Letters

Evidence for temporal decay in short-term episodic memory

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In their article, 'No temporal decay in verbal short-term memory', Lewandowsky, Oberauer and Brown [1] omit any mention of work suggesting an important functional role for decay in episodic memory and showing that decay is detectable with sufficiently sensitive behavioral measures [2,3] (see also Refs [4–6]).

The functional argument for decay is simply that interference is so potent an influence that the system would grind to a halt without some kind of garbage collection process running in the background. Like garbage collection in software systems, decay is effective to the extent it cleans up pervasively and automatically and is only minimally obtrusive.

To measure decay behaviorally, one approach is to probe the memorandum repeatedly across the retention interval to detect any trend in its accessibility over time. In our procedure, the memorandum is a simple task to be performed on each of a sequence (or 'run') of trials. On each trial, a stimulus is presented (commonly a digit) and the participant responds according to the current task (either to judge the digit as even or odd, or to judge it as higher or lower than five). The correct task for the current run is randomly selected and is cued only at the start of the run, so has to be stored in episodic memory. Response time (RT) and accuracy are measured on each trial, and decay of memory for the current task is reflected in an increase in RT and error rate over successive trials in a run. These 'within-run effects' are small – a few milliseconds per trial, in terms of RT – but are readily detectible because of the repeated measurements. They do not seem to be expectancy effects, as they occur even with a flat hazard function for the end of the run [3]. They do not seem to be speed-accuracy tradeoffs, which would require speed and accuracy to change in opposite directions.

This procedure also allows decay to be separated from retroactive interference (RI). When average run length is manipulated, either between blocks of runs [2] or between participants [3], the slopes of within-run effects change, becoming steeper the shorter the average (condition) run length. RI from trial-related processing cannot cause this change because RI on a given trial should depend only on the position of that trial within the run, not on the average run length in that condition. In our model, this and other effects emerge from a signal-detection representation of episodic memory in which the current task is the signal, proactive interference from previous runs is the noise, a high-pass activation threshold is the response criterion and decay of activation is represented as the signal distribution shifting gradually leftwards along the abscissa [3].

The case against decay seems to require both mooting the functional argument for garbage collection and offering an alternative account of within-run and other effects generated by the experimental procedure sketched earlier – a comprehensive set of which are reproduced by our cognitive simulation, which actually represents and thus has to contend with effects of proactive interference building up over time [3].

References

1 Lewandowsky, S. *et al.* (2009) No temporal decay in verbal short-term memory. *Trends Cogn. Sci.* 13, 120–126
2 Altmann, E.M. and Gray, W.D. (2002) Forgetting to remember: the functional relationship of decay and interference. *Psychol. Sci.* 13, 27–33
3 Altmann, E.M. and Gray, W.D. (2008) An integrated model of cognitive control in task switching. *Psychol. Rev.* 115, 602–639
4 Anderson, J.R. and Milson, R. (1989) Human memory: an adaptive perspective. *Psychol. Rev.* 96, 703–719
5 Schooler, L.J. and Hertwig, R. (2005) How forgetting aids heuristic inference. *Psychol. Rev.* 112, 610–628
6 Anderson, J.R. and Schooler, L.J. (1991) Reflections of the environment in memory. *Psychol. Sci.* 2, 396–408

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