Memories are Imaginary Stories

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When I recently discussed a meeting that had been held two weeks earlier with the attendees, I was not surprised that there was no agreement about the contents and conclusion. Each person was convinced that the others had poor memories and that his recollection was more accurate. No doubt each of us had a similar experience. Some remembered the meeting as a brain storming session to explore ideas, while others thought it concluded with an unambiguous decision. A manager might be remembered as promising a raise if a certain goal was met, while he might remember the idea only as a possibility. Why does a shared event result in such wildly different memories of the event? This is not a trivial question.

Perhaps you remember the childhood game of "telephone," where the first person whispers a story to the second person, who whispers the heard story to a third person, and so on. Everyone gets a good laugh when the story at the end of the chain is compared to the story that started the sequence. The starting and ending story appear to be completely unrelated. On each retelling, new errors and changes are introduced. Even over a one minute interval, memory fails: you cannot articulate accurately what you just heard.

Recently, I have been teaching a course on cognitive science and in preparation for the classes I have been reviewing the most recent research on what we are as a species. The most dramatic conclusion is that our self image of what it means to be human arises from a belief as to what we *should* be rather than what we *are.* Even though engineers know better, we like to think of our auditory memory as a sound recorder, and our visual memory as a camera. Nothing could be farther from the truth. Mechanical analogies are compelling but very misleading. The brain is not a computer; the visual memory is not a camera; the auditory memory is not a recording device.

BAD WEATHER PREDICTION

Our brains were not designed to be accurate; rather, they were designed to keep our ancient ancestors alive in a hostile world. Our ancestors had only a few goals: finding food, avoiding being eaten, and producing the next generation of children. Logic, rationality, and an accurate memory had nothing to do with survival. Over-estimating our memory of danger had more survival value than over-estimating safety. Hence, weather forecasters tend to predict the next big storm as massive, even if it turns out to be nothing more than a little rain. Survival is enhanced by overreacting to danger and underreacting to safety.

Over a lifetime, our eyes and ears are presented with more than 50,000 billion bits of information. Even if that information could be recorded, how would our brain find the useful information when needed? It is hard enough for me to find a document on my

computer from last year. The issue of memory is more about storing it in a way such it is available when relevant. The brain has to break an experience into “relevant” pieces and then connect each piece in such a way that you can find the useful pieces in a fraction of a second. Something has to give; accuracy is sacrificed for retrieval efficiency. When you day-dream, you are actually watching the brain follow associated connections of memory fragments. You think about an upcoming vacation, that links to last years vacation in the mountains, which links to a sudden storm, which links to the hole in your roof, which damaged your car, which links to the current price of gas, which links to the lack of an expected raise, and so on. The brain has its own retrieval logic. The same process takes place in a serious professional conversation.

MEMORY TYPES

Neuroscience research has conclusively shows that events are decomposed into thousands of “relevant” components, each of which is linked to an array of associated experiences. When you recall an event, the brain has to reassemble these pieces into a coherent picture. Essentially a memory is a re-creation not retrieval. You may not like this view of human brain, but you were not the designer of humanity.

To make sense of memory, we have to start with a broad definition: any experience that can influence future actions and decisions is effectively “remembered.” How it influences the future is not simple. Recall is only one manifestation of memory. There are two basic categories.

We have declarative and non-declarative memory. In the former category, the recall can be described in words, which is why his kind of recall is often called semantic memory. Within this category we have factual memory and autobiographical memory. Factual memory is simply what it says, such as our country has 50 states. Autobiographical memory is a personal experience, such as I had eggs for breakfast.

Facts actually arise from a personal experience. The first exposure might have been during a class when you were 6 years old. The biographic component eventually gets discarded. One can remember the “fact” but not the context and assumptions when it was learned.

Non-declarative memory is actually the more interesting case because it results when experiences change the brain so that the information can be used in a high speed non-conscious way. You may not be able to describe every turn in driving home each day but you can do it while thinking about other things. The route is remembered experientially but not declaratively. You can drive home easily but you may not be able to accurately describe each turn. Similar, you cannot readily describe how to ride a bicycle or give a lecture or hold a conversation or prepare a meal.

Emotional memory is central to all forms of information storage yet it is always non-declarative. You may remember *that* you were angry but you cannot remember *feeling* angry. A remembered face cannot be put into words. Pain (or any form of social

discomfort) can only be described as a metaphor, as in “his comments made me sick to my stomach.” We give facial displays and tone of voice meaning but our memory of this kind of information is far from objective.

THE WEAKNESS OF LANGUAGE

There are a large number of lectures by famous scientists on the subject of memory. Some of these are brilliant and require no previous background on the subject. YouTube, for example, has several lectures by Daniel Kahneman, who is a Nobel laureate, notable for his work on the psychology of judgment and decision-making. You can also find great discussions about false memories presented by Elizabeth Loftus.
(Kahneman: http://www.youtube.com/watch?v=XgRlrBl-7Yg,
Loftus: http://www.youtube.com/watch?v=hER-5mdIoN0).

Putting a memory into language also suffers from the weakness in language. Most verbal expressions are actually metaphors, which are really narratives using analogies to other shared experiences. In fact, if you describe a memory to a friend you will notice that it is nothing but a story that is consistent and meaningful without any way to validate its accuracy.

This issue is central to our legal system. Because there have been so many cases of faulty eye witness reports, which resulted in long prison sentences, the problem of memory has been studied extensively.

When an event is described multiple times each recall is actually the previous recall not the original. If I tell my spouse about my day during dinner, and tell the story again the next day, the 2nd retelling is closer to the first retelling than the actual event. Memories evolve and get changed. For this reason, the legal system places more credibility on a written version of events done shortly after they happened. They call this process memorializing.

Business executives use contracts as a way of explicitly stating what was agreed to without depending on memory. While a verbal agreement is legal, the courts dislike this kind of evidence. For this reason, any meeting that is worth having should also have a written summary distributed to the participants. They are more likely to recognize errors and omissions before their memories decay to the point of fantasy.

The conclusion of this discussion on memory is humility. Just as we look at a technical system as having properties, so too must we look at our brain as having a matching set of properties. In both cases, these properties arise from the way in which the system functions. We all need to become experts on the properties of the human brain, ignoring any assertion that we are what we want to be, or should be.