

# Smell your Way Back to Childhood: Autobiographical Odor Memory

## Introduction

The olfactory sensory system is our oldest sense and also unique among the senses in synapsing directly with the amygdala-hippocampal complex, the neural structures supporting basic survival functions such as memory and emotion. A growing body of evidence suggests that memories evoked by odors differ from other memory experiences. The scope of this brief overview is to provide some illustrations of these differences.



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## Autobiographical memory

Autobiographical memory is memory for the events of one's life. Research indicates that the autobiographical memory knowledge base may be described as three layers of knowledge: lifetime periods that span periods of years or decades (e.g., my

life as a scientist); general events representing time periods of weeks and months (e.g., my time as a research fellow at the CAS); and finally event-specific knowledge comprising sensory-perceptual knowledge spanning periods of seconds, minutes, or hours (e.g., the spectacular CAS farewell dinner held at the Norwegian Academy of Science and Letters).

One approach to the study of autobiographical memory is the exploration of the age distribution of event-specific memories recalled across the whole life span. The typical procedure in this research is to expose subjects to different sensory cues (e.g., tar may be presented visually, verbally or as an odor). In instances when a memory is evoked, that must be well defined, the person is asked to date when the specific event took place. Extensive research on memory distributions across the life span using verbal cues has evidenced a remarkable stability across individuals (e.g., Rubin & Schulkind, 1997). The distribution comprises three unique components: childhood amnesia, the bump, and the recency effect. Childhood amnesia reflects the dramatic reduction in the number of memories reported from early childhood. In contrast, a substantially larger number of memories are recalled between the ages of 10 and 30, which has been termed the reminiscence bump. The third component, denoted recency, reflects better retention of events occurring from the last 10 years. The well-documented distribution of verbally cued autobiographical memories over the lifespan is displayed in Figure 1.

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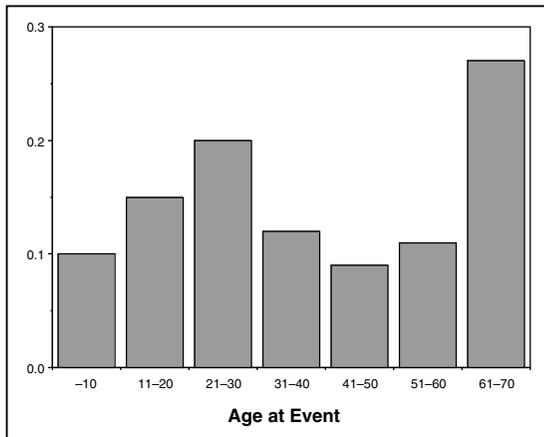


Figure 1. Distribution of verbally cued autobiographical memories over the lifespan.

A number of theories have been advanced to explain the “bump” phenomenon such as that the life period involves a high degree of dynamics illustrating that late youth and early adulthood is a time during which identity formation is a key process (e.g., education, marriage, children), resulting more memories being encoded. Another potential explanation is that the cognitive capacities are at an optimum level between the ages of 10 and 30. The relatively few memories reported from the childhood period are most likely due to the fact that the brain structures subserving personal memories are not fully developed.

As noted above, most of the available evidence on autobiographical memory is based on verbal cuing and knowledge is sparse regarding how other sensory cues influence recollection of personal events. In a recent study (Willander & Larsson, 2004), we found that memories evoked by odors differ from memories associated with verbal and visual information. Specifically, in contrast to the well-established memory peak in young adulthood, olfactorily evoked memories were associated with an earlier period in life – childhood. That is, when a memory was evoked by an odor (e.g., cinnamon, tar), the event was typically reported as having occurred when the person was between the ages of 5 and 10 years. The memory distribution obtained for odors is shown in Figure 2.

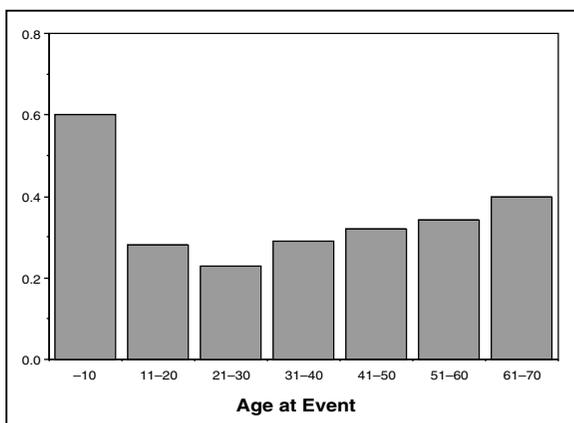


Figure 2. The memory distribution obtained from odors.

Furthermore, our participants also reported that the content qualities of autobiographical memories evoked by odors and words were different.

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Odor-evoked memories were associated with stronger feelings of being brought back in time, thought of, and spoken of less often, as compared with memories evoked by the verbal cues. In addition, olfactorily evoked memories were more often experienced with an emotional connotation as compared with their verbal analogue.

Why, then, are odor-associated memories older? We know that the olfactory sense is our oldest sensory system, both from a phylogenetical and ontogenetical perspective. It is a system that is highly active early in our lives and our chemosensory knowledge is often based on events that we experienced early in life. For example, chemosensory learning is already present in the womb and infants interact primarily with the environment through the chemical senses: smell and taste. Even though we do not think about it in our daily lives, we know exactly how most objects and materials would “taste” and “smell” if we were to place them in our mouths (e.g., the sensation of sand, a plastic bag, or a cloth).

It is possible that each sense has a “critical” period during which information in that system is processed more effectively. These periods may in turn reflect the evolution of the sensory systems. We know that the proportion of the brain that processes olfactory information decreases with increasing complexity of a species’ neural complexity. This may also be reflected in human development – from fetus, infant, child, to adult.

### References

- Rubin, D. C., & Schulkind, M. D. (1997). The distribution of memories across the life span. *Memory and Cognition*, 25, 859-866.
- Willander, J., & Larsson, M. (2004). *Smell your way back to childhood: Autobiographical odor memory*. Manuscript submitted for publication.