Forms of memory: Investigating the computational basis of semantic-episodic memory interactions
Neville, D.A.

Citation for published version (APA):

General rights
It is not permitted to download or to forward/distribute the text or part of it without the consent of the author(s) and/or copyright holder(s), other than for strictly personal, individual use, unless the work is under an open content license (like Creative Commons).

Disclaimer/Complaints regulations
If you believe that digital publication of certain material infringes any of your rights or (privacy) interests, please let the Library know, stating your reasons. In case of a legitimate complaint, the Library will make the material inaccessible and/or remove it from the website. Please Ask the Library: http://uba.uva.nl/en/contact, or a letter to: Library of the University of Amsterdam, Secretariat, Singel 425, 1012 WP Amsterdam, The Netherlands. You will be contacted as soon as possible.
Chapter 6
The present thesis investigated how the memory systems related to the processing of semantic and episodic information combine to generate behavioural performance as measured in standard laboratory tasks. Across a series of behavioural experiment I looked at different types of interactions between semantic and episodic memory systems and discussed the results in light of current global models of memory.

Chapter 2 reported a series of experiments aimed at assessing the existence of long-term repetition priming effects for subliminal words, that is words that were processed without the focus of attention. By means of a masking procedure, subjects first studied a list of subliminal primes in an unrelated lexical decision task and were subsequently tested on their recognition memory for these items in perceptual identification and recognition tasks. The observed results clearly indicated the presence of long-term repetition priming for subliminal primes. An explanation of this finding was proposed in SAM-REM in terms of the automatic updating of the lexical-semantic trace with contextual features extracted during the study phase. As discussed in Chapter 5, the mechanism proposed in the REM model for implicit memory, REM-I, can provide a plausible computational explanation of the subliminal long-term priming effect found.

Chapter 3 focused on a more elaborate experimental procedure, namely a state-trace experiment. The goal of this experiment was twofold. On the one hand we were interested in testing if behaviour across lexical decision and recognition, two tasks generally associated, respectively, with semantic and episodic forms of memory processing, would be supportive of a multi-dimensional explanation. On the other hand, we wanted to investigate specific aspects of the underlying processing components and their relation with memory dimensionality. This was done by combining the analytical approach offered by Bayesian state-trace analysis with modelling of choice reaction time data via the ballistic accumulator model. Results indicated support for a multi-dimensional model of memory across lexical decision and recognition tasks. More importantly, the results showed that changes in memory dimensionality were reflected in changes in the rate at which information is accumulated (i.e. drift rate) and in the amount of information needed to make the decision (i.e. threshold). All together these results show that memory dimensionality is reflected in changes in the quality of information thus indicating a different deployment of memory resources across lexical decision and recognition tasks.
We elaborated in the fifth chapter of the present thesis on how a model based on the ACT-R framework such as RACE/A could explain this pattern of results by positing different accumulation processes for semantic and episodic information.

Chapter 4 instead focused more closely on the functional organization of semantic memory. In the first experiment I looked at whether priming effects could be obtained in a standard lexical decision tasks for both objects with semantic meaning (words, morphemes) and objects with no semantic meaning (letters). Results indicated that the repetitions of words and morpheme led to reliable priming effects (both in accuracy and reaction times) whereas the repetition of letter strings led to only a negative priming effect in reaction times. These findings clearly show that only semantically meaningful objects are represented in semantic memory. In the second experiment I investigated if manipulations of normative frequency for word and letters would produce repetitions priming effects and possibly interactions. The observed results indicated, in line with previous studies, a main effect of normative word frequency with an interaction with item repetitions. Subjects were found to process high frequency words more accurately and faster than low frequency words. Normative letter frequency instead was found to be only marginally significant, with only a small decrease in reaction times for high frequency letters over low frequency letters and only for low-frequency words. Overall the combined results of these two experiments show that only objects bearing semantic content are represented in lexico-semantic memory and, more importantly, that these representations are functionally organized hierarchically. The discussion in Chapter 5 of these results provided a more principled analysis of this point and elaborated on how models of memory, and in particular connectionist models, incorporate and explain this aspect of semantic memory.

Chapter 5 presented a model based discussion of the reported findings of experimental chapters 2, 3 and 4. After introducing the modelling frameworks of interest, SAM-REM, ACT-R and connectionism, the empirical results from each of the experimental chapters were discussed in turn in relation to each memory model. The goal of this model based discussion was to identify fundamental computational principles shared across different frameworks which might explain the interactions between semantic and episodic memory. From the preliminary discussion of Chapter 5 the interactions between memory systems as observed in this thesis seem to conform to standard general principles: probabilistic retrieval of information from long-term
memory and a rational decision process for the evaluation of available evidence. On the basis of the different interactions observed across experiments and of model-based considerations derived from global models of memory, a novel assumption was also proposed; namely the need for a model of memory interactions which specifies how different memory resources are configured given a specific task-set. In slightly different terms, the novel assumption being proposed here is that the interaction between semantic and episodic memory is structured in a hierarchical fashion. Therefore a model of their interaction is needed to disentangle different theories of how the interaction is itself hierarchically structured.

The last and concluding chapter, chapter 6, presented an overview of the complete thesis with a brief summary of the major points for each individual chapter. The overarching goal of the present thesis was to provide a principled investigation of how the semantic and episodic dimensions of memory combine (with different characteristics) to produce well-known behavioural effects in laboratory tasks such as lexical decision, perceptual identification and recognition. The basis for evaluating alternative explanations regarding the configuration of the underlying memory resources was provided by current global models of memory.

In conclusion I would like to propose that the inner nature of memory systems is something flexible, highly dynamic and ultimately liquid. Their functional aspects can be crystallized in a well-specific configuration, depending on the demands of the both the external and internal environments. This makes memory systems temporary static, less dynamic, and solid. However, to fully understand how the different parts of memory interact with each other, how this static configuration comes to be, one has to appreciate not only one configuration, but as many as possible. Only by comparing different configurations of the same system one can get an impression of how different between memory states (i.e. configurations) relate to different observed behaviours and, more importantly how they originated from the same underlying structure.

If human memory is a bucket filled with water with a block of ice floating on atop, than understanding how the ice interacts with the water is one of the most thrilling questions of modern research on memory.