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The Infantile Amnesia Phenomenon and the Beginning of Autobiographical Memories

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Abstract: The first years of life are characterized by an absence or paucity of memories, a condition known as infantile amnesia (IA). This study examines the distribution of the early memory recall of young adults, considering the distinction between the first (0–3) and the second (4–6) epoch of IA. We used five categories to classify memories: Perceptual-Visual Fragment, General Semantic Memory, Episodic Fragment, Repeated Episode, Single Episode. Fifty-five students (20 males; mean age = 20.85) were asked to remember their earliest events. We were also interested in understanding the presence of content features. Remembering at first epoch were low; in the second epoch, the frequency of memory increased. Results showed as the presence and number of different types of memory decrease the likelihood of memory being structured as episodic. The participants reported more elements of perceptual-visual fragments, episodic fragments, semantic memories, or repeated events when a well-organized episodic memory does not emerge. These results suggest that the episodic system assumes the role of organizer of the experience and becomes the most relevant form of memory with respect a less structured form of partial remembering. Significant differences were observed in the content features of the different memory types. The offset of IA has a complex articulation, and the complete episodic memories are the last step in the different development stages.

Keywords: infantile amnesia; memory systems; autobiographical memories; remembering of events

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1. Introduction

Autobiographical memory refers to the way people encode, organize, and remember personal memories, that knowledge that has the self as an object in all its expressions, abstract and factual [1–3]. It includes both general knowledge regarding a person's own life and events that specifically occurred and are contextualized in each period [4–6].

Tulving [7], in his first model of memory systems, substantially treated episodic and autobiographical memory as synonymous. However, his notion of autonoetic awareness referring to the episodic memory system [8] requires more careful reflection. Recently, in an exhaustive review, Bauer [9] highlighted this problem. The memory of an event does not necessarily imply that this event must be treated as autobiographical memory: in order for it to become autobiographical, the memory of an event must have the quality of being self-referential, that is, having a personal or subjective perspective and being an event that is part of an extended lifespan narrative. This type of event allows for the construction of a life story, and its recall is accompanied by reliving the experience [10,11]. From this point of view, the autobiographical memory can be considered the most cognitively relevant element in relation to the construction of one's identity, with an importance that goes well beyond the mere organization of the events experienced.

One of the much-debated topics related to autobiographical memory concerns the phenomenon known as infantile amnesia (IA) [12–15].

Infantile amnesia (IA) was first described by Caroline Miles in an article published in the American Journal of Psychology in 1895. However, Freud can be considered the first author who dealt with the psychology of autobiographical memory by facing particularly

complex subjects such as the mechanisms underlying the formation of memory traces, the truthfulness and vividness of childhood memories, the role of emotions, and the forgetting of traumatic experiences. Freud defines infantile amnesia as the failure of memory for the first few years of life, underlining the emotive and psychological impact these experiences can have throughout the lifespan [16].

The IA phenomenon relates to the evidence that we have no or poor memories of what happened in our first years of life [17–20]. This difficulty is amplified when we try to think back to our earliest memories: It is often unclear whether they are real or just recollections based on photos or stories told to us by parents or others [21,22].

Several studies [23–26] conducted with adults have revealed a relative paucity of personal-episodic or autobiographical memories of events from the first 3–4 years of life, with a gradual increase in the number of memories until approximately 6–7 years of age, after which an adult distribution has been assumed. For these reasons, infantile amnesia is divided into two epochs. Adults have little or no autobiographical memories in the first epoch (before age 3–4 years). During the second epoch (between the ages of 5 and 7 years), some more organized autobiographical memories begin to emerge. During these periods, the memory of personal events becomes more and more accessible and verbally communicable [23,27–30]. We can say that only when we reach this age does the phenomenon that we properly call autobiographical memory to begin to take shape [31,32]. It is only at the end of the first decade of life when most adults can recall a significant number of spatially and temporally localized past events that have some degree of personal relevance or significance [3,9,33].

The division of IA into two epochs, therefore, implies that the memory of autobiographical events is not an all/nothing phenomenon but that it gradually develops so that some early childhood events (after 2–3 years) become a stable memory over the years [34–37].

The development of event's memory is made possible by the concomitance of several factors:

A. The distinctiveness of the event linked to its uniqueness, emotional salience, and importance [38–40].
B. The competence of storytelling because the coding took place when the child had already acquired sufficient linguistic skills to describe an event with a sequential organization in time. This skill is normally reached around 3–4 years [28,30,41,42].
C. The maturation of the Central Nervous System (CNS) [43–45]. Children who, from the first few months of life, have developed procedural memory and the perceptual representation system which allows for the learning of motor skills, conditioning and priming, do not, on the other hand, show memory skills conceived as a conscious memory of facts, information, or events. The different development of the cortical and subcortical areas (medial temporal, frontal, and prefrontal lobes, posterior cingulate, and parietal cortices) might explain the gradual emergence of different types of memory from birth to adulthood. In particular, the incomplete biological maturation of some structures of the CNS (medial temporal, frontal, and prefrontal lobes) in the first two years of life, make it difficult to store information in long term declarative memory (semantic and episodic memory) [20,46].
D. The development of the "historical self", that is the perception of being embedded in a temporal dimension that has a past, a present, and a future [28,29,31,47] and the development of self-concept organization and the subjective perspective [48–50].

Although recent studies suggest that all these factors are possible [17,51,52], several researchers have verified that children can remember events as early as the age of two and perhaps even earlier [9,53,54], therefore long before a complete organization of the self is established. Recently an unitary interpretation has been proposed in which the brain plasticity determines the maturation of cerebral areas in an experience-dependent manner [55].

Therefore, the elements in question become not so much the presence or absence of memory of events but how the ability to remember develops over time, and whether it

is feasible to grasp the characteristics that define this development [56]. Regarding this point, Bruce and colleagues [57], in a study on personal remembrances, make an important distinction between remembered events and fragment memories, taking up a distinction made by Salaman [58] and Tulving [7], who define fragment memories as the rudimentary units of episodic memory.

The remembered event is a complete story that describes a spatial-temporal context with one or more actions. In a fragment memory, by contrast, the person describes an isolated moment in time, and the prominent aspect of this memory is the visual image [57,59].

The Present Study

Since it is now clear that autobiographical memory develops over a period of several years, we wanted to shed light on the mechanisms underpinning the steps of this development.

To study the development of autobiographical memory, we examined the distribution of young adults' early memory recall, maintaining the classic distinction between the first and the second epoch of IA.

A primary aim of the present study was to analyze the first memories, starting from the distinction between fragment and event memories [59]. However, we think that these two categories (fragment and event memories) do not include all possible forms of memory. In other words, memories could be present, but it is not possible to classify them.

For this reason, we have introduced new categories which, in our opinion, represent different ways of remembering: Perceptual-Visual Fragment (PVF), General Semantic Memory (GSM), Episodic Fragment (EpF), Repeated Episode (REp), and Single Episodic Event (SEpE) (see event report scoring section). We organized these classes of memories following Tulving's model of memory according to systems organization. For this reason, we have kept separate the memories with a perceptual component in which a structured narration was very poor. Regards memory with a narrative, we have kept semantic memories alone because they represent a maturation level preceding episodic memory system. The latter system is characterized by a high degree of polymorphism which does not necessarily indicate greater or lesser complexity but diversity of contents elaboration. Because each individual has a personal perspective on the experienced world, episodic memory of an event is unique and virtually may change depending on the context in which it is remembered. As widely documented in the literature on memory, episodic system matures over time not only quantitatively but also qualitatively. Very schematically the principal cognitive components of episodic memory can be summarized as follows: personal event memory, episodic future thinking, imagination, time travelling, and prospective memory [47,60].

In line with previous literature, we expect the presence and the number of typical but incomplete elements of an event to be related to the development of episodic memory and to the subsequent organization of autobiographical memories. By virtue of this progressive maturation, we expect a presence of incomplete memories in both epochs of IA, with more frequent episodic events in the second epoch than in the first.

The second aim concerns specific features that characterize these memories, in particular, activity, location, presence of self and/or other participants, and the possible presence of emotions. Our hypothesis is that both the first fragments and the more organized memories contain these elements but in different quantities. Specifically, we expect to find a lower and more fragmented presence of these elements in fragment memories compared to other types of remembering. We did not analyze the importance of the events in relation to uniqueness and memorability. The memory of an event experienced during early childhood does not allow its importance and/or uniqueness to be evaluated ex post. These factors can take on different meanings in the memory compared to the original experience. In our opinion, these aspects could be studied only in conditions of time proximity between the real event and its remembering.

A latere, we also wanted to see if there were differences related to gender, often identified as a distinguishing factor in the age of early memory in women vs. men [61].

This aspect of the research has an exploratory character, as we are aware of the importance of cultural and educational factors in determining gender differences.

2. Materials and Methods

2.1. Participants

The sample comprised 55 students (20 males and 35 females; mean age = 20.85; SD = 1.17) attending their first year at the University of Bologna. Students were recruited by their professor on a voluntary basis during a university lecture in psychology. Each participant provided individual informed consent and received a course credit.

Ethical approval has been obtained from the Bioethics Committee of the University of Bologna (Bologna, Italy; Prot. n. 81598 of 13/04/2022).

2.2. Materials and Procedure

Participants were individually interviewed in the memory lab by a research assistant. Participants were told that the topic of the research was infantile amnesia and the development of events memory. The researcher began each interview by explaining to the participant that he/she would be asked to describe the first memories from his/her past. The participants were instructed to only tell the researcher about directly experienced events, and not to fill in any blanks with details obtained from family or friends' stories. Experimental questioning in this field is particularly important and it should be stressed to participants that they must only refer to events of which they have a personal memory. As Tulving [62,63] reminds us, adults believe that they remember early events, but, in actual fact, they only know about them from other sources (photos, parents' stories), using information drawn from semantic memory.

Specific instructions were provided, as well as practice tests at the beginning of the procedure, to make the nature of the recall tasks clear.

We analyzed the memories divided into the two classic epochs of infantile amnesia, in agreement with Jack and Hayne [25]. The first epoch was related to the period prior to kindergarten (0–3 years) and the second to the kindergarten years (4–6 years).

Please note that kindergarten and primary school refer to codified phases in the life of Italian children. In the Italian school system, the first epoch (0–3) includes educational structures called "nests". The kindergarten corresponds to the nursery school and then the elementary school begins. These levels are different both for the architecture of the environments and for the educational roles. Although kindergarten is not mandatory, it always starts at age 3 and, in our research, only children who attended kindergarten were selected. Primary school (formal schooling) is compulsory in Italy for everyone and starts at age 6. The mention of kindergarten as a temporal landmark to prompt the earliest memory is consistent with Peterson and Nguyen [64]. We are aware that this choice involves a difference of months in the age of children. According to the Conway Model of autobiographical memory [65,66], we believe that a lifetime event as kindergarten is more ecologically valid than age expressed in months.

Participants, who were individually tested, were asked to remember specific, personally experienced earliest events with the following question: "Try to tell me everything you can about your earliest infantile memories, concerning the time before you started kindergarten (i.e., about age 3). The memories must be your own, from your experiences, not something you saw in a picture or heard from someone else." Then, a similar question was formulated, but this time regarding "the time from when you started kindergarten until the beginning of primary school, from the end of 3 to 6 years." Particular attention was paid to labelling the two periods with reference to the attendance of the two types of school This element is particularly important because the problem of the correct dating of autobiographical events is well known in the literature (see the telescoping effect [67–70]).

Participants had to report early memories, albeit repeated, incomplete, or poorly defined. If a complete event was remembered, participants were preliminarily informed about the meaning of a "specific" event by providing examples: "we wanted to refer to

those single episodes, not repeated, temporally short, lasting less than a day (for example, a birthday party, a game at the stadium, and so on)."

In line with previous studies [25,71], for each memory recalled, we asked the following questions: **How old were** you? (With the date for the memory requested in years); **What** happened? (Activity); **Who** was present? (Self and/or other participants); **Where** did the event take place? (Location); what specific **Emotions** did you experience at that time?

The participants were always asked to give as many details as possible so that we could be sure that no details had been left untold. Furthermore, participants were reminded that they were not to guess and should answer only if they really remembered the features.

The experimental session lasted approximately one hour. This time might seem long, but our goal was to facilitate recollection and to leave the participants free to think over the period analyzed carefully. This point is very important since the reliability of early childhood memories is an open question [72]. Events recollections were audio-recorded and later transcribed verbatim.

2.3. Events Reports Scoring

Event reports were submitted to three independent judges who had no prior knowledge of the hypotheses formulated. The three judges were all trained psychologists, experienced in interview administration with adequate knowledge of the subject matter. Interrater reliability was >80% for all dimensions considered. Judges then resolved their scoring discrepancies, and the reconciled versions were used in the data analysis.

The verbal reports were transcribed verbatim by a trained research assistant. The memories from birth to the kindergarten entrance were coded in the first infantile amnesia epoch, whereas the memories recalled during the kindergarten period were considered in the second epoch.

For the analysis of the different types of events, a scoring grid was prepared in which the events collected were codified according to the presence of the following aspects:

Perceptual-Visual Fragment (PVF): The participant remembers only an image (visual, auditory, smell, or taste) without a narrative organization (e.g., "I remember the orange light in my room in the afternoon.").

General Semantic Memory (GSM): Generic situations in which the participant refers to a general memory without any contextual reference or exact space-time (e.g., "I never wanted to walk, I just needed to be held.").

Episodic Fragment (EpF): The participant reports a fragment of an incomplete event without specifying contextual details or narrative context but only a behavior as a disconnected memory (e.g., "I was playing in the countryside making perfumes, a mixture of mint, water, and soap.").

Repeated Episode (REp): The memory refers to a typical complete event in the life of the participant without reliving and without a specific time-space contextualized memory (e.g., "My brother, who was a little older than me, went out to go to kindergarten and I was crying on the sofa because I wanted to go too.").

Single Episodic Event (SEpE): The participant describes a personal recollection of a complete event (e.g., "In kindergarten I fell and broke my forehead. I remember that my mother came to pick me up at the hospital and I told her: 'Mum I was good, I didn't cry.' The teachers and my sister were there. I fell when I was alone. I got very scared.").

Each memory may present one or more of the aspects listed above. For example, a memory may present Perceptual Visual Fragment (PVF) referred together with a Single Episodic Event (SEpE: e.g., I remember a loud noise and then I remember sitting in my room playing with a teddy bear and my mother came in and told me to put on my shoes that we had to leave right away).

2.4. Statistical Analyses

All the statistical analyses were carried out using the statistical package SPSS 26 for Windows with an alpha level of 0.05. All the variables included in the study are dichotomous (both independent variables and the dependent variable).

To analyze the predictive effect of the Perceptual-Visual Fragment (PVF), General Semantic Memory (GSM), Episodic Fragment (EpF), and Repeated Episode (REp) on the Single Episodic Event (SEpE) a logistic regression analysis was applied in the whole sample of memories.

Subsequently, two separate logistic regression analyses were carried out, considering the two epochs separately. In all analyses, SEpE was used as the dependent variable, while PVF, GSM, EpF, and REp were independent, predictor variables.

To evaluate whether the number of typical but incomplete elements of an event was predictive of the development of SEpE, a new variable called Non-Single Episode (NSEpE) was calculated. NSEpE represents overall the number of all different memories, i.e., the sum of PVF, GSM, EpF, and REp. To study whether NSEpE predicts the presence of SEpE, one logistic regression analysis for the whole sample of memories and two additional logistic regression analyses (one for each epoch) were carried out using the variable NSEpE (continuous variable, ranging from 0 to 4) as the independent variable and the SEpE as the dependent variable.

All the logistic regression analyses were applied using the Forward LR (Forward Likelihood Ratio method) as the selection method for the estimation of the model. The Forward LR method is a stepwise selection method with entry testing based on the significance of the score statistic and removal testing based on the probability of a likelihood-ratio statistic based on the maximum partial likelihood estimates.

Finally, to analyze the presence and the frequency of specific details reported in association with the different types of memories, Chi-square analyses were applied to the entire sample of memories and, separately, to the samples of memories related to the two epochs. In particular, the presence and the frequencies of details related to the type of activity remembered (activity), the presence of self (participation of self), the presence of other participants (other participants), the place where the event took place (location) and the emotion associated to the memories reported (emotion).

For these analyses, each memory reported was classified according to the most complex characteristic described: If a memory presented the contemporary presence of PVF and EpF, then the memory was classified as EpF (characteristic indicating more complexity of memory). For this reason, the total sample of memories for these analyses was lower than those used in logistic regression analyses.

Moreover, the effect of gender on the type of memories reported was analyzed on the entire sample and on the two epochs by means of Chi-square tests.

3. Results

3.1. Descriptive Statistics

A total number of 277 events was reported. Each participant reported 1 to 17 events (mean = 5.02, SD = 3.61). A total of 34 **PVF memories** were reported (9 for epoch 1 and 25 for epoch 2), 86 **GSM** (18 for epoch 1 and 68 for epoch 2), 74 **EpF** (15 for epoch 1 and 59 for epoch 2), 85 **REp** (13 for epoch 1 and 72 for epoch 2), and 106 **SEpE** (17 for epoch 1 and 89 for epoch 2).

In Figure 1, the percentages of the different types of memory for each epoch were calculated. The percentages relating to the two epochs were calculated on the total frequency of the specific type of memory. It is possible to observe how most of the memories (regardless of the type of memory reported) were reported in epoch 2.

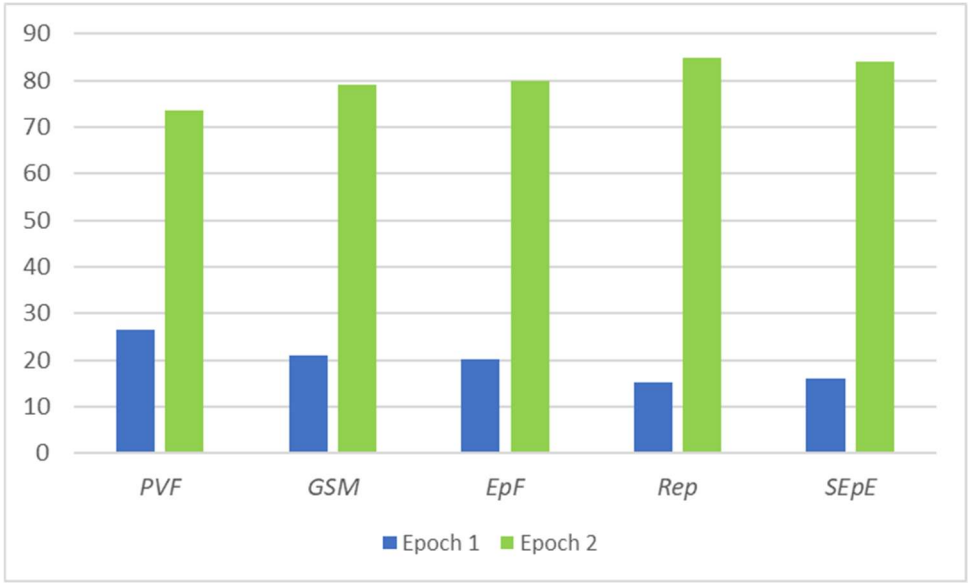

Figure 1. Percentages of reported memories related to the two epochs.

3.2. Logistic Regressions

3.2.1. Results on the Entire Sample of Memories

The Logistic Regression Model returned a significant level (Chi-Square = 209.10; $p < 0.001$), attesting that the factors considered (PVF, GSM, EpF, REp) significantly predicted the Single Episodic Event (SEpE) when taken together. The variables considered also showed significant effects when analyzed individually (see Table 1). Looking at the Table 1, it is interesting to note that the presence of these incomplete memories makes it less likely that the memory is structured as an episodic memory. However, the decrease in the probability of SEpE changes according to the type of memory, and the greatest decrease is associated with the presence of Perceptual Visual Fragment (the probability of SepE is reduced by 7.4 times).

Table 1. Predictive effect of the perceptual-visual fragment, general semantic memory, episodic fragment, and repeated episode on Single Episodic Event memory (n = 277).

Single Episodic Event (SEpE)				
	B (SE)	**Wald's Chi^2 (df)**	***p***	**Exp(B)**
Perceptual-Visual Fragment (PVF)	−2.60 (0.74)	12.44 (1)	<0.001	0.074
General Semantic Memory (GSM)	−3.80 (0.54)	49.91 (1)	<0.001	0.022
Episodic Fragment (EpF)	−5.24 (0.71)	54.20 (1)	<0.001	0.005
Repeated Episode (REp)	−2.97 (0.51)	34.05 (1)	<0.001	0.052

When analyzing how frequently SEpE and other types of memory were present, it could be observed that SEpE was present in 11.8% of cases in which PVF details were present, in 9.3% of cases with GSM, in 4.1% with EpF and in 15.3% of cases which contained Rep.

To evaluate the relationship between the number of Non-Single Episode Event (NSEpE) memories and the presence of SEpE, a second Logistic Regression analysis was carried out using NSEpE (continuous variable, ranging from 0 to 4) as the independent variable and SEpE as the dependent variable. The results showed that with the increase in incomplete memories, the likelihood of episodic memory significantly decreases (B = −3.67 (SE = 0.43), Wald's Chi^2 = 73.10 (df = 1); $p < 0.001$, Exp(B) = 0.026).

3.2.2. Results for Epoch 1 (0–3 Years)

No significant results were observed with reference to the predictive role of the PVF, GSM, EpF, and REp on SEpE memories considering epoch 1. It is probable that the low number of data collected for epoch 1 (n = 51) and the low number of memories that were structured as SEpE (n = 17) (see descriptive statistics) did not allow for a sufficient power in the statistical analysis to highlight any significant relationships.

However, for a descriptive purpose, the co-presence of SEpE and the other types of memories was analyzed: SEpE was present in 22.2% of cases with PVF, in 6.7% with EpF, in 7.7% with Rep, and in 0% of cases containing GSM.

The relationship between the number of Non-Single Episodic Events (NSEpE) and the presence of SEpE memory was evaluated using Logistic Regression analysis. Results showed that as the number of NSEpE increases, the likelihood of SEpE significantly decreases (B = −4.10 (SE = 1.14), Wald's Chi^2 = 12.93 (df = 1); $p < 0.001$, Exp(B) = 0.017).

3.2.3. Results for Epoch 2 (4–6 Years)

In epoch 2, the Logistic Regression Model returned a significant level (Chi-Square = 170.52; $p < 0.001$), showing that the factors considered significantly predicted episodic memory when taken together. The analyses performed on epoch 2 showed very similar results to those obtained from the analyses performed on the entire sample of memories. In particular, it was observed that the presence of PVF, GSM, EpF and REp significantly reduced the probability that SEpE were also present (see Table 2).

Table 2. Predictive effect of the perceptual-visual fragment, general semantic memory, episodic fragment, and repeated episode on Single Episodic Event (SEpE) (Epoch 2, n = 224).

	Single Episodic Event (SEpE)			
	B (SE)	**Wald's Chi^2 (df)**	***p***	**Exp(B)**
Perceptual-Visual Fragment (PVF)	−3.44 (0.91)	14.42 (1)	<0.001	0.032
General Semantic Memory (GSM)	−3.46 (0.56)	37.89 (1)	<0.001	0.031
Episodic Fragment (EpF)	−5.43 (0.84)	41.85 (1)	<0.001	0.004
Repeated Episode (REp)	−2.78 (0.54)	26.35 (1)	<0.001	0.062

Upon analysis of how frequently SEpE and other types of memory were present together, it emerged that SEpE was present in 8% of cases containing PVF, in 11.8% of cases with GSM, in 3.4% that had EpF and in 16.7% with REp.

The relationship between the number of Non-Single Episodic Event (NSEpE) memories and the presence of SEpE memories was evaluated by means of a Logistic Regression analysis. The results showed that as the number of incomplete memories increases, the likelihood of observing SEpE significantly decreases (B = −3.58 (SE = 0.46), Wald's Chi^2 = 60.03 (df = 1); $p < 0.001$, Exp(B) = 0.028).

These results suggest that the more the participants report perceptual-visual fragments, general semantic memories, episodic fragments, and repeated episodes, the less likely it is that the memory is structured as episodic (as the NSEpE reported an increase in memories, the probability of SEpE decreased).

3.3. Analyses for Characteristics Associated with the Type of Memory

An analysis was carried out in terms of the presence and frequency with which each type of memory and its individual details *(activity, location, participation of self, emotion, other participants*) were reported. The calculation of these characteristics is shown in Table 3.

Table 3. Frequencies of the details reported according to the different types of memories when present (the total number of memories was 275).

	Type of Memory				
Characteristics of Memory Report	**Perceptual-Visual Fragment (n = 4)**	**General Semantic Memory (n = 35)**	**Episodic Fragment (n = 43)**	**Repeated Episode (n = 75)**	**Single Episode Event (n = 118)**
Activity	50.00%	48.57%	95.35%	96.00%	97.46%
Location	50.00%	68.57%	53.49%	82.67%	90.68%
Presence of Self	50.00%	82.86%	72.09%	96.00%	97.46%
Emotion	25.00%	31.43%	58.14%	53.33%	80.51%
Others Participants	0.00%	71.43%	81.40%	92.00%	95.76%

Chi-square analyses were carried out to verify whether the frequency of the characteristics reported significantly changed according to the type of memory. Significant differences were found for activity ($Chi^2_{(4)} = 84.15$; $p < 0.001$), location ($Chi^2_{(4)} = 31.79$; $p < 0.001$), presence of self ($Chi^2_{(4)} = 36.39$; $p < 0.001$), emotion ($Chi^2_{(4)} = 36.20$; $p < 0.001$) and other participants ($Chi^2_{(4)} = 48.08$; $p < 0.001$). In particular, as can be seen in Table 3, the memory of a SEpE showed the highest frequency of details compared to the other types of memory. Frequency distributions change with memory type and tend to increase with increasing memory complexity.

No difference emerged when the effect of gender on the type of memory was analyzed. ($Chi^2_{(4)} = 6.58$; $p = 0.16$).

The same analyses were carried out separately for each epoch (epoch 1 and epoch 2) of the memories reported.

3.3.1. Results for Epoch 1

In epoch 1 the analysis of the details connected to the different types of memory revealed that details regarding location, participation of self, and other participants were more frequent in SEpE than in the other memory types (Table 4).

Table 4. Frequencies of the details reported according to the different types of memories when present in epoch 1 (the different types of memory reported are 51).

	Type of Memory				
Characteristics of Memory Report	**Perceptual-Visual Fragment (n = 0)**	**General Semantic Memory (n = 9)**	**Episodic Fragment (n = 6)**	**Repeated Episode (n = 12)**	**Single Episode Event (n = 24)**
Activity	–	11.11%	100.00%	91.67%	91.67%
Location	–	66.67%	66.67%	75.00%	100.00%
Self	–	77.78%	83.33%	91.67%	100.00%
Emotion	–	22.22%	66.67%	75.00%	62.50%
Others participants	–	77.78%	83.34%	91.67%	91.67%

Note: The titles of the columns represent the types of memory reported (in brackets the number of memories reported on the total of memories); the titles of the lines represent the details reported according to the different memories.

Significant differences in rate of occurrence were found for activity ($Chi^2_{(3)} = 29.46$; $p < 0.001$) and location ($Chi^2_{(3)} = 8.78$; $p = 0.032$). No significant differences were found for emotion ($Chi^2_{(3)} = 6.56$; $p = 0.087$), presence of self ($Chi^2_{(3)} = 5.27$; $p = 0.153$) and other participants ($Chi^2_{(3)} = 1.50$; $p = 0.683$). The frequency distributions related to location, presence of self and other participants tend to increase according to the complexity of the memory; for these details highest frequency of these aspects is associated with the single episode event. Location showed the highest frequency associated to Episodic Fragment, whereas emotion with Repeated Episode (see Table 4). No significant gender effect on memory types was found ($Chi^2_{(3)} = 6.35$; $p = 0.096$). As showed in Table 5, most of the male memories were Single Episodic Events (60.9%) and the least reported type of memory were

Episodic Fragment (8.7%) and Repeated Episode (8.7%). Females reported Single Episodic Events and Repeated Episode with equal frequency (35.7%) and greater than General Semantic Memory and Episodic Fragment (also with equal frequency equal to 14.3%).

Table 5. Frequencies of the different types of memories reported by females and males in epoch 1 (the different types of memory reported are 51).

Gender	Type of Memory				
	Perceptual-Visual Fragment (n = 0)	**General Semantic Memory (n = 9)**	**Episodic Fragment (n = 6)**	**Repeated Episode (n = 12)**	**Single Episodic Event (n = 24)**
Females	–	14.3%	14.3%	35.7%	35.7%
Males	–	21.7%	8.7%	8.7%	60.9%

3.3.2. Results for Epoch 2

Regarding the frequency of the characteristics associated with the different types of memory in epoch 2, significant differences were found (Table 6).

Table 6. Frequencies of the details reported according to the different types of memories when present in epoch 2 (the different types of memory reported are 224).

Characteristics of Memory Reports	Type of Memory				
	Perceptual-Visual Fragment (n = 4)	**General Semantic Memory (n = 26)**	**Episodic Fragment (n = 37)**	**Repeated Episode (n = 63)**	**Single Episodic Event (n = 94)**
Activity	50.00%	61.54%	94.60%	96.83%	98.94%
Location	50.00%	69.23%	51.35%	84.13%	88.30%
Self	50.00%	84.62%	70.27%	96.83%	96.82%
Emotion	25.00%	34.62%	56.76%	49.21%	85.11%
Others participants	–	69.23%	81.08%	92.06%	96.81%

Note: The titles of the columns represent the types of memory reported (in brackets the number of memories reported on the total of memories); the titles of the lines represent the details reported according to the different memories.

In particular, activity ($Chi^2_{(4)} = 53.30$; $p < 0.001$), location ($Chi^2_{(4)} = 25.60$; $p < 0.001$), presence of self ($Chi^2_{(4)} = 32.56$; $p < 0.001$), emotion ($Chi^2_{(4)} = 37.08$; $p < 0.001$) and other participants ($Chi^2_{(4)} = 47.39$; $p < 0.001$) showed significant differences in rate of occurrence in relation to the type of memory. The highest frequency of these aspects was associated with the SEpE also in this epoch. An increasing frequency can be observed for activity, location, presence of self, emotion and other participants associated with the increasing complexity of the memory reported, with these aspects appearing more frequently when associated with SEpE. On the contrary, the frequency of occurrence for location and participation of self did not differ. Regarding gender significant effect on memory types was found ($Chi^2_{(4)} = 12.73$; $p = 0.01$). In particular, females reported General Semantic Memory and Single Episodic Events more frequently than males. Looking at Table 7, it is possible to note that most of the female memories were Single Episodic Events (48.7%) and the least reported type of memory were Perceptual Visual Fragments (0.9%). Males also reported Single Episodic Events more frequently (34.6%) and Visual Perceptual Fragments less frequently (2.8%). However, males reported more Perceptual Visual Fragments, Episodic Fragments, and Repeat Episodes than females.

Table 7. Frequencies of the different types of memories reported by females and males in epoch 2 (the different types of memory reported are 224).

Gender	Type of Memory				
	Perceptual-Visual Fragment (n = 4)	**General Semantic Memory (n = 26)**	**Episodic Fragment (n = 37)**	**Repeated Episode (n = 63)**	**Single Episodic Event (n = 94)**
Females	0.9%	15.4%	11.1%	23.9%	48.7%
Males	2.8%	7.5%	22.4%	32.7%	34.6%

4. Discussion

The present research had two purposes. The first was to investigate how the earliest memories develop during the infantile amnesia period, considering the difference between first and second epoch. Our interest was to better understand the development of early childhood memories, distinct in their different typologies, based on their recollection in terms of characteristics and contents of experiential awareness. The second purpose was to examine the content characteristics of the events (presence of activity, location, self, emotions, other participants); in particular, we assumed that the presence of emotions could be an important feature of the first rudimental form of autobiographical memory. We also analyze any gender differences in the type of events. We classified five types of memories: Perceptual Visual Fragment, General Semantic Memories, Episodic Fragment, Repeated Episode, and Single Episodic Event. We wanted to verify whether these different types of memory were indicators of early forms of memory and whether they play a predictive role in the development of episodic memory, that is an indispensable requirement for autobiographical organization. The results obtained confirm our hypothesis and allow for interesting suggestions regarding the characteristics of remembering during the period of infantile amnesia.

4.1. Pattern of Recall during the First and Second Epoch

Overall, the analyses show a pattern of age-related increase in the remembering of memories. During the second epoch, the frequency of memory generally increases with a notable presence of complete episodic events, particularly around 5 years of age. These data confirm what is widely known about infantile amnesia.

The regression analyses (see Tables 1 and 2) consider the remembering based on different types of memory and show that the presence of incomplete or semantic memories (PVF, GSM, EpF, REp is inversely related to the memory of single episodic events (SEpE)). In other words, the participants reported elements of Perceptual-Visual Fragments, General Semantic Memories, Episodic Fragments, and Repeated Events (daily routines) when a well-organized episodic memory still did not emerge. The co-occurrence of SEpE with other types of memory remains low for all types of memories considered. This result suggests that when the episodic system begins to assume a role of organizer of the experience, it becomes the most relevant form of memory and superimposes itself on less structured forms of remembering.

It should be noted that the participants were explicitly asked to report events from their childhood. The reports obtained show that they recalled any memory, even when it consisted only of perceptual fragments without a well-defined narrative or general semantic memories. This phenomenon is also quite frequent and widely discussed in autobiographical memory studies [73,74]. When a specific event is not (or poorly) remembered, it is somehow reconstructed by appealing to semantic aspects of our memory. In the remembering process the memory systems work in an integrated way, making the best use of the information available from different systems in terms of their developmental maturation. The presence of semantic memories and memories linked to daily routines confirms the important role played by the semantic system in the genesis of autobiographical memory. Barsalou [33] has already observed the role that general or repeated events play in the recovery of one's past. The events of daily life, despite their apparent irrelevance, consti-

tute the substratum of the child's knowledge and the prerequisites for the construction of the identity and awareness of one's self [75,76]. Memories of trivial events are generally re-elaborated and grouped into general categories (i.e., semantized). Only the relevant events are subsumed in self-awareness as representations of crucial or salient moments of one's life.

A particularly interesting aspect to discuss is the presence of memories with a prevalent perceptual component (Perceptual Visual Fragment, PVF). This component probably fosters the construction of a mental image and could play a fundamental role in giving strength to the first forms of subjective experience and their remembering. We know that the Perceptual Representation System (PRS) develops before declarative memory from an ontogenetic point of view and, therefore, precedes the maturation of semantic and episodic systems [77,78]. PRS could be considered a sort of long-term visuospatial sketchpad, like a type of proto-memory from which the first representations, which later will become part of declarative memory, are built. Starting from these first primarily perceptive traces, a more structured organization develops to elaborate traces of memories as a complete event with a space-time contextualization. Our data confirm that visual mental imagery plays a fundamental role in the first remembering processes involved in autobiographical memory [3,79].

The presence of Repeated Events is almost always involved in the subjective sense of remembering [66,80]; its age-related increase could be a crucial factor in the development of autonoetic experience [81,82]. This ability reflects a growing ability to describe personal events from the perspective of the self [48], with contextual details (i.e., recalling not only what happened but also where, when, and how, with some phenomenological features [83]). Moreover, the presence of Repeated Events underlines the link between semantic and episodic memory in the autobiographical narratives: semantic memory "guarantees" stability to repeated events which, precisely because of this feature, will become autobiographical narrative. In this sense the autobiographical memory demonstrates how semantic and episodic system must be understood as complementary [84].

From a developmental point of view the memory of a single and specific event is certainly an indicator of a maturation process that involves other cognitive abilities in parallel with memory [85]. The achievement of a good narrative ability is an essential requirement for the offset of infantile amnesia and the emergence of a coherent autobiographical organization. So, we are more likely to think that the offset of infantile amnesia should not be placed with the emergence of the first autobiographical memories but with the presence of fragment memories that represent the most rudimentary and primitive basis for autobiographical memory.

4.2. Characteristics of Event Reports

The second aim of this study was to analyze the characteristics of the different types of remembering. A significant difference between Single Episode Event (SEpE) vs. other types of remembering emerged for activity, other participants, and emotions. For all these contents the percentage is close to 100% but the other types of remembering are also present with a high frequency. The findings of this study lead to the conclusion that the difference in frequency with which certain contents appear also emerges in relation to the qualitative aspects of the memories. The presence of emotions deserves a separate reflection, since it is one of the areas we wished to consider in our study. From the data obtained, a marked difference in frequency of emotion emerged between all the categories and the single episodes of memory. These data are in line with our hypothesis. It is probable that emotional salience consolidates memory traces and widens the temporal window within which an event has the possibility of being integrated into the autobiographical narrative schema [86–88].

A last interesting aspect is linked to gender differences. In particular, females reported General Semantic Memory and Single Episodic Events more frequently than males. In literature there is a large number of studies that document gender differences in autobiographical

memory may (for a review see [89]). Such differences could reflect the importance narrative style during childhood by parents [42] and consequentially the role of sociocultural aspects in the construction of autobiographical memory [90].

4.3. Limits and New Directions for Future Studies

This research has attempted to broaden the data regarding the genesis of autobiographical memory during childhood, although we are well aware of the problems that this type of experimental research presents. A critical element is linked to the different samples of events in the two epochs; this difference did not allow for a fine-grained statistical comparison.

A second critical aspect is related to the dating of childhood memories, which does not allow us to state the time of each event with absolute certainty.

A third critical aspect is linked to the self-reported memories. We can never be certain that the events reported are an expression of the authentic experience or are mixed by other sources of information. This problem requires a broader reflection regarding the characteristics of our remembering in episodic system. Autobiographical memory benefits greatly from a collective narrative (friends, relatives, familiar environments) and these collective remembering supports the organization of memory system as a whole.

Further developments in this research area could take several directions. One could concern a more specific study of the relationship between early childhood memories and quality of emotions, positive or negative. Another very interesting line of research could explore the relationship between autobiographical memory and temporal cognition during childhood.

5. Conclusions

Autobiographical memory is a subtype of episodic memory that depends on a wide range of cognitive skills such as the emergence of a cognitive self and the development of language. It assumes a fundamental role in the process of self-awareness and in general in the development of consciousness.

Generally, in infantile amnesia research, participants are simply asked to provide their single earliest memory. But what do earliest memories mean? A complete event? A routine? Semantic knowledge? These questions have inspired our research and can be summed up with just one: Does autobiographical memory develop as a consequence of other memory systems? Our research confirms the special status of episodic memories from the preschool years, covering the period of infantile amnesia, as well as the assumption that the development of the first forms of autobiographical remembering mainly relies on the interplay of more basic systems [19,42,91].

During the two periods of infantile amnesia, we observed that episodic recollection certainly begins to take shape, but autobiographical memory never concerned the first 2 years and only rarely appeared between 2 and 6 years of age.

Our results agree with Tulving's theory [8,91,92] that the end of infantile amnesia corresponds with the emergence of episodic memory at 4–5 years of age. First memories are, in fact, mainly fragment recollection and are semantic, whereas complete episodic memories predominantly emerge at the end of the preschool period [93–95]. This experimental evidence is in favor of a differential genesis of the different memory systems reproducing the ontogenesis of memory systems according to the model proposed by Tulving [82,96].

The cohesion between multiple types of remembering constitutes the basis of autobiographical memory. This network of subjective experiences and semantic schematizations represents the foundation forming the history of one's life and one's identity.

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References

1. Conway, M.A.; Bekerian, D.A. Organization in autobiographical memory. *Mem. Cognit.* **1987**, *15*, 119–132. [CrossRef]
2. Conway, M.A.; Rubin, D.C. The structure of autobiographical memory. In *Theories of Memory*; Collins, A.E., Gathercole, S.E., Conway, M.E., Morris, P.E.M., Eds.; Lawrence Erlbaum: Hove, UK, 1993; pp. 103–137.
3. Conway, M.A. Memory and the self. *J. Mem. Lang.* **2005**, *53*, 594–628. [CrossRef]
4. Rubin, D.C. *Autobiographical Memory*; Cambridge University Press: Cambridge, UK, 1986.
5. Rubin, D.C. *Remembering Our Past: Studies in Autobiographical Memory*; Cambridge University Press: New York, NY, USA, 1996.
6. Prebble, S.C.; Addis, D.R.; Tippett, L.J. Autobiographical memory and sense of self. *Psychol. Bull.* **2013**, *139*, 815–840. [CrossRef]
7. Tulving, E. *Elements of Episodic Memory*; Claredon Press: Oxford, UK, 1983.
8. Tulving, E. Memory and consciousness. *Can. Psychol.* **1985**, *25*, 1–12. [CrossRef]
9. Bauer, P.J. A complementary processes account of the development of childhood amnesia and a personal past. *Psychol. Rev.* **2015**, *122*, 204–231. [CrossRef]
10. Fivush, R. Subjective perspective and personal timeline in the development of autobiographical memory. In *Understanding Autobiographical Memory: Theories and Approaches*; Berntsen, D., Rubin, D.C., Eds.; Cambridge University Press: Cambridge, UK, 2012; pp. 226–245.
11. Tulving, E. Episodic Memory and Autonoesis: Uniquely Human? In *The Missing Link in Cognition: Origins of Self-Reflective Consciousness*; Terrace, H.S., Metcalfe, J., Eds.; Oxford University Press: New York, NY, USA, 2005; pp. 3–56.
12. Crovitz, H.F.; Schiffman, H. Frequency of episodic memories as a function of their age. *Psychon. Bull. Rev.* **1974**, *4*, 517–518. [CrossRef]
13. Fivush, R.; Hammond, N.R. Autobiographical memory across the preschool years: Toward reconceptualizing childhood amnesia. In *Knowing and Remembering in Young Children*; Fivush, R., Hudson, J.A., Eds.; Cambridge: New York, NY, USA, 1990; pp. 223–248.
14. Hayne, H.; Jack, F. Childhood amnesia. *Adv. Rev.* **2011**, *2*, 136–145. [CrossRef]
15. Bauer, P.J.; Larkina, M. Childhood amnesia in the making: Different distributions of autobiographical memories in children and adults. *J. Exp. Psychol. Gen.* **2014**, *143*, 597–611. [CrossRef]
16. Freud, S. Progetto di una Psicologia e altri scritti. In *Opere*; Musatti, C., Ed.; Bollati Boringhieri: Torino, Italia, 1892–1899; Volume 2.
17. Alberini, C.M.; Travaglia, A. Infantile Amnesia: A Critical Period of Learning to Learn and Remember. *J. Neurosci.* **2017**, *37*, 5783–5795. [CrossRef]
18. Hayne, H.; Imuta, K. Episodic memory in 3- and 4-year-old children. *Dev. Psychobiol.* **2011**, *53*, 317–322. [CrossRef]
19. Howe, M.L.; Courage, M.L.; Edison, S.C. When autobiographical memory begins. *Dev. Rev.* **2003**, *23*, 471–494. [CrossRef]
20. Madsen, H.B.; Kim, J.H. Ontogeny of memory: An update on 40 years of work on infantile amnesia. *Behav. Brain Res.* **2016**, *298*, 4–14. [CrossRef] [PubMed]
21. Haigh, S.N.; Robinson, E.J. What children know about the source of their knowledge without reporting it as the source. *Eur. J. Dev. Psychol.* **2007**, *6*, 318–336. [CrossRef]
22. Yang, B.W.; Deffler, S.A.; Marsh, E.J. A comparison of memories of fiction and autobiographical memories. *J. Exp. Psychol. Gen.* **2022**, *151*, 1089–1106. [CrossRef] [PubMed]
23. Pillemer, D.B.; White, S.H. Childhood events recalled by children and adults. *Adv. Child Dev. Behav.* **1989**, *21*, 297–341.
24. Rubin, D.C. The distribution of early childhood memories. *Memory* **2000**, *8*, 265–269. [CrossRef]
25. Jack, F.; Hayne, H. Childhood amnesia: Empirical evidence for a two-stage phenomenon. *Memory* **2010**, *18*, 831–844. [CrossRef]
26. Tustin, K.; Hayne, H. Early memories come in small packages: Episodic memory in young children and adults. *Dev. Psychobiol.* **2016**, *58*, 852–865. [CrossRef]
27. Fivush, R. Constructing narrative, emotion, and self in parent-child conversation about the past. In *The Remembering Self: Construction and Accuracy in the Self-Narrative*; Neisser, U., Fivush, R., Eds.; Cambridge University Press: New York, NY, USA, 1994; pp. 136–157.
28. Fivush, R.; Schwarzmueller, A. Children remember Childhood: Implications for childhood amnesia. *Appl. Cogn. Psychol.* **1988**, *12*, 455–473. [CrossRef]
29. Welch-Ross, M.K. An integrative model of the development of autobiographical memory. *Dev. Rev.* **1995**, *15*, 338–365. [CrossRef]
30. Morrison, C.M.; Conway, M.A. First words and first memories. *Cognition* **2010**, *116*, 23–32. [CrossRef] [PubMed]

31. Conway, M.A.; Pleydell-Pearce, C.W. The Construction of Autobiographical Memories in the Self-Memory System. *Psychol. Rev.* **2000**, *107*, 261–288. [CrossRef] [PubMed]
32. Harley, K.; Reese, E. Origins of autobiographical memory. *Dev. Psychol.* **1999**, *35*, 1338–1348. [CrossRef] [PubMed]
33. Barsalou, L.W. The content and organization of autobiographical memories. In *Remembering Reconsidered: Ecological and Traditional Approaches to the Study of Memory*; Neisser, U., Winograd, E., Eds.; Cambridge University Press: Cambridge, UK, 1988; pp. 193–243.
34. Newcombe, N.S.; Lloyd, M.E.; Ratliff, K.R. Development of episodic and autobiographical memory: A cognitive neuroscience perspective. *Adv. Child Dev. Behav.* **2007**, *35*, 37–85. [PubMed]
35. Rubin, D.C.; Wetzler, S.E.; Nebes, R.D. Autobiographical memory across the adult lifespan. In *Autobiographical Memory*; Rubin, D.C., Ed.; Cambridge University Press: Cambrdige, UK, 1986; pp. 202–221.
36. Rubin, D.C.; Schulkind, M.D. The distribution of autobiographical memories across the lifespan. *Mem. Cogn.* **1997**, *25*, 859–866. [CrossRef]
37. Tustin, K.; Hayne, H. Recollection improves with age: Children's and adults' accounts of their childhood experiences. *Memory* **2019**, *27*, 92–102. [CrossRef]
38. Aydin, C.; Conway, M.A. Cultural self-goals influence how much is remembered from early childhood events. *J. Pers.* **2020**, *88*, 794–805. [CrossRef]
39. Bohanek, J.G.; Fivush, R.; Walker, E. Memories of positive and negative emotional events. *Appl. Cogn. Psychol.* **2005**, *19*, 51–66. [CrossRef]
40. Peterson, C.; Morris, G.; Baker-Ward, L.; Flynn, S. Predicting which childhood memories persist: Contributions of memory characteristics. *Dev. Psychol.* **2014**, *50*, 439–448. [CrossRef]
41. Fivush, R. The stories we tell: How language shapes autobiography. *Appl. Cogn. Psychol.* **1998**, *12*, 483–487. [CrossRef]
42. Nelson, K.; Fivush, R. The emergence of autobiographical memory: A social cultural developmental theory. *Psychol. Rev.* **2004**, *111*, 486–511. [CrossRef] [PubMed]
43. Usher, J.A.; Neisser, U. Childhood amnesia and the beginnings of memory for four early life events. *J. Exp. Psychol.* **1993**, *122*, 155–165. [CrossRef] [PubMed]
44. McKee, R.D.; Squire, L.R. On the development of declarative memory. *J. Exp. Psychol. Learn. Mem. Cogn.* **1993**, *19*, 397–404. [CrossRef] [PubMed]
45. Moscovitch, M.; Cabeza, R.; Winocur, G.; Nadel, L. Episodic Memory and Beyond: The Hippocampus and Neocortex in Transformation. *Annu. Rev. Psychol.* **2016**, *67*, 105–134. [CrossRef]
46. Moscovitch, M.; Nadel, L.; Winocur, G.; Gilboa, A.; Rosenbaum, R.S. The cognitive neuroscience of remote episodic, semantic and spatial memory. *Curr. Opin. Neurobiol.* **2006**, *16*, 179–190. [CrossRef]
47. Conway, M.A. Episodic memories. *Neuropsychologia* **2009**, *47*, 2305–2313. [CrossRef] [PubMed]
48. Fivush, R. Owning Experience: The development of subjective perspective in autobiographical memory. In *The Self in Time: Developmental Perspective*; Moore, C., Lemmon, K., Eds.; Erlbaum: Hillsdale, MI, USA, 2001; pp. 35–52.
49. Renoult, L.; Davidson, P.S.R.; Palombo, D.J.; Moscovitch, M.; Levine, B. Personal semantics: At the crossroads of semantic and episodic memory. *Trends Cogn. Sci.* **2012**, *16*, 550–558. [CrossRef]
50. D'Argembeau, A.; Salmon, E. The neural basis semantic and episodic forms of self-knowledge: Insights from functional neuroimaging. *Adv. Exp. Med. Biol.* **2012**, *739*, 276–290.
51. Li, S.; Callaghan, B.L.; Richardson, R. Infantile amnesia: Forgotten but not gone. *Learn. Mem.* **2014**, *21*, 135–139. [CrossRef]
52. Artioli, F.; Cicogna, P.C.; Occhionero, M.; Reese, E. "The people I grew up with": The role of sociodemographic factors in early memories in an Italian sample. *Memory* **2012**, *20*, 189–197. [CrossRef]
53. Bauer, P.J.; Wenner, J.A.; Dropik, P.L.; Wewerka, S.S. Parameters of remembering and forgetting in the transition from infancy to early childhood. *Monogr. Soc. Res. Child Dev.* **2000**, *65*, 1–204. [CrossRef]
54. Bauer, P.J.; Leventon, J.S. Memory for one-time experiences in the second year of life: Implications for the status of episodic memory. *Infancy* **2013**, *18*, 755–781. [CrossRef]
55. Bouyeure, A.; Noulhiane, M. Episodic memory development in normal and adverse environments: The importance of critical periods. In *Factors Affecting Neurodevelopment*; Martin, C.R., Preedy, V.R., Rajendram, R., Eds.; Academic Press: Cambridge, MA, USA, 2021; pp. 517–527.
56. Jabès, A.; Nelson, C.A. 20 years after "The ontogeny of human memory: A cognitive neuroscience perspective," where are we? *Int. J. Behav. Dev.* **2015**, *39*, 293–303. [CrossRef]
57. Bruce, D.; Wilcox-O'Hearn, L.A.; Robinson, J.A.; Phillips-Grant, K.; Francis, L.; Smith, M.C. Fragment memories mark the end of childhood amnesia. *Mem. Cognit.* **2005**, *33*, 567–576. [CrossRef] [PubMed]
58. Salaman, E. *A Collection of Moments: A Study of Involuntary Memories*; Longman: London, UK, 1970.
59. Bruce, D.; Phillips-Grant, K.; Wilcox-O'Hearn, L.A.; Robinson, J.A.; Francis, L. Memory fragments as components of autobiographical knowledge. *Appl. Cogn. Psychol.* **2007**, *21*, 307–324. [CrossRef]
60. Hassabis, D.; Maguire, E.A. Deconstructing episodic memory with construction. *Trends Cogn. Sci.* **2007**, *11*, 299–306. [CrossRef]
61. Kingo, O.S.; Berntsen, D.; Krøjgaard, P. Adults' earliest memories as a function of age, gender, and education in a large stratified sample. *Psychol. Aging* **2013**, *28*, 646–653. [CrossRef]

62. Tulving, E. Episodic and semantic memory. In *Organization of Memory*; Tulving, E., Donaldson, W., Eds.; Academic Press: New York, NY, USA, 1972; pp. 381–403.
63. Tulving, E. Organization of Memory: Quo Vadis? In *The Cognitive Neurosciences*; Gazzaniga, M., Ed.; MIT Press: Cambrige, USA, 1996.
64. Peterson, C.; Nguyen, D.T.K. Parent–child relationship quality and infantile amnesia in adults. *Br. J. Psychol.* **2010**, *101*, 719–737. [CrossRef]
65. Conway, M.A. A structural model of autobiographical memory. In *Theoretical Perspectives on Autobiographical Memory*; Springer: Dordrecht, Germany, 1992; pp. 167–193.
66. Conway, M.A. Sensory–perceptual episodic memory and its context: Autobiographical memory. *Phil. Trans. R. Soc. Lond. B* **2001**, *356*, 1375–1384. [CrossRef]
67. Rubin, D.C.; Baddeley, A.D. Telescoping is not time compression: A model of the dating of autobiographical events. *Mem. Cogn.* **1989**, *17*, 653–661. [CrossRef]
68. Wang, Q.; Peterson, C. Your earliest memory may be earlier than you think: Prospective studies of children's dating of earliest childhood memories. *Dev Psychol.* **2014**, *50*, 1680–1686. [CrossRef] [PubMed]
69. Wang, Q.; Peterson, C. The Fate of Childhood Memories: Children Postdated Their Earliest Memories as They Grew Older. *Front. Psychol.* **2016**, *6*, 2038. [CrossRef] [PubMed]
70. Scarf, D.; Boden, H.; Labuschagne, L.G.; Gross, J.; Hayne, H. "What" and "where" was when? Memory for the temporal order of episodic events in children. *Dev. Psychobiol.* **2017**, *59*, 1039–1045. [CrossRef] [PubMed]
71. Reese, E.; Jack, F.; White, N. Origins of adolescents' autobiographical memories. *Cogn. Dev.* **2010**, *25*, 352–367. [CrossRef]
72. Ece, B.; Demiray, B.; Gülgöz, S. Consistency of adults' earliest memories across two years. *Memory* **2019**, *27*, 28–37. [CrossRef]
73. Wells, C.; Morrison, C.M.; Conway, M.A. Adult recollections of childhood memories: What details can be recalled? *Q. J. Exp. Psychol.* **2014**, *67*, 1249–1261. [CrossRef]
74. Renoult, L.; Rugg, M.D. An historical perspective on Endel Tulving's episodic-semantic distinction. *Neuropsychologia* **2020**, *2*, 139. [CrossRef]
75. Conway, M.A.; Justice, L.V.; D'Argembeau, A. The Self Memory System Revisited: Past, present. and future. In *The Organization and Structure of Autobiographical Memory*; Mace, J., Ed.; Oxford University Press: Oxford, UK, 2019; pp. 28–51.
76. Willoughby, K.A.; Desrocher, M.; Levine, B.; Rovet, J.F. Episodic and semantic autobiographical memory and everyday memory during late childhood and early adolescence. *Front. Psychol.* **2012**, *3*, 53. [CrossRef]
77. Schacter, D.L.; Tulving, E. What are the memory systems of 1994? In *Memory Systems*; Schacter, D.L., Tulving, E., Eds.; MIT Press: Cambridge, MA, USA, 1994; pp. 1–38.
78. Squire, L.R. Declarative and nondeclarative memory: Multiple brain systems supporting learning and memory. *J. Cogn. Neurosci.* **1992**, *4*, 232–243. [CrossRef]
79. Greenberg, D.L.; Rubin, D.C. The Neuropsychology of Autobiographical Memory. *Cortex* **2003**, *39*, 687–728. [CrossRef]
80. Dewhurst, S.A.; Conway, M.A. Pictures, images, and recollective experience. *J. Exp. Psychol. Learn. Mem. Cogn.* **1994**, *20*, 1088–1098. [CrossRef] [PubMed]
81. Piolino, P.; Desgranges, B.; Eustache, F. Episodic autobiographical memories over the course of time: Cognitive, neuropsychological and neuroimaging findings. *Neuropsychologia* **2009**, *47*, 2314–2329. [CrossRef] [PubMed]
82. Tulving, E. Multiple memory systems and consciousness. *Hum. Neurobiol.* **1987**, *6*, 67–80. [PubMed]
83. Ramsarana, A.I.; Schlichtingb, M.L.; Frankland, P.W. The ontogeny of memory persistence and specificity. *Dev. Cogn. Neurosci.* **2019**, *36*, 100591. [CrossRef]
84. De Brigard, F.; Umanath, S.; Irish, M. Rethinking the distinction between episodic and semantic memory: Insights from the past, present, and future. *Mem. Cogn.* **2022**, *50*, 459–463. [CrossRef]
85. Bauer, P.J.; Larkina, M. Predictors of age-related and individual variability in autobiographical memory in childhood. *Memory* **2019**, *27*, 63–78. [CrossRef]
86. Holland, A.C.; Kensinger, E.A. Emotion and autobiographical memory. *Phys. Life Rev.* **2019**, *7*, 88–131. [CrossRef]
87. Montebarocci, O.; Surcinelli, P.; Rossi, N.C.F. Self-Defining and Early Childhood Memories: Subjective Intensity Rating of Memory-Related Emotions. *Am. J. Appl. Psychol.* **2016**, *5*, 32–37. [CrossRef]
88. Kensinger, E.A.; Ford, J.H. Retrieval of Emotional Events from Memory. *Annu. Rev. Psychol.* **2020**, *71*, 251–272. [CrossRef]
89. Grysman, A.; Hudson, J.A. The self in autobiographical memory: Effects of self-salience on narrative content and structure. *Memory* **2011**, *19*, 501–513. [CrossRef]
90. Fivush, R.; Habermas, T.; Waters, T.E.; Zaman, W. The making of autobiographical memory: Intersections of culture, narratives and identity. *Int. J. Psychol.* **2011**, *46*, 321–345. [CrossRef] [PubMed]
91. Tulving, E. Episodic memory: From mind to brain. *Annu. Rev. Psychol.* **2002**, *53*, 1–25. [CrossRef] [PubMed]
92. Wheeler, M.A.; Stuss, D.T.; Tulving, E. Toward a theory of episodic memory: The frontal lobes and autonoetic consciousness. *Psychol. Bull.* **1997**, *121*, 331–354. [CrossRef]
93. Farrar, M.J.; Goodman, G.S. Developmental changes in event memory. *Child Dev.* **1992**, *63*, 173–187. [CrossRef] [PubMed]
94. Farrar, M.J.; Boyer-Pennington, M.E. Remembering Specific Episodic of a Scripted Event. *J. Exp. Child Psychol.* **1999**, *73*, 266–288. [CrossRef] [PubMed]

95. Pillemer, D.B.; Picariello, M.L.; Pruett, J.C. Very long-term memories of a salient preschool event. *Appl. Cogn. Psychol.* **1994**, *8*, 95–106. [CrossRef]
96. Tulving, E. Memory: Performance, knowledge, and experience. *Eur. J. Cogn. Psychol.* **1989**, *1*, 3–26. [CrossRef]