

## Chapter XIII

# Building Digital Memories for Augmented Cognition and Situated Support

**Mathias Bauer**

*mineway GmbH, Germany*

**Alexander Kröner**

*German Research Center for Artificial Intelligence (DFKI GmbH), Germany*

**Michael Schneider**

*German Research Center for Artificial Intelligence (DFKI GmbH), Germany*

**Nathalie Basselin**

*German Research Center for Artificial Intelligence (DFKI GmbH), Germany*

### ABSTRACT

*Limitation of the human memory is a well-known issue that anybody has experienced. This chapter discusses typical components and processes involved in the building and the exploitation of augmented memories. SPECTER, an adaptive, self-learning system supports the user in everyday activities by interpreting sensor information captured in the environment and deriving adequate suggestions for actions to be taken in the current situation. A particular form of introspection allows the user to reflect on the digital memory's contents and the system behavior; thus leaving the user in control. An empirical study in a shopping scenario evaluates the benefits and limitations of the approach taken.*

## INTRODUCTION

Limitation of the human memory is a well-known issue that anybody has experienced. Do you remember how the colleague you just met was dressed, how much you paid for your television, what you prepared this year for dinner to your various guests, which books you looked at the last time you visited a bookstore, and, by the way, when exactly was it again? Human sensory, short-term and long-term memories appear to have limitations or problems which disable us to store and retrieve all data.

Human sensory memory consists of a buffer in which items perceived are stored. There exists one per perception channel (e.g. view, touch). The storage time usually lasts 200 to 500 ms after the perception of an item. George Sperling conducted several studies and reported that sensory memory could store a maximum of 12 perceived items, but, because of the fast degradation of this memory, only a few could actually be memorized and reported by the subjects (Sperling, 1960).

While limitations of the short-term human memory are still controversial, views argue that short-term memory would have capacity- and / or time-limitations. According to Miller (Miller, 1956) this memory would have limitations regarding enumerations of more than seven items plus or minus two or, according to more recent research (Henderson, 1972), the upper capacity limit would rather be between 3 and 5 chunks. In addition, memory has various biases such as for instance the one to remember rather the first or last items of an enumeration than the ones in between. Diverse strategies therefore allow for dealing with these issues. While the storable number of chunks would be limited, the easiest way to remember a long number or list of letters is, according to Herbert Simon, to divide them into chunks of three letters or numbers. Phone numbers are indeed usually divided into chunks of three or two numbers. To cope with the time limitation of the short-term memory, rehearsal of

chunks is an efficient way to store them longer into the short-term memory.

Long-term memory problems have also been studied and categorized into “seven sins” by Schacter (2001). Three of the seven sins involve forgetting: “transience”, i.e. the decreasing ability to access memory over time, “absent-mindedness”, i.e. lapses of attention and forgetting to do things, and “blocking”, i.e. temporary inaccessibility of some data. Three other sins involve distortion problems: “misattribution”, i.e. a right memory is associated with a wrong source or one believes to have seen or heard something while this is not the case, “suggestibility”, i.e. implanting of misinformation via leading questions for instance, and “bias”, i.e. distortion of past memories by current knowledge. The seventh sin is of less interest for the purpose of this chapter since it consists of “persistence”, i.e. pathological inability to forget, which can happen after a traumatic-stress. In order to cope with the usual memory problems, people often resort to memory aids such as sticky notes and mnemonics.

Some of the previously mentioned limitations of the human memory can be addressed by exploiting one of the strengths of computers: the ability to store huge amounts of information for an unlimited time without loss of precision. And actually, state-of-the-art mobile devices in general provide features for creating reminders, linking notes to time and dates, and for managing time.

However, these techniques require the user to capture this data manually, and thus the quality of such memories greatly depends on her cognition and carefulness (please note that throughout this chapter we will refer to the user of our system in the female form.). These issues can be addressed by capturing and recording the desired data *automatically* within an intelligent environment. Such records can then be used not only to augment the user’s memory, but also to enable new types of user support, such as contextual reminders or reflection on missed opportunities. This chapter provides a discussion of various challenges related

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