More is less: Increased Processing for Unwanted Memories

Every day from the minute we wake up in the morning to when we fall asleep each night, we are constantly bombarded by information. How do we determine what’s important to keep memories of and what should be forgotten? The ability to forget is a key aspect of successful memory by discarding information that is no longer relevant or useful to us. This includes forgetting processes that are automatic, but also other types of forgetting that we have more deliberate control over – in some instances, we have the ability to intentionally weaken specific memories. How do we do this?

Until now many studies have shown that by drawing attention away from or disengaging with an unwanted memory, this will encourage forgetting1. Our recent research has revealed, paradoxically, that by drawing more attention to a memory you’re trying to forget, you’ll be more successful at doing so. Inside an MRI scanner, we showed participants pictures of faces and scenes followed by an instruction to remember or forget the previously shown picture. We recorded their brain activity during this task using functional magnetic resonance imaging and we used machine learning techniques to measure how strongly they processed information related to each picture.

For this analysis, we decoded patterns of brain activity in a region of the brain that is particularly sensitive to face and scene categories called the ventral temporal cortex. This provided a quantitative index of how participants engaged with their memories of these pictures when they were instructed to remember or to forget them. We were surprised to find that the strength of engagement with the picture memory increased after a Forget instruction, in comparison to a Remember instruction. The results suggested that participants engaged more with their memory of the picture when asked to forget it relative to when they were asked to remember it. This finding is consistent with recent research suggesting that intentional forgetting is more effortful than remembering.

How does the increased engagement with an unwanted memory relate to forgetting? We found that when people engage a memory “just enough”, not too little, and not too much, this produces the most successful forgetting. If you engage too much, the memory gets strengthened – if you engage too little, the memory isn’t modified at all. But if you engage a moderate amount, this can weaken the memory and lead to forgetting. This relationship is predicted by a memory theory known as the nonmonotonic plasticity hypothesis2 which describes a U-shaped relationship between memory activation and learning, such that moderate levels of activation lead to memory weakening. Our previous work showed that memories can be unintentionally forgotten when they happen to be moderately activated3, and the present results extend these findings by showing that people can deliberately forget by intentionally promoting moderate activation.

These results confirm that there’s a way of thinking about memories that can have a deliberate impact on whether these memories are later remembered or forgotten. The intention to forget leads to greater engagement with an unwanted memory, and this can render it vulnerable to automatic memory weakening mechanisms in that brain that produce forgetting. Gaining a better understanding of how people can leverage this forgetting mechanism could pave the way for powerful new therapies to mitigate the effects of trauma, e.g. in PTSD.

Anderson, M. C., & Hanslmayr, S. (2014). Neural mechanisms of motivated forgetting. *Trends Cogn Sci*, *18*(6), 279–292. <https://doi.org/10.1016/j.tics.2014.03.002>

Newman, E. L., & Norman, K. A. (2010). Moderate excitation leads to weakening of perceptual representations. *Cereb Cortex*, *20*, 2760–2770. <https://doi.org/10.1093/cercor/bhq021>

Lewis-Peacock, J. A., & Norman, K. A. (2014). Competition between items in working memory leads to forgetting. *Nat Commun*, *5*, 5768. <https://doi.org/10.1038/ncomms6768>