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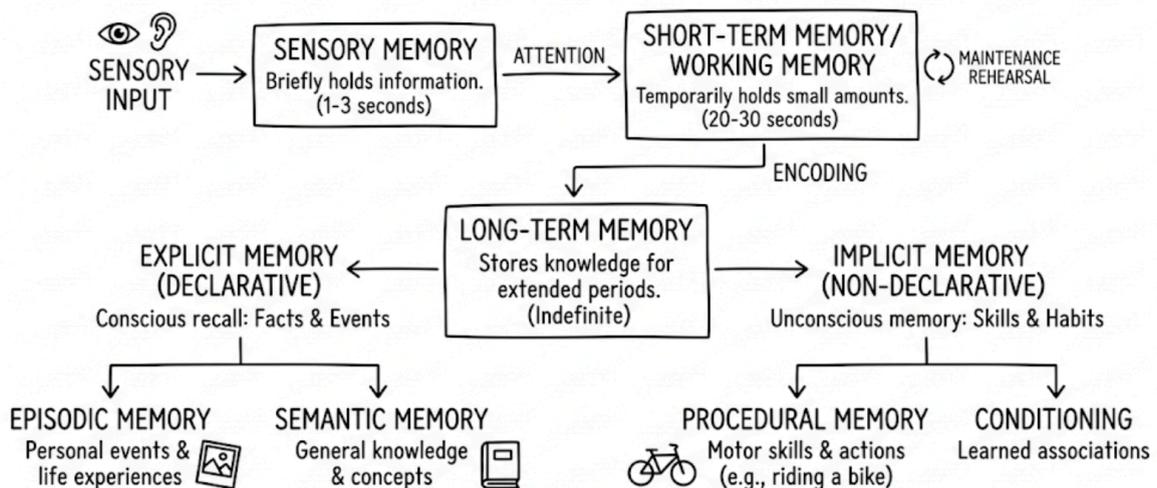
"We are the Borg. Lower your shields and surrender your ships. We will add your biological and technological distinctiveness to our own. Your culture will adapt to service us. Resistance is futile." [Star Trek](#).

How can we protect thinking, memory and human learning when the machines can do it "for us"? This is a (very adapted) excerpt from *Chapter 2: Understanding Learners, Learning & AI*, from my upcoming book, [\(If You\) USEME-AI: Learning for Hope & Agency in an AI World](#). It pulls in some sub-sections on thinking, memory, load, System 1 & 2 thinking and shares some new papers on proposed System 0 and System 3.

### Cognitive What?

Making learning stick means making memory *work*, relying on [neuroplasticity](#): the mechanism for "supporting long-term memory formation, adaptation and stability"<sup>1</sup>. Our brains are shaped by experience, reflection, recall and application. As we encounter new stimulus, our limited [short-term/working memory](#) processes it, and through rehearsal and maintenance, it can be encoded to *long-term memory*, available to access later<sup>2</sup>. Some of this long-term memory is *implicit*, or non-declarative (unconscious skills and habits), and some is *explicit*, or declarative (episodic or semantic events, experiences, knowledge and concepts).

## TYPES OF MEMORY



Generated in Google NanoBanana



An AI-Generated Summary of Types of Memory,  
 adapted from structures suggested by Atkinson & Shiffrin (1968).



New learning builds on the learning that has come before and requires *effort*; if our students are putting the right types of effort into their thinking, recall and application, they are building their learning, making connections and developing the capacity for yet more learning.

Sweller's work on [cognitive load theory](#)<sup>3</sup> is a useful frame for thinking about effort. Where *cognitive load* represents the total mental load of processing information, it can be broken into three sub-types: *germane* (the load dedicated to understanding), *intrinsic* (the complexity of the target material), and *extraneous* (the unnecessary load that can come from poor task design, distractions or decision fatigue). As teachers, being aware of the load we intentionally and unintentionally place on students can make a real difference to what really sticks in the long-term. Learning for *automaticity* at lower levels of recall and application protects cognitive load for deeper thinking, connection and investigation. Planning intentionally for deep thinking about the right things, and making high expectations for real thinking clear, sets the stage for meaningful inquiry.

*Cognitive offloading* is the use of external aids to reduce the mental effort required for a task<sup>4,5</sup>. We have always done this: writing notes, using calculators, bookmarking pages. But AI takes it to another level. When a student can get a fully formed essay, a solved maths problem or a complete lab report from a simple prompt, the cognitive work that would have built understanding, memory and transferable skill is bypassed entirely. When the task gets "one-shotted", we move from cognitive offloading to cognitive **outsourcing**, bypassing the learning entirely. So we really need to think about thinking.

## Thinking, Fast and Slow... an Non-Human?

In *Thinking, Fast and Slow*<sup>6</sup>, Daniel Kahnemann describes two systems: *System 1 fast thinking* (learning that has been automatised and comes intuitively, but which is prone to bias) and *System 2 slow thinking* (new cognitive "work" that is deliberate, effortful and analytical). When we think about our learners' thinking, what do we want them to be able to recall and apply automatically and what do we need them to be thinking deeply about? Kahnemann's ideas have been transposed to descriptions of how AI works, from *intuition* to *deliberation*<sup>7</sup>. AI is not a human brain, but it can learn and function in ways that make for neat analogies. In the current wave of reasoning models, being able to articulate our questions and negotiate outputs through clarity and domain-specific language could be genuine learning superpowers at the cognitive level.

When we consider all the complexities of the brain, thinking and memory, we might consider one guiding question: *What do we need to make routine so that students can access higher-order thinking, and what are we going to do about it?*

More recently, Milena Stepanova<sup>8</sup> has proposed that a "System 3", drawing from *emotional* and *affective* connections to systems 1 and 2 is added; an interesting proposition as we



engage with (and try to distinguish ourselves from) the machines. What happens when we lose the emotional connection to our learning, or the motivation to keep thinking deeply, when we know the machines can do it for us?

*But what if the machines are already affecting our thinking and not the reverse?*

A recent paper by Francesco Branda suggests that this is already happening<sup>10</sup>, with AI acting as a “nonbiological cognitive layer that precedes and modulates human intuitive and reflective thinking”. Building on Chiriatti et al’s proposition that human-AI interaction represents a new “System 0” thinking<sup>11</sup>, which “interacts with and augments both intuitive and analytical thinking processes”, there is the risk that AI-mediated processes and information don’t just help us offload tasks, they outsource human agency and accountability. As we move further into an era of an “expanded mind”<sup>11</sup>, Branda suggests that “Thinkframes”<sup>12</sup> are already forming, creating extensive networks of “pervasive cognitive architectures” that might fundamentally shift our relationships with knowledge, attention and decision-making at a social scale.

You might already feel the influence of AI on your own thinking. I used to love an em-dash and various other language moves that are now “indicators” of AI-writing, and it has changed the way I write (and worry about writing). It makes logical sense: as existing, effective writing structures are swallowed up into the blob of training data, they are spit back out at us with AI outputs. But it doesn’t feel great. AI-related terms are entering the culture, and the homogenising effects of LLMs may be impacting voice<sup>12,13</sup> and ideation<sup>14,15</sup>, squeezing thinking to a mediocre middle. We are handing over our bodies and our homes to smart-tech and AI wearables, forming relationships with our augmented selves and striving to “close the loop”<sup>16</sup>.

Interestingly, Shaw & Nave at Wharton have also proposed a new System 3, “artificial cognition that operates outside the brain”<sup>17</sup>, (which is closer to Chiriatti’s System 0 than Stepanova’s System 3), and which coins the term “cognitive surrender” as a step beyond outsourcing. They test a “cognitive reflection test” which engages (their) System 3: participants were allowed to consult AI, but some was seeded as correct and some incorrect. Accurate AI boosted learner accuracy; inaccurate AI reduced it. Either way, “participants with higher trust in AI and lower need for cognition and fluid intelligence showed greater surrender to System 3”. If it’s there, they’ll use it.

Let’s let the academics decide who gets to call what system what. Maybe they can give all their research to Claude and it can work it out ;-). But for us: as Systems 1 & 2 form the cognitive layers of our thinking, how are we going to protect what’s important for students to be able to know and do with fluency, and think about deeply? With the tendrils of Chiriatti’s System 0 (or Shaw & Nave’s System 3?) potentially shifting us to a human-AI hybrid culture, how might we lean on the emotional and affective layers of Stepanova’s System 3 to really highlight what makes us human?



We need to create strong [Cultures of Thinking](#) in our responses to AI that prioritise the human-human interactions that drive deeper learning and connections. When we engage with the machines, make it worthwhile... then get outside.

We are the Borg (in the making).

Or are we?

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## Wayfinder Learning Lab

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## We Are The Borg

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