



First words and first memories

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ABSTRACT

In two experiments autobiographical memories from childhood were recalled to cue words naming common objects, locations, activities and emotions. Participants recalled their earliest specific memory associated with each word and dated their age at the time of the remembered event. A striking and specific finding emerged: age of earliest memory was systematically later, by several months, than the age of acquisition of the word to which it was associated. This was the case for earlier and later acquired words, for all word types, and for younger as well as older adults. It is suggested that this systematic lag reflects the formation of conceptual knowledge that is abstracted from details represented in early episodic memories. It is not until such knowledge is formed that a word cue and the conceptual knowledge in long-term to which it corresponds, can be used to access specific episodic memories. The implications of this for understanding childhood amnesia and for theories of the development of autobiographical memory are considered.

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1. Introduction

It is well known that adults can remember relatively few events from below the age of about 7 years, even fewer from below the age of 5 years, and it is thought none from the pre-verbal period of about 24 months of age and younger (Hayne, 2004; Howe & Courage, 1997; Howe, Courage, & Rooksby, 2009; Pillemer & White, 1989; Waldfogel, 1948; Wang, 2001; Wetzler & Sweeney, 1986 – see Bauer (2007), for a recent review). There are several different explanations for this period of *childhood amnesia* and most postulate some form of deficit, e.g., that memory, language, concepts, executive function, working memory, even the brain itself, have to attain some level of development before memories can be encoded and/or encoded in a retrievable form e.g., Newcombe, Lloyd, & Ratliff, 2007; Nelson, 1992. Quite feasibly all these factors contribute in some way to impaired adult recall from the age of seven and below. However, what is now clear is that children below the age of seven have many memories of specific experiences

and this may be true even of the pre-verbal period, so an encoding deficit account is not a tenable explanation of childhood amnesia (Bauer, 2004; Hayne, 2004; Nelson & Fivush, 2004). Instead, the evidence shows that the problem lies not in forming memories but in representing them in long-term memory in a way that renders them retrievable; we term this the *retrievability hypothesis*. How this is achieved by the developing infant/child is not known, although here we focus on one of the important factors: the development of language and in particular the development of vocabulary. We postulate that it is not until the developing child can name aspects of experience that they can begin to encode their memories in a way that will make them retrievable later in life. If this retrievability hypothesis is correct there should be a systematic relationship between the age of acquisition (AoA) of words and the age of earliest memories, the age at encoding (AaE), associated with those words. These two measures, AoA of words and AaE of memories, form the main variables of the present studies.

AoA is a concept that has been shown to offer explanatory power for many key effects in lexical processing, for example, early-acquired words are easier to recognise (e.g., Bonin, Chalard, Meot, & Fayol, 2001; Morrison & Ellis,

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2000), quicker to name (e.g., Morrison, Hirsh, Chappell, & Ellis, 2002; Morrison, Hirsh, & Duggan, 2003), and have briefer gaze durations in sentence processing (Juhász & Rayner, 2003, 2006). The AoA measure is usually a subjective, rated measure of word learning age. Adult raters are asked to make a judgement about the age at which they learnt certain words, typically along the seven-point scale introduced by Gilhooly and Logie (1980). Despite the fact that subjective ratings are widely used in the lexical processing literature (familiarity, imageability and concreteness are just some of the many measures that rely on subjective estimates), the validity of AoA has raised particular concern. However, there are several indicators that subjective measures of AoA are valid. For example, two studies (Chalard, Bonin, Meot, Boyer, & Fayol, 2003; Morrison, Chappell, & Ellis, 1997) compared subjective, adult ratings with objective measures of AoA from the study of children's vocabulary development. Both concluded that objective AoA was the best predictor of subjective AoA. Several other studies have also compared children's vocabulary knowledge with AoA ratings and concluded that they provide a valid measure of word learning age (Carroll & White, 1973; De Moor, Ghyselinck, & Brysbaert, 2000; Gilhooly & Gilhooly, 1980; Jorm, 1991). These thorough efforts to prove the validity of AoA give us confidence in the measure.

Age at encoding has been widely used in the study of autobiographical memory. It has proved particularly useful in the study of memories across the lifespan and in identifying the lifespan retrieval curve (Conway, 1990; Conway & Pleydell-Pearce, 2000; Rubin, Wetzler, & Nebes, 1986 – see Conway & Williams (2008), for a recent review). The lifespan retrieval curve, in people aged about 35 years and older, has three main components: a recency component, the reminiscence bump, and the period of childhood amnesia. The recency portion of the curve shows good memory for recent experiences gradually decreasing as the retention interval lengthens, until that is the curve enters the period of the reminiscence bump. The reminiscence bump is marked by an increase in recall of autobiographical memories and other knowledge too. In its broadest terms the period of the reminiscence bump encompasses the two decades between the ages of 10–30 years. However, many studies find the bump to occur in the period of 15–25 years of age (Conway & Rubin, 1993; Rubin, Rahhal, & Poon, 1998). The bump, which is one of the most stable findings in the study of human memory (Conway & Rubin, 1993) is identified solely by the AaE of memories which are virtually always supplied by the participant. The period of childhood amnesia is marked by a fall in the accessibility of memories and below the age of about 5 years by an exponential decline in memory retrievability. This too is one of the most stable findings in the study of autobiographical memory and is identified by AaE of memories and the number of memories that can be recalled (see Hayne (2004), for a review).

Age at encoding is then one of the important variables in the study of autobiographical memory; however, although it produces reliable and stable data, AaE judgements are estimates rather than exact dates. Calendar time is rarely part of autobiographical memories which typically

are dated by inference and with reference to other memories or other known dates with which they are associated (Thompson, Skowronski, Larsen, & Betz, 1996). This is especially true of childhood memories because at the time of encoding few children would have knowledge of calendar dates and even fewer would be able to incorporate these into memories. Childhood memories are then dated with reference to other known dates such as a birthday, holiday, the birth of a sibling, or some other important family event (see Bauer (2007) for a review). Because of this estimates of AaE of childhood events are approximate and only rarely exact. Nonetheless, reliable patterns are found in AaE judgements, as outlined above, and accuracy is possible in terms of months and years rather than weeks, days, and smaller units of time (Bauer, 2007; Thompson et al., 1996). In the present research a high degree of accuracy of dating is not essential and that is because we are concerned with the *relation* between AaE of memories and AoA of words used to cue memory retrieval. Our expectation is that if there is a relation between language development, vocabulary acquisition, and memory then there should be a systematic relation between AaE of earliest memories and AoA of word cues.

According to our retrievability hypothesis there should then be a reliable relation between AoA of words and AaE of earliest memories that can be elicited to those words. Consider, for example, an early-acquired word such as *ball*. Retrievability posits that many memories that feature the item *ball* can and most likely will be formed during the period of childhood amnesia. However, memories that can be accessed by the word *ball* must contain some representation of that word and/or the concept that the word activates. Memories that contain this knowledge will be accessible by *ball* in adulthood. Thus, the earliest memory retrievable by an adult to a word such as *ball* should in terms of AaE be close in time to the AoA of that word. It follows that in general the AoA of a word should be close to the AaE of the earliest memory retrievable to that word. It is this aspect of the retrievability hypothesis that we test here.

2. Experiment 1

In the experiments reported here we use the cue word method to investigate the association between AoA of words and the earliest memories (AaE) that can be retrieved to the words. Note that the word cues are taken from AoA norms and therefore their AoA is known. Participants are presented with words individually and required to recall the earliest memory they can that is associated with what is named by the word. They are instructed that the memory must be of a specific event that lasted minutes or hours and cannot be of more general knowledge of one's life (see Conway & Pleydell-Pearce, 2000).

2.1. Method

2.1.1. Participants

The participants were fifty undergraduate students at the University of Leeds, who took part in partial fulfilment

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