematic
274. Orderly

275. Vigorous
276. Purposeful
277. Witty
278. Likable
279. Trustworthy
280. Unfair
281. Foolish
282. Fearful
283. Nervous
284. Troubled
285. Cunning
286. Quiet
287. Sensitive
288. Direct
289. Casual
290. Decisive
291. Decent
292. Independent
293. Intellectual
294. Imitative
295. Gullible
296. Crafty
297. Dreary
298. Rebellious
299. Outspoken
300. Obscene
301. Aloof
302. Obliging
303. Enterprising
304. Observant
305. Perceptive
306. Trustful
307. Dignified
308. Cold
309. Lazy
310. Violent
311. Hostile
312. Critical
313. Emotional
314. Suspicious
315. Subtle
316. Noisy
317. Calm
318. Skilled
319. Realistic
320. Active

321. Ingenious
322. Compulsive
323. Impractical
324. Sinful
325. Discontented
326. Daredevil
327. Hesitant
328. Meticulous
329. Righteous
330. Outgoing
331. Venturesome
332. Tolerant
333. Imaginative
334. Benevolent
335. Carefree
336. Reckless

Appendix U: Information Sheet for Chapter Five

The Effect of Task Switching on Self-Knowledge

Participant Information Sheet

Thank you for your interest in this study. Before you decide whether to take part, please read the following information carefully (this sheet is for you to keep). You may ask me any questions if you would like more information.

What is this research looking at?

The aim of this investigation is to examine how trait knowledge is stored in the brain and determine whether referencing traits to yourself or your experiences will affect ability to switch between tasks.

Do I have to take part?

It is up to you to decide to join the study. We will describe the study and go through this information sheet. If you agree to take part, we will then ask you to sign a consent form. You are free to withdraw at any time, without giving a reason. This would not affect you in any way.

What will happen if I agree to take part?

If you agree to take part, you will be asked to complete five tasks. In each of these tasks you will be asked to make judgements on a series of trait adjectives (e.g. cheerful, jealous). One of these tasks will also ask you to complete a questionnaire which examines sleep quality, mood, and cognitive ability. The whole study will last no longer than 90 minutes for young adults or 120 minutes for older adults.

Are there any problems with taking part?

You may experience fatigue. We will give you frequent breaks, and you can request as many as you wish. Also as part of the study you will be asked to complete a questionnaire asking details about your mood over the past 2 weeks and your sleep quality over the last month, some of these questions are of a sensitive nature, you are free to skip any questions if you feel uncomfortable with providing an answer. You may also be asked for personal memories associated with personality trait words; however, you are free to not disclose if you feel uncomfortable doing so. If you experience any irritation or inconvenience during the study, you can choose to stop at any time.

Will it help me if I take part?

You will not directly benefit from taking part in this study; however, your participation will benefit the programme of research and improve knowledge in the field.

How will you store the information that I give you?

All information which you provide during the study will be stored in accordance with the 2018 General Data Protection Regulation and kept strictly confidential. The chief investigator, Rachel Lambert, will be the custodian of the anonymous research data. Any identifiable data will be stored separately in a password protected file and will be securely disposed of as soon as it is no longer necessary, and within 5 years. All anonymized results will be stored indefinitely in order to comply with open practice standards. All electronic data will be on a password protected computer and completed paper questionnaires will be stored in a filing cabinet within a locked office. All data is anonymised and not linked to your name, and only Rachel Ward and the research team will have access to the data.

How will the data be used?

The information obtained from this study will be presented at scientific conferences, in scientific journals, and in Rachel Ward's MSc thesis, but your name will never appear in any public document. Only group data will be presented

What happens if I agree to take part, but change my mind later?

You have the right to withdraw at any time during the study, and your data will be immediately destroyed. You will also be issued with a unique participant code at the study start for anonymisation purposes, if you wish to withdraw your data from the study after leaving the lab you can email the researcher with this code up to 48 hours after leaving, and all of your associated data will be immediately destroyed.

How do I know that this research is safe for me to take part in?

All research in the University is looked at by an independent group of people, called a Research Ethics Committee, to protect your safety, rights, wellbeing, and dignity. This research was approved by the Psychology Research Ethics Committee at the University of East Anglia on 09/08/2019.

You are under no obligation to agree to take part in this research. If you do agree you can withdraw at any time without giving a reason.

Contact details:

Dr Louis Renoult – Primary Supervisor - l.renoult@uea.ac.uk

Rachel Lambert – PhD Researcher - Rachel.j.lambert@uea.ac.uk

Rachel Ward – MSc Student – Rachel.ward@uea.ac.uk

Do also contact us if you have any worries or concerns about this research. **School of Psychology Ethics Committee**:

ethics.psychology@uea.ac.uk; Phone 01603 597146

Head of School Professor Kenny Coventry: k.coventry@uea.ac.uk; Phone 01603 597145

☐

I have read and understood the information sheet

☐

My participation is voluntary, and I know that I am free to withdraw at any time, without giving any reason and without it affect me at all

☐

I know that no personal information will be shared outside of the research team nor published in the final report from this research

☐

I agree to take part in the above study

Appendix V: Debrief for Chapter Five

Top of Form

The Effect of Task Switching on Self-Knowledge

Thank you for participating in this study. Your time and efforts are greatly appreciated.

The purpose of this study was to determine if consciously associating memories to stimuli ('Do you remember acting this word?') would improve your later recognition memory for them.

Previous research into Autobiographically significant concepts has shown that factual concepts such as famous names that have been associated with a personal memory, result in superior recognition memory for those names compared to famous names with no associated memory (Westmacott et al., 2003; 2004; Renoult et al., 2015).

This memory enhancement is implicit, as memories are not consciously associated with the stimuli at encoding (when the stimuli are being studied), as the memories are disclosed and linked to the stimuli after the recognition task has been completed.

The self-reference effect, associating stimuli with yourself ('Do you think this word applies to you?') has been consistently shown to boost later memory performance for the stimuli (Symons & Johnson, 1997), and therefore has been shown to be a useful memory training technique.

The current study will contribute to the greater understanding of autobiographically significant concepts, particularly whether the memory enhancement will still be present when participants are consciously aware of the association, and what relation this phenomenon has to the self-reference effect. It is hoped with additional research, it may be possible to develop rehabilitation techniques surrounding this concept, to improve semantic memory.

If you have any questions regarding this study please feel free to ask or contact the researcher or supervisor of this study now, or at a later date. *If you wish to withdraw your data, please inform the researcher by commenting in the box below*. Due to the anonymised nature of the data, withdrawal after you end the questionnaire will not be possible.

General Sources of Support

Seeking help or information for emotional difficulties or memory concerns

The first step in accessing help is to discuss the problem with your GP. They will be able to advise you on access to local resources and refer you on if appropriate.

Useful web sites

The Alzheimer's Society (www.alzheimers.org.uk) provides information on dementia and a directory of help available locally. The website offers an online forum

The Wellbeing Service (www.wellbeingnands.co.uk/) provide a range of support for people with common mental health and emotional issues, such as low mood, depression, or stress. They offer local workshops, self-help workbooks and the opportunity to refer yourself for sessions with local therapists.

Mind website (http://www.mind.org.uk/) is supported by a leading mental health charity in England and Wales and also provides high-quality information and advice about mental health issues.

If you would like to receive a report of the main findings of the study (or a summary of the findings) when it is completed, please write your email below, however individual feedback on your results cannot be given.

Researcher Contact details:

Principal investigator: Rachel Lambert, PhD Researcher Rachel.j.lambert@uea.ac.uk

Student-researcher Rachel Ward, MSc Student, Rachel.ward@uea.ac.uk

Post-doc Researcher - Dr Ann-Kathrin Johnen: a.johnen@uea.ac.uk

Supervisor: Dr Louis Renoult l.renoult@uea.ac.uk

Do contact us if you have any worries or concerns about this research.

School of Psychology Ethics Committee: ethics.psychology@uea.ac.uk; Phone 01603 597146

Head of School Professor Kenny Coventry: k.coventry@uea.ac.uk; Phone 01603 597145

Thank you again for your participation!

Bottom of Form

Please record below if you would like to *withdraw* your task performance results from this research project. If not, leave this blank.

If you would like to receive a summary of the findings of this research project, please record your email in the box below. If not, leave this box blank.

Thank you again for your time in completing this study.