

Much current research of memory focuses on the question of 'what memory is for'. That research strives to understand human memory systems by asking how they have been adapted, through evolutionary pressures, to promote decisions that serve survival (fitness) goals. Clearly, retrieving particular memories can improve decisions by increasing the chance that reward would be obtained or decreasing the chance that a loss would be incurred. For example, remembering a recent incident of an upset stomach after carnival might induce me to go home and cook rather than buy street food. Indeed, it is the case that to some extent, current theories of decision-making and memory use the same mathematical equations to predict both recall and choice.

Decision theories have not been sufficiently informed by research on human memory processes. For example, attentional and retrieval processes – key to memory success – are entirely missing from existing work on how memory biases decision. One reason for this is that existing quantitative models of memory focus on memory for emotionally-neutral stimuli, while computational theories of decisions focus on choice between stimuli that are associated with reward and punishment, which have obvious emotional value. For these two fields to properly cross-fertilise we need a mathematical model of memory of rewarding and punishing stimuli. Nathaniel Daw (ND - Princeton) is an internationally renowned expert in decision-making; Deborah Talmi (DT – Manchester) is an expert in human emotional memory. Recently, we have spent a year together and developed a mathematical model of memory for emotional stimuli¹.

One objective for our research programme, going forward, is to flesh out the memory model. We can achieve this objective by conducting empirical memory experiments, using tasks that are more strongly linked to the relevant decision scenarios. For example, so far the model has been tested using emotionally-evocative pictures, but it really needs to be tested with stimuli that predict reward or punishment. ND will collaborate with DT on objective 1, bringing in theories of decision making and choice to inform the development of the memory model, and test more directly how the same manipulations result in parallel effects on recall and choice.

The second objective is to understand how these memory processes play out in guiding decisions - the consequences of the emotional modulation of memory for evaluation, action, and planning. Data from work towards objective 1 can be used to develop decision models; but this will require including ND as a co-investigator, with staff jointly supervised and partly based in Princeton (even if paid through Manchester). We are contacting the Trust for guidance on whether this will be permissible, given that only DT is a UK-based applicant.

¹ Talmi, D., Lohnas, L., & Daw, N. (submitted). Emotional modulation of episodic memory. *Psychological Review*.
<http://www.biorxiv.org/content/early/2017/08/14/175653>