Simulation and the Evolution of Thought

Joanna J. Bryson

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Our culture often describes memory as if it were all pastoral reverie—a safe and quiet form of entertainment allowing us to revisit events and places, lovers, families and friends. Memory acts as a low-tech alternative to novels and video games, used to keep spirits up. In traditional narrative, memory serves to remind characters of their devotion to each other, or other obligations. Like other forms of entertainment, reverie might occasionally by chance lead to reflection, insight or self-knowledge. Sometimes this is facilitated by technology, such as film, or the memories of others casting a new light on previous events. In more contemporary writing, some authors dwell on a more traumatic form of this reverie that psychotherapists call 'negative rehearsal'—the self-castigating narrative revisitation of past mortification or worse, of own wrong-doing that accompanies depression and leads to a spiralling devaluation of self-worth.

But memory is much more than a narrative patchwork quilt we occasionally pull over our heads. Memory is the stored form of everything we have ever learned. And when I say 'we' here, I mean it very broadly. Conventionally, memory is what an individual has learned, everything from co-ordinated action (such as the ability to catch a ball) to the English language or arithmetic, from trivia to our own names to literacy—absolutely everything that separates our current self from our new-born state. Or even our foetal state, since we now know new-borns carry memories of their mother's accents heard in the womb, and use these to choose (when given a choice) who to spend more time observing (Kinzler et al. 2007).

Unconventionally, memory is much more even than that. Our capacity to learn language, not shared by other species, is something our ancestors evolved (Fitch 2005). It is stored in our genes to be passed on to our children. Without that memory in our DNA, our memories of English would be almost useless. Dogs, birds and chimpanzees can learn a few hundred labels for objects and actions; they may even invent new terms. But no other species has been able fully to exploit language's powerful productive capacity. Humans can express thoughts of any length and complexity, by embedding new clauses in a sentence. If these thoughts are written down, even the most elaborate might eventually be communicated to a sufficiently motivated reader.

If we call our DNA part of our memory as well, then everything about us—how many legs we had when we were born, how many fingers, how large our brain, the colour of our eyes, the colours we can see—is some kind of memory stored by chemistry and the laws of physics, distributed across our species. This is something explored by Sebastian Groes in his reading of J. G. Ballard's work in Chapter 21. With every living organism we share a common memory about how to make a thing like itself; that can replicate itself in nearly every environment present on our planet. With every other human being we share as well the memory to make a very special kind of animal one that stores vast troves of further knowledge in books, on paintings, inside silicon and even in oral culture. As amazing as our culture is, and as fantastically as it is now exploding in size, it is not clear that information compares to the chemical memories resulting from billions of years of evolution that exist in a web of knowledge that life has evolved about what is the most likely way to take energy and minerals and create more copies of the ability to make more copies—despite all the changes that get thrown at us: the asteroids, the volcanoes, the ice ages.

Most of these other things that know how to replicate, most of this other life, doesn't have individual memories like ours. The vast majority of it is single-celled, with no neurons at all. The evolutionary transition to multi-cellularity is itself an open question, a high-profile mystery of biology (Szathmáry and Maynard Smith 1995; Ågren 2014). Though given the trillions and trillions of single-celled organisms on our planet, perhaps, the multi-cellular organisms are just a mistake—a low-probability but interesting flash in the pan that are so far managing to support themselves and diversify in interesting ways. The same question could be asked about the

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special apes we are, these musical simians that only about ten thousand years ago, after splitting off from the other apes millions of years earlier and running around with big heads and stone axes for at least one and a half million years—just 10,000 years ago (plus or minus 2,000 years) started writing, building cities, planting seeds and proselytising about their origins to those to whom they were not related (Whitehouse et al. 2014). Was that an accident or an inevitable transition that will happen again and again on planet after planet once life evolves? Would it happen even faster on planets of fourth-generation stars, with even more complex elements available as raw materials? More importantly, can the transition to dominance by cultured animals be stabilised? A few decades ago we achieved the theoretical capacity to destroy all mammalian life on our planet by using just ten percent of our collective nuclear war chest (Ehrlich et al. 1983). Are we lucky this hasn't happened, or does the creation of such a technological capacity generally require the stability of governance that prevents its exploitation?

What is the reason for culture—this potentially dangerous turn in life's set of capacities? At least, what is the evolutionary niche of cognition (Laland et al. 1996)? It seems that individual cognition evolved for planning—for example, for navigation. The kind of memory needed to develop new skills and detect patterns (which is most of what our brains do) seems to exist mostly as 'snapshots', or in humans, of brief episodes (Pöppel 1994; Bryson 2009). The most basic kind of learning is simply associating a context with an action (Dickinson 2012). We see this across all sorts of species, from Pavlov's dogs to sea slugs. But to navigate requires a string of such associations—a set of possible affordances for every location, of directions and consequences. Finding the sequence you want requires searching through a vast map of possible paths—including the ones that lead in circles back to your origin (Levy 1996). You can think of each memorable location as a node in a network, a knot in a web, where every route out of it is a possibility—a possible future. The process of choosing one path, one string of actions out of that net is called *planning* (Simon 1972).

In children, the capacity to plan what you might do tomorrow emerges at the same point in development as the capacity to remember what you were doing yesterday, and that perhaps you wanted something different than what you want now (Russell et al. 2010). This is a huge achievement for a child. The effortless mental time travel of their parents is a mystery for them; how can we discuss a time when we had or will have what we do not have now, how can not having be anything but wanting? The stories we tell children illustrate the flow of past to future, the picking of a single string from a web of possibilities, the hazards of picking the wrong one, the difficulties and potentials of returning to the same intersection again at a later time to try another way. Somehow, sometime we grasp all this—it begins to make sense.

Narrative memory is more like planning than we usually realise, although most of us know it is difficult and imperfect. Our memory has the nodes of the web, many as general (semantic) knowledge no longer linked to episodes, plus a few snapshots, a few flashbulb moments that were so outstanding in some way that we have never managed to process them entirely away into a cluster of semantic knowledge. We try to reconstruct the path that brought us through the net we know to the flashbulb episodes we recall. We think we are reading a story from a book, but we are not. We are confabulating, reconstructing a memory out of what has stuck in our heads (I explore this further in Chapter 40).

The fact it is so hard to remember narrative, the fact we do it so badly, almost certainly means that narrative is not what memory originally evolved to record. It has all the hallmarks of a retrofitted kludge we have invented, this capacity to reconstruct a past. Describing a past may not seem or even be as useful as choosing a future, but it does have a role. In many human societies, precedence is used to establish priority such as ownership, which in turn allows us to reduce conflict over resources (Taylor 2014). Arguably, the entire related concept to narrative of identity has similarly been invented to allow societies to self-regulate (Hobbes 1651; Lebow 2012).

Order in a sense may also be what we are establishing with our personal reveries, whether pleasant or damning. Perhaps we are helping our own minds establish a social place for ourselves, avoiding unnecessary conflict with others, searching for advantages and knowledge, recalling other aspects of our own identity that we might be able to exploit or avoid in the future. Sometimes pulling a patchwork quilt over our heads and dreaming might be the right thing to do just now, as well as a thing that helps us do the right thing the next day. Whether that quilt is our own recall or the narrative fictions of others, learning from the safety of a story is one of the great benefits of being human.

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