
Design Recommendations for Augmented Memory Systems

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Abstract

This paper explains the concept of Autobiographical memory (AM), the process of remembering and gives design recommendations for Augmented Memory Systems.

Keywords

Autobiographical memory, recollecting memories, cuing recall, augmented memory systems

ACM Classification keywords

H.5 Information interfaces and presentation (e.g. HCI): H.5.1. Multimedia Information Systems and H.5.2 User Interfaces

Introduction

Most people are actively dealing with their personal memories. Reminiscing is a recurring process, continuously shaping people's personal histories and identities.

The aim of this paper is to answer the following questions. How does the recollection of memories work? And how can we develop an augmented memory system that can help people to recollect their personal memories?

Autobiographical Memory

For the topic presented in this paper, concerning people who are recollecting personal experiences, Autobiographical Memory (AM) is the most relevant long-term memory type. The definition of AM is "memory for the events of one's life" [4], which includes all the memories people have that have something to do with themselves.

Functions of Autobiographical Memory

Six functions of Autobiographical Memory can be distinguished [2]:

1. The construction and maintenance of the self-concept (who you think you are) and self-history (what you have experienced in life), shaping the personal identity;
2. Regulating moods, e.g. when someone is feeling blue it can help to think of positive memories;

3. Making friends and maintaining relationships by sharing experiences, e.g. sharing personal memories with someone else, can result in hearing about personal memories from the other person, creating a bond;
4. Problem-solving based on previous experiences, e.g. if someone encounters a problem, memories are used as input to solve or overcome the problem;
5. Shaping likes, dislikes, enthusiasms, beliefs and prejudices, based on remembered experiences;
6. Helping to predict the future based on the memories of the past.

Note the wide range of functions, from solely internal usage, to communication between people. For an augmented memory system it is important to know which one of these functions should be supported. In addition it is useful to know how memories are thought to be retrieved from memory, which will be explained in the next section.

Recollection Retrieval Theory

The Constructionist Approach [6] is a theory for recollection retrieval, which describes a constantly adapting memory system. Since memories change connections between ideas and concepts, mainly recent events, patterns and unique events are stored. By repeating or rehearsing events (talking about them or experiencing similar events several times, such as eating breakfast every day) the connections get stronger (e.g., between cereals and breakfast). This explains why a person remembers information relating to her expertise with less effort compared to new information; the ideas, concepts and connections are already present.

Memory recall happens by means of reconstruction. Because of this reconstruction process memories change over time according to current knowledge and

beliefs and no two recollections of a specific event are the same [3]. Forgetting occurs when reconstruction is no longer possible due to too many adaptive changes. Currently, the constructionist approach is taken forward by the majority of memory researchers. This theory is supported by both psychological and neurophysiological investigations [6].

Cuing Memories

The fact that people reconstruct events indicates that the memory itself cannot be stored in an augmented memory system, because a person is needed to recreate this memory every time someone wants to recollect. In order to help people reconstruct one can cue memories and these cues could be stored in an augmented memory system. A cue (or trigger) is a stimulus that can help someone to retrieve information from Long-Term Memory, but only if this cue is related to the to-be-retrieved memory. The stimuli most often used in studies are photos, smells or text labels. But anything could be a cue (a spoken word, a color, an action or a person), as long as there is a link between the cue and the to-be-remembered event. A combination of cues increases the chance of retrieving a memory, especially when a subject in a cued-recall experiment has to perform activities, which have to be remembered later, such as to write with a pen or close a door [1,5].

What kind of cues might work best for memory retrieval? Three memory-type categories exist on this topic, namely context-, state- and mood-dependent memory [1]. All three are based on overlap of internal or external conditions during the encoding of a memory and the retrieving of the same memory. The first example is called the encoding-specificity principle [13]

and falls within the category context-dependent memory [1]. Both principle and category refer to the idea that a memory is easier to retrieve if the physical context during retrieval is (partly) the same as the physical context during encoding. A famous example (Godden and Baddeley, 1975 in [1]) shows that divers who learned words under water recalled more words when they were under water again instead of on the beach and vice versa.

The second category explaining a relation between cue and retrieval result, is called state-dependent memory, including the state-dependency effect [1]. This category does not focus on the external context of the person remembering, but the internal one, which is tested often with participants who are drugged or drunk. In general, it appears that when something is learned when drunk, it is best remembered when drunk.

The third and last category is called mood-dependent memory, which states that retrieval is best if the mood at recall is similar to the mood at encoding, because of hypothesized distinct emotion modes [9]. Summarizing, an augmented memory system for recollection of everyday memories benefits most from the first category mentioned above, the context-dependent memory cues. Such cues could consist of anything physically related to the external context of the to-be-remembered event, ranging from photos to sounds to physical objects.

Forgetting

Sometimes cuing does not help recalling a specific memory, and then one might speak of forgetting. Although forgetting is not yet understood completely, there is evidence in support of cue-dependent forgetting, which means that memories are still present

in memory but they cannot be accessed, i.e. the right cues cannot be found [12].

Relevant literature

For an extensive overview of literature on Augmented Memory systems, take a look at [8]. Because of space limitations only the conclusions of this overview will be given here.

The number of studies on augmented memory systems shows that the topic of helping people remember is a popular one. Despite the popularity none of the studies mentions (Autobiographical) Memory theory or used it to inform their design. Most studies (except two [7,10]) therefore do not (explicitly) identify that cues are important for recollecting, nor do they use the different levels of specificity of memories.

The majority of examples focus on "recording" memories and not on "retrieving", which could be based on "cuing" or "reconstructing" them. Some studies do not even make a distinction between these processes, perhaps assuming that the process of recording memories can automatically make people recollect.

Design Recommendations

The following design recommendations (R) are based on our own research [8] and form an extension of recommendations given by Stevens et al. [11]. During the workshop we can expand more on the following recommendations:

R-I Include souvenirs in an augmented memory system since physical souvenirs can form context-dependent memory cues.

R-II Choose explicitly whether some of the functions of Autobiographical Memory should be supported by the augmented memory system and use them as input for the design.

R-III Choose which part of the remembering process should be supported by the augmented memory system: recording and/or retrieving memories. Design the chosen part also with the requirements of the complementary part in mind.

R-IV An augmented memory system should not necessarily present recorded material as the "only" instantiation of what really happened, since this might interfere with the experience of remembering of the user.

R-V Create a metadata system that can be changed easily by the user to support changing memories.

Conclusions

This paper shows on the basis of Autobiographical Memory theory that personal memories can change over time, which means that „absolute“ memories cannot be stored in a device. One way of dealing with these changes is presenting memory *cues*, which is a stimulus that can help memory recall. With a cue a person gets a hint towards a memory but the person can (unconsciously) decide what he wants to remember. These cues could consist of souvenirs, photos, sounds, smells, text and they could be collected in a device that could then support recollecting.

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