“I know who, but not how many!” – Forgetting in Collaborative Settings

Christoph Oemig, Tom Gross

Human-Computer Interaction Group, University of Bamberg, Germany

Abstract

Forgetting is a natural mechanism that keeps our memory from overloading. In the past it had a large influence on the design of Human-Computer Interaction. Yet, its main focus was on single user tasks and systems. Collaborative settings introduce the secondary task of coordination which has to share the already scarce capacity of the working memory with the knowledge of the primary task. Secondary task knowledge is critical to a team’s success but stored subconsciously, i.e., it can be easily lost due to interruption or interference. Therefore, a solid understanding of forgetting in collaborative settings is expected to have strong implications on the design of collaborative systems. This paper presents our first steps towards the goal applying an exploratory experiment observing primary and secondary task knowledge in a shared task. The results show how secondary task knowledge finds its way to stay alive.

1 Introduction

The human memory and it subsystems have had a strong influence on Human-Computer Interaction (HCI) research and resulting systems. For instance, already in the early days the Model Human Processor (Card et al. 1986) helped to calculate task times. Nowadays, especially the working memory plays an important role in interaction design. Its largest limitation is its capacity (Miller 1956). Forgetting is a natural mechanism to face this limit. In computing, forgetting algorithms were designed for a wide range of purposes: they help filtering instant messages (Seifert et al. 2007) or facilitate the calculation of interest curves as part of recommender systems (Chen et al. 2014). Forgetting even became a core feature of the currently popular social app *Snapchat* (Bayer et al. 2016). Here, it contributes the major incentive to conceal personal information.

One of the first to study the mechanisms of forgetting was Hermann Ebbinghaus (1885). He used self-experiments (memorisation of letter chunks) and visualised the results as graphs known as “forgetting curves”. These illustrate the memory’s retention over time. He found the best methods for mitigating forgetting to be better memory representations (mnemonic techniques) and active repetition/rehearsal. Yet, collaborative settings have never been analysed using forgetting curves. They are known to introduce the user to the secondary task of coordination right next to the primary task itself (e.g., working on a shared document). Consequently, the capacity of the working memory is not only limited but has to be shared among primary and secondary task knowledge. Making things worse, secondary task knowledge is critical to a team’s success, yet, it is not stored intentionally but subconsciously as opposed to primary task knowledge. Rehearsing, as Ebbinghaus suggests, is not an option. Additionally, interruptions and interferences have a devastating impact on its recall. The general idea is now to gain a solid understanding of forgetting in collaborative contexts deriving implications that help with the design of collaborative systems. In this paper we present our initial steps on how we approached the issue of forgetting in the context of a sample collaborative task. It describes how we conducted a small and simple exploratory experiment. Its goal was to jointly observe and analyse the forgetting of primary and secondary task knowledge using forgetting curves. The approach is briefly described as well as some of the key findings. Finally, we discuss the results and outline upcoming next steps.

2 Approach

Conducting his self-experiments, Ebbinghaus never considered secondary task knowledge. Doing so requires a collaborative task. For primary and secondary task knowledge our approach needs to measure how much of each knowledge type is lost over time. The result will be depicted as forgetting curve (one for each type of task knowledge). To gain even deeper insights the secondary task knowledge can be subdivided into knowledge about a user’s own activities and the knowledge about the activities of others. We borrowed our collaborative task from the *Standardized Coordination Task Assessment (SCTA)* (Oemig & Gross 2011). Here, a group of participants has to count individual letters inside a shared document. During the task the group has to coordinate its counting efforts. The participants are also required to share their results with the group. These are recorded using the letter, timestamp, and participant name. To determine the status of forgetting we suspended the counting task to query each participant. As in the original SCTA approach, the questions are based on the recorded counting results. The participants were asked to complete a list of letters stating how many of a certain letter were counted (primary task knowledge) and by whom (secondary task knowledge). To make it more difficult the list also contained letters that were not counted at all (secondary task knowledge). Since the results also recorded who originally counted the letters, the list of answers returned by the participants can be analysed in terms of self and group knowledge. Yet, in contrast to the original SCTA we did not record the response times. Another difference is that we also queried and considered primary task knowledge. This is mainly done to be able to compare the forgetting curves for primary and secondary task knowledge. The forgetting curve diagram itself shows the percentage of correct answers on the y-axis and the time elapsed since the start of the task on the x-axis.

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3 Smoke Test & Findings

For a smoke test on the entire procedure we chose a pen and paper setup. We invited four participants (age 28 to 45, 50% male, 50% female) to engage the counting task in pairs. They were allowed to coordinate and to take notes. They were also expected to share their results. The times the experiment was suspended were a) in the middle of the task, b) directly after finishing the task, c) 30 minutes afterwards, and d) 2 hours afterwards (cf. Figure 1).

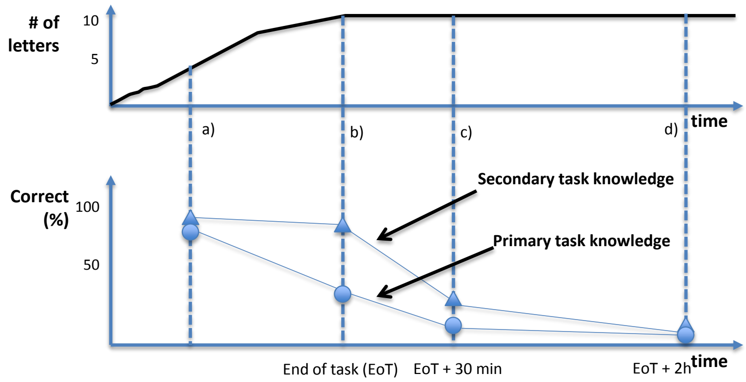

Figure 1: Forgetting curves for primary and secondary task knowledge.

At point a) four letters were counted. The recall of primary and secondary knowledge was the highest here. The recall of secondary task knowledge worked better than that of primary task knowledge. At point b) ten different letters were counted in total. While the recall of secondary task knowledge still worked well, we saw a significant drop for the primary task knowledge. Reaching point c) the primary task knowledge was nearly gone and also the secondary task knowledge was at lower levels. At point d) both knowledge types were nearly gone. An interview after the test revealed that most of the participants agreed that they still knew who counted the letter but they forgot how many of them. They stated that they told their partner the counting result, wrote it down and forgot about it. They had no further use for this information while the secondary task knowledge still helped them to coordinate. Another statement made by one participant regarding the secondary task knowledge was that “I knew I did not count that letter, therefore it had to be him”. This basically explains why the levels of self and group knowledge have been nearly equally high throughout the test. A larger group of participants will probably eradicate the opportunity of this kind of conclusion. Overall, taking notes obviously relieved the working memory from primary task knowledge leaving more room for the secondary. The reason for high values for the primary task knowledge at point a) is likely to be sufficient capacity of the working memory (in accordance with Miller’s 7+/- 2 chunks).

4 Discussion

In this paper we briefly outlined the significance and the research gap regarding forgetting in collaborative settings. Here, measuring forgetting helps gaining a deeper understanding especially of the secondary task knowledge. The latter has to share the already limited capacity of the working memory with primary task knowledge. However, as our small experiment showed, the secondary task knowledge stayed longer in the working memory than the primary task knowledge, since it was continuously useful for coordination while maintaining its small memory footprint. Yet, the experiment also revealed room for improvements: the group size for the counting task needs to be increased at least by one so that the knowledge about the group cannot be directly inferred from the knowledge of one self. Another issue we have not covered yet, is interruption or interference. Since secondary task knowledge is not stored intentionally we expect it to be very vulnerable to interruptions. Forgetting curves will surely help illustrating this effect. Being able to measure the impacts on secondary task knowledge sets the ground for explicitly answering the questions on how to rehearse or cue secondary task knowledge to let computer-supported cooperative work be more successful and efficient.

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Authors

Prof. Dr. Tom Gross, tom.gross(at)uni-bamberg.de, T. +49 951-863-3940
Christoph Oemig, MSc., coemig(at)acm.org