Unravelling the Nature of Early (Autobiographical) Memory

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Abstract

In this article, I provide an overview of the problems associated with understanding the nature of early autobiographical memory and discuss issues concerning the forgetting of these memories (infantile/childhood amnesia). Specifically, I provide a brief exegesis as to whether such memories are stored in a fragile manner to begin with, become difficult to retrieve over time, or both. In order to answer this and other related questions, I review the contribution of the articles in this special issue to understanding the enigma that is infantile/childhood amnesia. I then outline some of the issues that remain and suggest a functional approach to understanding why the forgetting of early experiences may be more adaptive than remembering them. I conclude by suggesting that infantile amnesia may actually begin during infancy itself.

Keywords: Infantile amnesia, childhood amnesia, autobiographical memory, early memory development, forgetting

Unravelling the Nature of Early (Autobiographical) Memory

For at least three centuries (Henri & Henri, 1895; Miles, 1895), and probably much longer, students of memory have puzzled over the enigma of early childhood memory. More specifically, although it is clear that young children can exhibit various rudimentary forms of memory very early in life (see Bauer, 2015; Howe, 2011), researchers have wondered when memory for events themselves becomes part of a child's recollective armamentum. Of course, children can remember events but with the advent of the cognitive self at around 18 to 24 months of age, they now begin to remember these events as experiences that happened to "me" – in other words, these memories are now autobiographical (e.g., Howe & Courage, 1993, 1997).

The importance of the self in autobiographical memory is not limited to its genesis and early development, but is also key throughout the lifespan of an individual (e.g., Bluck & Alea, 2008; Conway, 2005; Prebble, Addis, & Tippett, 2013). In fact, the mnemonic benefits of self-referencing and self-generation (e.g., Cunningham, Brebner, Quinn, & Turk, 2014; Mulligan & Lozito, 2004) have been well established in both the child and adult memory literatures for some time. Indeed, for some (Humphreys & Sui, 2016; Sui & Humphreys, 2015), the self is the very "glue" that binds encoded elements together to create a strong and durable trace for personal (autobiographical) experiences.

Importantly, the advent of the cognitive self creates a necessary although not sufficient condition for the creation and retention of autobiographical memories. Indeed, not only are scientists concerned about the emergence of autobiographical memory, but also what happens to those memories over time. Although some have dated earliest

memories back to around the age of two years, the same time as the emergence of the cognitive self, most of our early memories become irretrievable later in childhood or by early adulthood (see various articles in this special issue for examples). In fact, some prefer to think of two periods of forgetting childhood events: a particularly dense amnesia for memories up to the age of approximately two years (infantile amnesia) and another period of not-so-dense amnesia lasting up to about five to seven years of age (childhood amnesia) (e.g., see Jack & Hayne, 2010; Newcombe, Lloyd, & Ratliff, 2007).

A key question concerns whether these amnesias are brought about by failures in retrieval, failures in storage, or failures in both storage and retrieval. Concerning retrieval, the basic argument goes like this: memories that are formed early in life are constrained by the context in which they are encoded and although vestiges of these memories remain in storage, they are difficult to retrieve unless one can reinstate the original (infant) context in which they were stored (basically, an encoding specificity argument). Thus, although these memories remain retrievable as long as the context can be reinstated, as the child is developing rapidly, this context changes and the memories are no longer accessible (for reviews, see Bauer, 2015; Howe, 2011). Concerning storage, the argument is that memories that are formed early in life are fragile and hence, tend to be forgotten rapidly. The amnesia problem emerges because memories that were formed early in life dissipate rapidly, perhaps being replaced by newer memories. That is, early memories are no longer in storage and thus, are not available for retrieval (e.g., Alberini & Travaglia, 2017).

Of course, there are a number of other weighty matters concerning how or even if we remember early experiences. These include whether children and adults have rehearsed and elaborated these experiences through conversations with others, something that raises additional questions concerning whether what is being remember later on are the

memories themselves or the discussions that ensued about those memories for early experiences. Another critical question is exactly when does infantile and childhood amnesia begin? Does it suddenly appear abruptly in late adolescence or early adulthood, or is it a more continuous process that emerges in childhood and continues to develop into adulthood? Finally, there are a number of individual and group differences questions including whether variation in the ability to remember early experiences across cultures, as a function of education, gender, or language skills contribute to one's ability to remember early experiences. The articles in this special issue all address various aspects of these problems in early memory and in what follows, I provide a brief synopsis of these papers. I then turn to a discussion of what we have learned from these (and other recent studies) and suggest a number of questions that require further research in order to help resolve the enigma that is infantile/childhood amnesia.

ADULTS' RECALL AND DATING OF EARLY MEMORIES

Some of the articles in this special issue focus on the question of how accurately adults date their early (or first) memories. For example, Wang et al. (this issue) found in two experiments that North American college students' earliest memories could be dated as far back as 2.5 years of age (consistent with the time the cognitive self emerges). Of course, this age was calculated in part by removing what are known as telescoping errors, errors that arise when dating early memories. Specifically, earlier memories tend to be postdated because they are thought to have happened more recently than they actually have.

Ece, Demiray, and Gülgöz (this issue) conducted an online survey where participants reported their earliest memories twice with an intervening two-year interval. Interestingly, they found a remarkable consistency in content, dating, and qualities of earliest memories

being reported across this two-year interval. However, such consistency was not observed uniformly across all memories. Indeed, this consistency was seen primarily for the earliest of childhood memories (those dated before 48 months of age). Perhaps the extent to which early memories exhibit such consistency depends on how the data from adult recollection is analysed.

Using a similar line of thought, Wessel, Schweig, and Huntjens (this issue) investigated the malleability of dating earliest memories. Specifically, these researchers examined undergraduate students' ability to date earliest memories by manipulating the instructions prior to recall. Here, one type of instruction informed students that early memories might be sketchy and fragmented and they were provided with some examples of such memories. Instructions also included vignettes that referred either to events that happened around the age of two years or events that happened later at age six years. As predicted, age of the event memories mentioned in the instructions affected the age of the earliest memories being recalled. As well, just thinking about events (self-relevant or public) that happened during their preschool years, also resulted in memories that were dated earlier than when no such instruction is given. Thus, age information introduced in the instructions to remember one's earliest memories can affect the age estimates provided for the memories that are retrieved.

These studies raise the issue as to how reliable age estimates are for early memories? Indeed, what these studies suggest is that the search for the dating, or the "when," of early memory is fraught with problems, particular ones to do with measurement. Of course, one of the most persnickety problems arises from the fact that the "when" of a memory is not necessarily encoded at the time of the event. What this means is that dating them at some later time amounts to a guestimate, one that may other

faulty time estimates when we try to date related memories in order to date a target memory (i.e., when we estimate the date of our earliest memory based on memory for other events). So in essence, the dating of earliest memories relies on processes that are outside the realm of simple retrieval processes related to what is stored in memory – that is, we are asking for judgements about things we have never stored in the first place.

To put a finer point on this, consider a recent study by Akhtar, Justice, Morrison, and Conway (in press). They conducted a large-scale online survey of people's (6641 respondents) first memories, age-at-encoding, as well as a number of other memory judgements. Consistent with most previous research, as well as the studies published in this special issue, they found that age-at-encoding of earliest memories was 3.2 years of age on average (uncorrected for telescoping errors). However, unlike many previous studies in which there are few or no memories from the preverbal period (i.e., prior to two years of age), Akhtar et al. found that nearly 40% of the sample (or 2487 people) had first memories that were dated to an age of two years and earlier, with 893 (almost 14%) dating their first memories to the age of one year and younger.

So, if memories from this period are theoretically impossible (as most researchers would agree), what accounts for this unusual frequency of very early (and improbable) memories? Akhtar et al. (in press) examined a number of hypotheses (errors in dating memories, potentially self-selective nature of the respondents, and the narrative and fictional nature of the "life story,") and found all of them to be wanting. Instead, they proposed that given that memories are constructive in nature, these recollections come from a class of what they term, fictional memories. Specifically, because all memories are time-compressed and do not literally represent the experience from which they derive, these very early memories, like other memories, contain details that are either consciously

or non-consciously inferred. In other words, fictional memories derive not from the reality that was experienced, but rather from how well it corresponds with, and is coherent with, other parts of autobiographical memory (also see Conway, 2005 and Conway, Loveday, & Cole, 2016 for a discussion of coherence and correspondence). The important point here is that because memory is (re)constructive and can rely on many different sources (e.g., remnants of the experience itself, conversations about those experiences, accrued [semantic-autobiographical] knowledge about how the world works, coherence pressures in autobiographical memory) when one is trying to retrieve a specific memory, the "when" of such memories may be as impenetrable and unreliable as the very content of the memory itself.

CHILDREN'S RECALL AND DATING OF EARLY MEMORIES

Another strategy used by researchers to investigate questions about early childhood memories in this special issue is that of examining early memories in children themselves. Indeed, it has been known for some time now that amnesia for childhood events actually begins in childhood not adulthood (e.g., Bauer & Larkina, 2014; Cleveland & Reese, 2008; Peterson, Grant, & Boland, 2005; Tustin & Hayne, 2010; Wang & Peterson, 2014). Adding to this line of inquiry in the current issue, Bauer and Larkina (this issue) examined the development of autobiographical memory (rather than its absence) in 4- to 10-year-olds children. Using a cohort-sequential design, they examined children's autobiographical narratives of events that had happened in the preceding four months. Each cohort (4-, 6-, and 8-year-olds) was tested twice, separated by a one-year interval between tests. For some events, the child was interviewed by the experimenter and for others, interviews involved both the mother and the child. These latter interviews were conducted in order to evaluate

the influence of maternal narrative style, a variable thought to be important in the development of older children's ability to produce autobiographical narratives (e.g., Fivush, 2014).

The results showed that the length of children's autobiographical narratives increased with age, a finding that is fairly typical in this area (e.g., Fivush & Schwarzmueller, 1998). Of course, an increase in narrative length does not necessarily mean that the memories themselves are any better, simply that there may be a growth in narrative competence, something that affords an increase in verbal elaboration of what is in memory (Howe, 1998). Indeed, their results also showed that one of the better predictors of children's autobiographical narrative reports was change in children's language ability. Interestingly, maternal narrative style contributed little if anything to changes in children's autobiographical narratives. Perhaps most importantly, although narrative length increased with age, the slowest variable to change was the thematic coherence of those narratives. Thus, although children across the age range studied improved dramatically in narrative competence, autobiographical narratives were neither as complete not thematically coherent as those found for adults (similar outcomes have been obtained in cross-sectional studies as well; e.g., Reese et al., 2011).

In a related prospective study in this special issue, Reese and Robertson (this issue) examined childhood memories in adolescents (16-year-olds) that have been followed since they were very young (1½ years of age). In addition to assessing measures of early memory at ages 12 and 16 years, they examined measures thought to be important in the preservation of earliest memories. These included self-awareness, attachment security, nonverbal and verbal memory, language, theory of mind, narrative, and mothers'

elaborative reminiscing which were measured during the early childhood phase of this research (ages 1½ to 5½ years).

There were two key findings that emerged from this study. The first was that the age of earliest memory was still changing during adolescence. That is, the majority of 16-year-olds' (73%) earliest memory was significantly later than their earliest memory when measured at 12 years of age. Second, the link between the various measures taken between the ages 1½ to 5½ years and earliest memories recalled at 12 and 16 years of age showed that elaborative maternal reminiscing was critical to the ability to remember earlier memories. However, by the age of 16 years, mothers' elaborative reminiscing was important only for those children whose level of self-awareness was lower at the age of 19 months.

Although this research does not distinguish between forgetting and retrieval explanations of infantile and childhood amnesia, it does tell us that one's earliest memory does tend to become later and later as we develop into our teenage years. These findings from a longitudinal study dovetail nicely with other findings from similar studies (e.g., Peterson, Warren, & Short, 2011) as well as with cross-sectional research (e.g., Tustin & Hayne, 2010). This work also confirms that one's ability to remember early life events involves a confluence of factors, including maternal elaborative reminiscing and self-awareness.

Another paper examined the role of mother-child conversations in remembering what happened in Kindergarten (Leichtman, Steiner, Pillemer, Camilleri, & Thomsen, this issue). Here, mothers recorded their conversations with their 5- to 6-year-old children (Study 1) and 6- to 7-year-old children (Study 2) about the child's Kindergarten year and another specific episode of their own choosing. Like other studies in this issue (and

elsewhere in the literature), mothers' elaborative conversational style predicted children's memory contributions about all of the events being remembered. Of course, as the studies just reviewed indicate, when other variables are measured simultaneously, parental conversational style is not the only factor predicting children's autobiographical memory for their experiences.

Using a slightly different tact, Sonne, Kingo, Berntsen, and Krøjgaard (this issue) also examined early memories in children and attempted to specifically address the question of encoding specificity of those memories. Here, 3½-year-old children were presented with one of two unique events (i.e., a "Teddy" event or a "Game" event) that were associated with a one of two unique boxes (i.e., a red metal box or a grey plastic box). Children experienced an event in one room and then returned a week later and were tested for their memory of the event either in the same room or a different one. The results showed that changing the spatial context for retrieval (at least as implemented by changing rooms) did not alter children's ability to spontaneously retrieve the earlier experienced event. Of course, this change was one of external context and perhaps amnesia for earlier experienced events is more a matter of change in the internal (cognitive) context.

Interestingly, Tustin and Hayne (2010) have argued that differences in the dating of early memories may arise due to correlated differences in what a person (child or adult) considers to be the criteria for a memory, with these differences varying as a function of culture, gender, and a number of other individual differences variables. In the current issue, Tustin and Hayne (this issue) extend this line of argument and note that what we remember from our earliest years may not actually reflect what was originally encoded about that event as a child. Indeed, as adults, we may end up embellishing these memories when asked to recall such information. In their experiment, they asked children, adolescents, and adults

to remember events from different points in their lives. In this way, they could vary both the age of the rememberer and the retention interval while keeping constant the age at the time the event occurred. What they found was that adults not only provided the same amount of information about past events regardless of when it happened, but they also reported either the same amount or more information about memories from age 5, 10, and 13 than did children of those same ages. Thus, in order to truly understand what early memories are like, there may be some folly in asking adults to remember the past when it is not tempered by examining what children encode and remember about those events in the first place.

INDIVIDUAL DIFFERENCES IN RECALLING EARLY MEMORIES

One individual difference factor that contributes to how far back one can remember into one's childhood, formal schooling, was examined by de la Mata et al. (this issue). These authors examined the role of three levels of schooling (from rudimentary literacy to primary school to formal university education) in the narration of childhood memories in Mexican adults. They asked participants to provide oral narratives of three childhood memories (not necessarily their earliest memory) and then analysed a number of factors related to these narratives. As predicted, they found a positive correlation between extent of formal education and the length, specificity, and self-orientation of childhood memories. Clearly these results show that sociocultural factors (in this case level of education) can play a critical role in one's ability to provide complex narratives about childhood memories.

OLD MEMORIES IN NEW BOTTLES: WHAT HAVE WE LEARNED?

So how far have we advanced over the last several centuries? It is clear from this special issue that myriad developments contribute to a mature autobiographical memory system. These include fundamental changes in cognitive (the self, language), social (e.g., conversations about the past with others), cultural, and formal educational components in a child's development. It is laudable that many current models of autobiographical memory development incorporate multivariate theories that include self-awareness, elaborate reminiscence (with parents as well as peers), language and general memory development, attachment factors, culture, and gender, among a number of others. Additional research on other, related factors would be welcome as well. For example, examining the impact of changes in self-awareness throughout childhood, adolescence, and adulthood would contribute greatly to our understanding of the dynamic link between the self and autobiographical memory throughout the lifespan. Similarly, new research on the role that stress and trauma can play on autobiographical memory would also be worthwhile as it might dispel certain myths that early childhood stress and trauma make memories either more or less susceptible to the effects of infantile amnesia.

We have also learned that infantile and childhood amnesia do not represent abrupt transitions in memory, at least not at the behavioural level (but see later discussion concerning neuroscience evidence). As reviewed here, and as seen in other recent articles, evidence has accumulated that infantile amnesia begins early in childhood and continues through adolescence and into adulthood. But now that we know this, why would early memories be forgotten during childhood? Is it because they are no longer adaptive and have been supplanted (modified, overwritten; also see Richardson & Hayne, 2007) by newer experiences that are more germane to our current needs? After all, what good is it to keep

memories of the past when they are no longer functional, either in terms of our current or future survival requirements, especially when memories of more recent experiences serve us better?

MORE QUESTIONS: WHERE DO WE GO FROM HERE?

Despite all of these advances in our understanding of the development of autobiographical memory, we have still not answered the basic question as to what happens to our early memories and do they still affect our psychological development across the lifespan even if we cannot consciously remember them? Moreover, are traumatic experiences immune to infantile and childhood amnesia or do these memories also succumb to the ravages of forgetting (whether storage-based or retrieval-based)? Finally, are early memories simply poorly encoded in the first place, leading to more rapid forgetting, or are they encoded just fine but become "trapped" and irretrievable due to internal changes in one's cognitive context?

First, concerning the latter storage-retrieval issue, the evidence provided by longitudinal studies, showing that with increasing age early memories appear to become irretrievable, augers well for a retrieval interpretation of infantile and childhood amnesia. However, such data do not completely rule out the idea that early memories are poorly and incompletely encoded and stored and then simply fade into the background. Indeed, evidence from adults recalling early memories suggests that these recollections are sparse and fragmented (e.g., Akhtar et al., in press). Moreover, often what children remember of early experiences is similarly sparse and fragmented, although, unlike adults, such findings are constrained by relatively immature language and narrative skills.

Second, concerning stress and trauma, although these issues were not dealt with specifically in this special issue, there is evidence that the majority of early memory reports do not involve emotional or traumatic events (e.g., Akhtar et al., in press; Bruce et al., 2005). Indeed, painful and traumatic experiences early in life (e.g., circumcision without anesthetic) often do not translate into declarative memories for those experiences and behavioural evidence of their persistence often dissipating within a relatively short period of time (e.g., see Taddio, Katz, Ilersich, & Koren, 1997). Although there will no doubt be exceptions to this pattern, depending perhaps on age at the time of the experience, it would seem that for early-life (before the age of two years) experiences, such memories, like other early memories, are either very poorly encoded, forgotten rapidly, or both (for a review, see Howe, 2011).

Third, whether early experiences, consciously remembered or not, can still have an impact on subsequent psychological development is still a matter for debate. Some have argued that adverse early-life experiences are associated with the development of depression and anxiety-related illnesses in adulthood in both humans (e.g., Struber, Struber, & Roth, 2014) and non-human primates (e.g., Conti et al., 2012). It might seem from studies such as these that regardless of whether one does or does not form a conscious, autobiographical memory for these early experiences, adverse early events affect our subsequent psychosocial development. However, interpretation of these outcomes must be tempered by the fact that, at least in studies with humans, these conclusions are primarily based on correlational not causal data. Although studies with non-human animals can involve experimental (potentially causal) manipulations, it is not always clear what the link is between these various animals (primates, rats, mice) and humans.

In what follows, I summarize some crucial recent findings that shed some additional light on these questions and that suggest additional avenues of investigation. I begin with some recent neuroscience research that addresses the storage-retrieval question. I then turn to a potentially new approach to asking questions about infantile and childhood amnesia, namely, a functional/adaptive analysis of memory and forgetting.

Recent Neuroscientific Evidence

To be blunt, the battle still rages on as to whether memories are still there but just cannot be retrieved (Travaglia, Bisaz, Sweet, Blitzer, & Alberini, 2016) or whether they fail to store/consolidate in the first place (neurogenesis; Akers et al., 2014; Josselyn-Frankland, 2012). For example, one recently examined neuroscientific mechanism (increased neurogenesis during early infancy) has been suggested as a source of storage-based amnesia for early events. Here, given rapid neurogenesis (thought to be critical in the formation of memories) that occurs during the infantile amnesia period, memories that are formed during this time are subsequently erased or at least modified by additional experiences so that they can no longer be retrieved. This explanation squares well with a recently proposed cognitive, adaptive approach to memory whereby early memories are blended with more recent experiences in order to form schemas that better represent the world in which the young organism finds itself (for an overview, see Howe, 2011). Although these schemas provide for better organization of experiences of the past, allowing the infant to interpret the present and anticipate the future, it comes at the expense of remembering specific, individual experiences that took place early in life.

The idea of neurogenesis as a factor in both adult forgetting and infantile amnesia certainly makes physiological sense. That is, new neurons overwrite old ones at memory

sites and although this overwriting still preserves some of the structural features corresponding to the original memory, it also substantially changes its contents (particularly memory context). Importantly, however, although neurogenesis is high during the infantile amnesia period, the fact that forgetting is also high may simply be correlational. I would argue that there exists a preference to rewrite memories stored early in life with new, more representative contemporaneous information as experience accrues. What the neurogenesis data show is that while meaning may be preserved in traces that undergo rapid change, the context of what is being learned is overwritten. These findings are consistent with what we know at a cognitive level about how infant memory develops. Once these early memories are better organized, perhaps through the development of binding processes (e.g., Olson & Newcombe, 2014) that link the various features of events (including with reference to an emerging self-consciousness), they become more durable and stable, and infantile amnesia wanes.

Infantile and Childhood Amnesia as Adaptive Forgetting

There are myriad advantages to forgetting, both in childhood and adulthood. These include emotional regulation, knowledge restructuring, automatization, and memory updating, to name but a few (for a recent review, see Nørby, 2015). Indeed, oftentimes we may sacrifice specific episodic details of experiences in order to form semantic memories about how things work in the world. For example, it is not necessary to remember every time we tried to learn how to ride a bicycle to then ride a bicycle once learning has been accomplished.

The theory just espoused concerning the forgetting of early memories is in line with the recently advanced adaptive memory view in which early memories are particularly

fragile as they are being reworked across multiple experiences to generate reliable information structures that guide future behaviours. That is, earlier representations are reshaped by new experiences, iterating toward a more viable worldview that promotes accurate models that can be used to anticipate and deal with the current needs and future demands (for an overview, see Howe, 2011, 2014, 2015). After all, what would be the purpose to remembering outdated information once it has been replaced by newer, more recent (and ostensibly accurate) information? As Rovee-Collier and Cuevas (2009, p. 168) noted,

> . . . at each point in development, infants of all species epitomize a successful evolutionary adaptation . . . [where] they rapidly learn the relationships that define their niche and confer survival and reproductive advantage … . To meet each new set of ecological demands, infants select aspects of episodes to learn and remember until their niche changes again.

Therefore, from a more functional perspective, rapid forgetting of early experiences in light of more recent and diagnostic information may be a very adaptive mechanism. This is particularly true during early infancy where one is learning about the world and trying to form schemas (or other semantic devices) that allow the infant to survive in the environment they find themselves. Indeed, more rapid forgetting early in life may promote better adaptation to one's surroundings. That is, early infant experiences may no longer be relevant even in later infancy – knowing how to interact with objects when one can crawl

may no longer be relevant once one has learned to walk. Thus, infantile amnesia may start during infancy itself!

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