

Where have all our (early) memories gone?*

In the landscape of autobiographical memory we find two interesting, apparently contrasting landmarks. First, *childhood amnesia*, the relative paucity of memories from early life experienced by adults, and second the '*reminiscence bump*' occurring in early adulthood. To start with the second: adults tend to recall a disproportionately large number of personal events from their adolescence and early adulthood. For instance, faces and voices of familiar persons from that period may still stand out crisp and clear even when 50 years have passed. It has been often argued that adolescence is an episode in life full of novel and interesting events. That are better encoded, and thus remembered than habitual or dull events. And since we have a tendency to talk more often about our interesting than dull moments in life, the events from early adulthood become even more firmly anchored in our episodic memory.

Another possibility however is that the capacity to store events in memory is generally enhanced in adolescence and early adulthood (see Jaap Murre's article). And that brain structures crucial for consolidation of events in episodic memory are operating at full gear in young adults. In addition effects of interference in particular proactive interference may play only a minor role, due to the relative paucity of memories from the preceding childhood period. This brings us to another remarkable autobiographical landmark, childhood amnesia.

Childhood amnesia has been a topic of substantial interest at least since its identification in the late nineteenth century. Research on memories and free recall studies found that people find it difficult to remember events before the average age of 3.5 years. This holds for adults as well as older children at the end of their first decade of life.

Can the fragility of early memories be attributed to incomplete encoding or consolidation, or to defective retrieval of initially intact memory events?

Some researchers like Patrica Bauer have advocated the idea that even infants are able to store events in long term memory, but then gradually lose the ability to retrieve these events when they grow older. Her idea was based on the discovery that even three-year-olds can retrieve events from earlier years in their life.

Could it be that in early childhood language is limited which makes it difficult to comprehend, rehearse and express our experiences? The offset of infantile amnesia (around 7 years) corresponds to the start of increased language development.

Perhaps the most plausible explanation is that networks in the maturing brain are not yet capable of formation of stable declarative memories. Findings derived from neurological patients show that memories of events that occurred several months prior to their head injury are also lost. Apparently consolidation of declarative memories may take quite some time, and information that has not yet been fully consolidated is lost. This suggests that childhood amnesia could also 'simply' reflect incomplete consolidation in episodic memory. It's not that the early memories of our infancy cannot be retrieved, they simply never had the chance to become fully established.

Indeed, from modern neuroscience we learn that development of memory systems in early childhood depends on a basic anatomical principle: the formation of molecular components of the synapse between nerve cells, a nerve and a receptor or a skeletal muscle. This occurs in concert with exuberant branching of axonal and dendritic tree branches. Although the key organizational features of the human *connectome* may already be completed after birth (see van den Heuvel), the substituent networks are still in an immature state and need further development to attain full functional connectivity.

If this view is correct, early development is accompanied by an increase in synaptic efficiency in widespread areas of the brain like the hippocampus, striatum, cerebellum and amygdala. Providing a common basis of maturation of all forms of learning (and memory): explicit and implicit, episodic as well as semantic, procedural and motor learning.

Which of course does not exclude different development trajectories, because different forms of memory/learning depend on different neural networks of different complexity. For example, episodic learning/memory would depend on a network involving regions like temporal cortex and hippocampus, procedural memory on a network involving motor cortex and basal ganglia. Since babies and young children have not yet reached 'full connectivity', they also lack the full capacity to store (or retrieve) information in their cortical networks. This holds for episodic memory (e.g. poor representations of specific events in time and place) as well as procedural memory (e.g. poor representations of motor programs, perceptual-motor skills). 'Poor representations' could imply either a) fragmentary or incomplete memory traces or b) temporary or unstable memory traces that fail to translate into permanent structural changes in the brain.

With respect to emotional memories it can be argued that only the 'hardwired' implicit forms of learning (such as conditioning) play a role during infancy. These forms of learning and memory are mediated primarily by structures in the limbic system, with the amygdala as nodal point. The conscious 'feeling' part of emotion probably develops a couple of years later in childhood, in concert with episodic memory and higher cortical connections. It's the distinction made by Anton Damasio between 'primary emotions' of early childhood and 'secondary emotions' that develop later in life.

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**this is an extended version of a contribution to the Question & Answer section of Research Gate.*

https://www.researchgate.net/post/Why_cant_humans_remember_things_and_experiences_from_the_early_phase_of_life_until_preschool_time#view=54202729d11b8b5b778b4694