What is Associative Memory?

Associative memory refers to the binding of a certain unrelated factor to a more distinct and singular memory. It can affect behavior, such as it famously did on Pavlov's dog. Or associative binding can simply mean that a person can remember someone else's name when looking at their face.

The Hebbian plasticity hypothesis is a major part of this topic of research. This simply refers to "the strengthening of a presynaptic input on a postsynaptic neuron when both pre- and post-synaptic neurons are coactive" (Johanson *et al.*) A factor in this field of study since the 1940s, it is, however, not the sole responsible for associative binding.

Neuromodulators, such as dopamine or norepinephrine, which affect large groups of neurons rather than singular pairs, are a significant part of the process as well. Though associative binding can happen without these neuromodulators, the process becomes much more time-consuming and unsure. In that case, the association has to be made repetitively. And this goes the other way around as well, Hebbian plasticity is necessary to the process of associative binding.

The formation of these associative memories rely on cortical excitability and proper timing of the neurons firing. Aging, however, can "reduce the window of when cortical excitability can facilitate synaptic efficacy and therefore plasticity" (Fertonani et al.) This plays into the fact that it's harder to learn new things, specifically things which require associative learning, such as new languages, as you grow older.

It would be interesting to see technology accommodate this. We are a generation born into rapidly-changing technology, and most common pieces of technology have become user-friendly to allow a wider audience to use them, including older adults. I wonder not only how these pieces of technology will continue to adapt to the growing generations that were born with a background of rapidly-changing technology, but how our phones or our computers can help us keep our neurons firing properly. Games that are intellectually stimulating, pattern recognition games, or puzzles that we tend to see as a waste of time definitely help somewhat, but how can we do this on a bigger scale? I find it easier to remember something I taped on my phone since I've most likely watched it a million times by the time I delete it or transfer it to the abyss of photos on my computer. How can tomorrow's technology allow us to relive parts of our lives so we remember more clearly? Or could it tweak these parts so we can forget associations between a traumatic event and neutral stimulus?

Fertonani, Anna, Michela Brambilla, Maria Cotelli, and Carlo Miniussi. "The timing of cognitive plasticity in physiological aging: a tDCS study of naming." *Frontiers in aging neuroscience* 6 (2014): 131.
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