/dev/random
Rewind Your Mind

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In the course of writing a speculative fiction short story about the direction human intellectual evolution might take (it doesn't involve giant melon-shaped foreheads with pulsing veins, if that's what you were visualizing), I found myself ruminating on the intersection between human and artificial intelligence. If we are to consider that, sooner or later, we and machines will become competitors for the same resources (electricity and self-direction), then it might be logical to presume that evolutionary fitness principles will also apply.

Which is to be master, that's all.

It seems probable to me that carbon and silicon will eventually merge, although perhaps not in the way many people envision. One of the first points of intersection may well be solid state biological memory. Not SSDs with our neural connections imprinted on them (we'll get to that later), but rather onboard computing of physiological data derived from embedded sensors, the results of which may be downloaded by your friendly neighborhood medical professional whether you like it or not. Taking your blood pressure or assaying your CBC might soon happen anytime you wander too near an RFI (Radio Frequency Intrusion) hub. That certainly puts the "Portability" into HIPAA.

Since we've brushed lightly past the subject, how practical is the "store your complete neural identity in electronic form" pipe dream/nightmare? Given that each of your 16 billion or so cortical neurons can have thousands of connections—which makes your neocortex a neural network of neural networks—we're talking about a level of convolution that would impress even a tax code author. I've seen a plethora of thought experiments on "post-humanity" that reduce us to digitized entities streaming Douglas Adams-style across the universe as a series of ones and zeroes. I think this is about as far-fetched as Star Trek teleportation, to be brutally honest (or honestly brutal, which, not to be brutal, I honestly prefer). Reducing our cognition to a collection of binary impulses seems beyond impractical.

I think neurons in the neocortex communicate not only using simple point-to-point connections, but also by interpreting patterns generated by attenuation of depolarization signals traveling those connected nerve fibers. Axons aren't just "on" or "off," in other words: they can demonstrate different signal strengths, which can then be used to overlay more information onto the binary connection map. This adds another layer of complexity, the depth of which is at least partially dependent on the minimum pattern size needed for constructing meaningful data objects.

Let's say memories are stored like multimedia files, with video, audio, olfactory, and gustatory tracks. Rather than a simple bitwise image map, however, we'll pretend the optical component is compressed by some form of pattern-based encoding that is then decoded by the visual cortex when a memory is replayed. That encoding relies on a large collection of "primitives" or stored data archetypes stitched together from the individual's past experiences. When we remember a scene containing a tree, for example, we don't need to visualize

a specific tree unless that specificity is integral to the memory. How much space a memory requires depends on the number of unique moieties it contains and the array of "facets" each of these exhibits. Accessing a memory containing only a few modifications from an existing template is, after all, a lot less processor-intensive than building the entire scene from scratch. Think of it as "clipping" for the memory.

While the process by which it is accomplished is even less clear to me, the brain may also use the archetype approach for smells, sounds, and tastes. Tastes are probably the simplest, since they are all some combination of the five identified base sensations (20% sour / 15% sweet / 5% bitter / 35% salty / 25% umami, for example). This scheme is no doubt overly simplistic (especially since science recognizes seven, not five, basic tastes), but you get the idea. Odors, being closely associated with tastes, are likely stored in much the same manner. The audio track has to encode, at a bare minimum, pitch, timbre, rhythm, balance, dynamics, and several other characteristics. There are doubtless archetypes for all of these, too. Percussion, strings (plucked and bowed), winds, and voice must have their own sets of primitives that can be mixed and matched to create any music. This presumably goes as well for sounds of nonmusical origin (such as my singing).

The longer I think about this, the more it seems to me that the algorithms for data storage and retrieval in the human memory are probably even more subtly complex than we currently imagine. I expect some sophisticated sorting goes on, such that each data object can trigger a variety of different patterns depending on the contextual filtering it experiences along the way to the area where the memory is rendered. The brain in this respect works more like an analog music synthesizer than a digital computer. I think memories could well be categorized as waves, rather than particles; perhaps there's even a photon-like duality at work. Maybe thoughts are themselves packetized in quanta, giving the term "neuron" another meaning altogether: the intelligence particle. Its anti-particle is, then, the "moron."

Storing ourselves electronically may require a continuous recording medium like magnetic tape, as opposed to a lattice of discrete bits. Future humans might need to carry around some kind of analog-to-digital converter in order to back up to or restore memories from hard drives. After all, thoughts are not exactly binary in nature. What do you see in your mind's eye when you hear your favorite music: zero or one? Not a useful descriptor.

Mapping and storing a human's mental landscape would, realistically, require a lot more than just bit-flipping. I believe that our brains use those patterns we discussed as fundamental storage tokens. Sensory input is formed into multidimensional objects that are then stored ad hoc in some pseudo-hierarchical matrix. Specific memories are composed of pattern fragments pulled from this cache using a linked index created by ranking those fragments by frequency of appearance and something representationally equivalent to color or texture, along with other metadata.

Perhaps the brain employs a QR code-like mechanism to assemble complex memories from disparate archives scattered around wherever those moieties could be fitted in (hence the "ad hoc"). It does seem that something akin to disk fragmentation occurs in my own memory from time to time, which leads to attention headache. People with true long-duration eidetic recollection may keep all the fragments of a memory object in much closer logical proximity to one another than do the rest of us. I'm pretty certain my sensory input tumbles immediately into a neural woodchipper, to be blown across the perceptual lawn like gale-driven autumn leaves. My memory is more pathetic than eidetic.

Or maybe this whole line of reasoning is utter nonsense. Perhaps it turns out we store our memories on a very long VHS tape looping in the hippocampus. If we forget to rewind, it takes a lot longer the next time we want to access that memory. I'm pretty sure that somewhere on my personal VHS tape there is a memory of flunking neuroanatomy, so you might think I would avoid tossing around terms like "gyrus," "sulcus," "nucleus," and "ganglion," but it makes me feel like a stable genius.