THE BRIGHT SIDE OF MEMORY ERRORS

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On several occasions in 2001, following the attacks the World Trade Centre on 9/11, US President George Bush said he remembered watching on TV the first plane crashing into the Towers. However, at the time there was no footage of the first plane crash, so his recollection could not be accurate. He was told about the crash, but did not watch it on TV. More recently, in 2015, presidential candidate Donald Trump said he remembered witnessing large crowds of Muslims celebrating the 9/11 attacks in New Jersey. There is no evidence that such a celebration occurred, although there was a rumour at the time that some Muslims had cheered at the news of the terrorist attack. This rumour was never confirmed, and later proved false.

It is natural to interpret memory errors like these—where a person misremembers the details of a past event—as showing that the person who makes the error is poor at remembering things, or at least poorer at remembering things than other people. If the person is a new mother, you might conclude that they have "baby brain". If the person is over a certain age, you might conclude that their memory is declining. In any case, you are likely to take evidence of the memory error to provide reason for reducing the trust that you place in the person who makes the error, perhaps looking for other, more trustworthy people to depend upon for information.

This could be a serious mistake. If Bush misremembers details of how he learnt about the first plane crashing into the World Trade Centre, you have reason not to trust his description of that event. If Trump misremembers seeing large crowds of Muslims cheering, you should not take his word about the reaction Muslims had after the attacks. But it can be a mistake to infer from evidence that people have made a memory error that they are less reliable at remembering things than other people or their younger selves, or that they are generally an unreliable source of information.

These points become clearer when we consider the recent discussion of memory errors in cognitive science. It is now widely recognised that memory errors are often the result of the ordinary ways that the human brain operates. It is generally accepted that memories are *reconstructed*. Memory systems do not act like storehouses, retaining complete records of events in the past in discrete files. Instead, they store traces of information about events. These traces of information are recombined at the point when a person remembers an event, *constructing* a memory of the event. Because memory systems construct representations of the past from traces, and there are gaps to be filled, they are prone to error: for instance, traces of information from different events can be combined in ways that inaccurately reflect the past.

We all have reconstructive memory systems. Consequently, we are all highly susceptible to making the types of memory errors that result from the process of reconstruction. When we make these errors, we should not be assumed to be less reliable than other people at remembering the past because other people are also susceptible to making these errors. We should not be assumed to be less reliable than our former, younger selves, because they too were susceptible to making the same errors. If other people judge us in these ways, then they are being overly harsh.

REASON FOR PESSIMISM?

We might get quite pessimistic at this point. The picture of human memory sketched by the cognitive sciences might be interpreted as indicating that we should not trust anyone because we are all susceptible to making memory errors. In fact, there are good reasons to resist this pessimism. First, it is consistent with memory systems being reconstructive that they very frequently, even most of the time, produce true memories of the past. In order to navigate our physical and social environments, we need to be able to learn from past experiences. The fact that we make our way around our physical and social worlds largely successfully suggest that our memory systems often construct memories of the past that are reliable. Reconstructive memory systems are clearly not infallible because they produce errors, but this does not mean that they are not highly reliable, producing accurate memories under many circumstances.

Second, some of our memory errors can increase our overall fitness and even boost our psychological wellbeing. For instance, memories of the past that are biased and self-enhancing lead us to remember our past selves better than we really were at the time (e.g. smarter). This allows us to form an unrealistically positive view of ourselves which may support our motivation to continue pursuing our goals after setbacks rather than give up, and thus improves our resilience in critical situations and our chances of success in fulfilling our goals.

Third, and perhaps most surprisingly, the very features of the human brain that make us prone to memory errors can also put us in a good position to gain knowledge about the world by making us good at gathering and processing information. To illustrate this point, let us focus in on two commonly discussed memory errors.

ADVANTAGES OF RECONSTRUCTIVE MEMORY

One error that has been the focus of intense debate in psychology and legal theory, in large part due to the work of University of California, Irvine psychologist Elizabeth Loftus, is the post-event *misinformation effect*. When this effect occurs, memories are updated to reflect false information that is received *after an event*. The effect has been widely discussed within the legal and forensic context as it is argued that claimants

and eyewitnesses are susceptible to being influenced by false information, for example through suggestive police questioning, and consequently provide false testimony. Clearly, the misinformation effect can be deeply problematic, leading us to have and report false beliefs about events that we experienced. In a criminal context, this can involve people being falsely accused or acquitted of serious crimes.

However, it is important to notice that recent explanations of the misinformation effect suggest that the mechanisms leading to the effect can, under some circumstances, increase the chance of gathering and storing accurate information. Neuroscientists tell us that, when the memory of an event is recalled, the information stored in the memory is reactivated, and there is a period during which new information about that event can be incorporated into the memory—this process has been labelled *reconsolidation*.

In a bad case, the new information about the event that is incorporated into the memory is false, leading to the misinformation effect. It is likely that something similar happened to the recollections of 9/11 reported by Bush and Trump. Bush might have heard reports about the first plane crashing and incorporated that story into his own experience of 9/11 ("I *saw* the crash"). Similarly, Trump might have heard the rumour about crowds of Muslims celebrating and incorporated that story in his own recollection of how people reacted on the day ("I *saw* crowds cheering"). In the such examples, the information added to the memory is inaccurate.

However, in good cases, reconsolidation allows existing memories to be updated to reflect the most recent information that we have about an event, and that information is accurate. Imagine, for example, that you have met your new colleague James while walking through your workplace. You decide to make eye contact, smile and say hello. However, James ignores your efforts, avoids eye contact, and walks on by. You form the impression that James is rude. You think to yourself that he is not going to be a good colleague. You later meet another colleague and friend, Rita. She tells you that James has just received some bad news about a family member. At this point, your memory of the original event (meeting James and being ignored by him) is reactivated and the new information (James had just received bad news) is incorporated. You no longer remember that James behaved in a rude way, but remember instead that he looked distracted and upset. The information that is stored and ready for retrieval at the end of this process does not accurately reflect your experience of the initial event but it does reflect the most up to date information available to you. You are able to update your impression of your new colleague so that it is not inappropriately negative about his personal characteristics. What this example illustrates is that the brain mechanisms that produce the misinformation effect also enable us to form beliefs that reflect up to date information.

There is another common memory error, known as the Deese-Roediger-McDermott (DRM) illusion because it was initially studied by James Deese in the 1950s and then

again by Henry L. Roediger III and Kathleen McDermott in the 1990s. Deese, and Roediger and McDermott conducted experiments in which participants were presented with a list of words that had a related meaning (e.g. *baker, butter, filling, brown, dough, grain, flour, knife, wheat, old)* and then asked to recall the items on the list. Participants systematically claimed to have studied items that were not on the list but were related in meaning to those that were. In a related experiment by Brewer and colleagues in 1981, participants spent some time in an office context and then asked what they saw in the office. They claimed to have seen items that were not present but are commonly found in offices. Inside and outside of experimental settings we can believe that we encountered items that we did not, and therefore have false memories.

Mistakenly thinking that you encountered items that you did not can prevent you from having knowledge about your environment. But there are two explanations of the DRM illusion, both of which suggest that the features of the human brain that sometimes lead us to mistakenly think that we encountered items can also lead us to gain knowledge.

The first explanation is that the encounters with items that are closely related to each other trigger the concepts of related items. Thoughts about bakers, butter, and fillings, for example, trigger the thought of bread. Then, mistakenly, we remember the concept being triggered but misidentify the memory, thinking that it is a memory of encountering the item.

On this explanation, the DRM illusion is due to the way that the mind comes to associate items with each other. It is also due to the way that exposure to some items triggers thoughts about related items. These tendencies can help us to gain knowledge. If items are associated with each other because they have been encountered in the same place and time, e.g. they have all been encountered in an office, then they are likely to be encountered together again. Associating the items with each other allows us to predict what we are likely to find in our environment. If we are in a new workplace, for example, we associated the items that we encounter with other items that we are likely to encounter, because they are frequently found in offices. This will enable us to predict what we are likely to find in the novel environment. Making such associations can allow us to predict features of our environment.

The second explanation of the DRM illusion proposed within cognitive science is that the information about the items that are encountered is represented in two different ways in the mind. The mind records each of the items (e.g. each office item) and separately records the common theme linking all the items (office items). The memory of the common theme outlasts the memory of the specific details. If we try to recall the specific items after the memory with the details has faded we depend upon our memory of the common theme. For instance, the memory that there were office items can be used to determine which specific items we encountered. Errors occur

when our memory systems fill out details about the items that we have encountered in a way that fits with the memory of the common theme of the items (e.g. with office items) but includes items that were not present.

On this explanation of the DRM illusion, the formation of memories that reflect a common theme among the items we encountered and the dependence upon that memory are the source of the memory error. Once again, this feature of human memory systems can help us to gain knowledge. Human memory only has limited storage capacity, so it is not efficient for it to store details about each of the items encountered in an environment, which is why the details fade. But the common theme of the items can be contained in a compact record; it does not require much storage capacity and therefore lasts longer. Once details fade, the compact, abstract memory of the common theme provides an important source of information: it is possible to make an inference from the common theme we remember to the specific details that we experienced. For instance, it is possible to infer from the memory of being surrounded by office items that we were near a desk. The memory of the common theme can also support further abstract thinking, inference and convergent thinking.

Take the example of Antonia. She has been given a shopping list by her partner, but she misplaces the list after briefly looking at it. She does not recall the specific items on the list but has formed a memory of the common theme of the items on the list: they were ingredients for a cake. Based on her memory of this common theme, she buys eggs and flour. She buys eggs because they are cake ingredients, not because 'eggs' was on the list. 'Eggs' was not on the list, because she already has eggs at home. However, Antonia's formation of the memory of the common theme (cake ingredients) and her dependence on that memory allows her to buy flour, which was one of the items on the list and is one of the ingredients she needs. Using the memory of the common theme, Antonia can also engage in further reasoning: she can conclude that her partner is planning to bake a cake, that she is going to have something tasty after tea, that she does not have to buy dessert, and so on.

So the features of the human brain that lead it to produce some of the most commonly discussed memory errors also enable us to gain knowledge. Memories of past events can be updated with new information. Information that might otherwise be lost can be retained. Predictions can be made about items that are likely to be found in an environment. We can engage in abstract reasoning. Each of these outcomes can be both the result of the features of the human brain that cause common memory errors *and* sources of knowledge.

Now let us consider our opening examples of memory errors. It might be natural to think that Bush's and Trump's memory of what happened in 9/11 is unreliable, that they should not be trusted, and that other people are more reliable sources of information. But in fact they could be a good source of information on other matters because it is likely that the errors they made are due to the *ordinary* ways that *all*

human brains work. Other people could have made similar errors, and indeed there is a vast literature on flashbulb memories and false testimonies concerning events such as 9/11.

Some of our memory errors are likely to be the product of a feature of the human brain that enables us to gain information, through updating our existing memories, retaining information that might be lost, and engaging in abstract reasoning. Rather than being a sign that we are less reliable than we used to be, or less reliable than other people, our memory errors can simply be due to the ordinary operation of features of the mind that allow us to navigate the world.