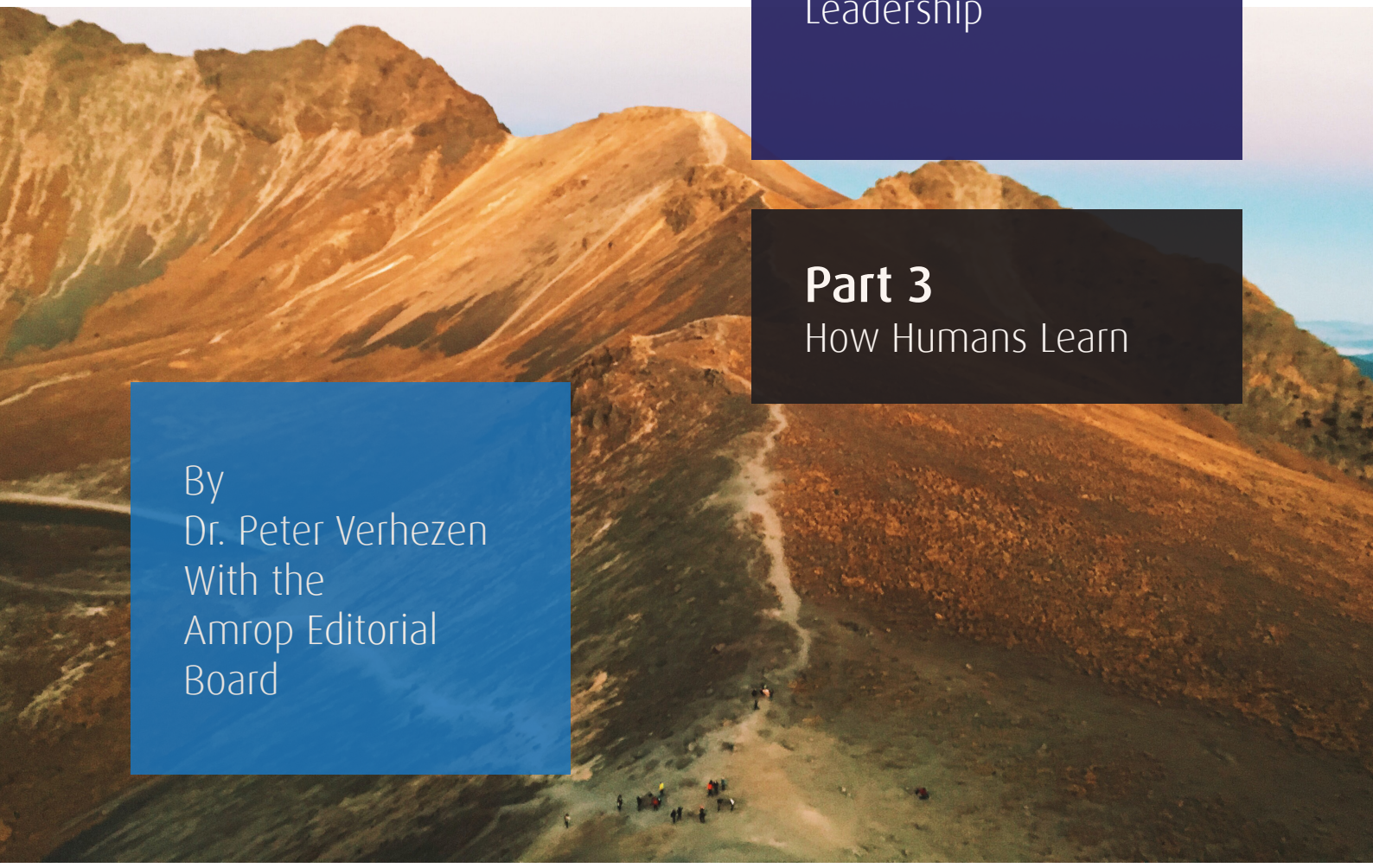
Leadership

Inside the Wise Leader's Brain

The Neuroscience of Leadership



Part 3

How Humans Learn

By
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With the
Amrop Editorial
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Leaders For What's Next

Why is a Cat Not a Dog? How Humans Learn

The word 'learning' has the same root as 'apprehending'. As an adult or a child, it is about grasping a fragment of reality. We catch this fragment through our senses and bring it inside our brain. Our brain then forms an internal model of the world.

Learning is basically a massive research problem.

Looking inside human brains allows us to understand how enormous our adaptability is. Every human inherits a great deal of innate circuitry. We also inherit a highly sophisticated learning algorithm that can refine early skills according to our education and individual experience.

Our human cortex breaks down the problem of learning by creating a model. This model is hierarchical, multilevel, like a step pyramid. From it emerges the ability to detect increasingly complex objects or concepts.

In both human and machine brains, learning requires searching for an optimal combination of parameters. Together, these define the mental model in every detail. Learning, *in silico* or *in vivo,* is basically a massive research problem.

From the unconscious to the conscious

Through learning, then, raw data that strike our senses turn into refined ideas, abstract enough to be re-used in a new context. Neuroscientist Stanislas Dehaene calls these "smaller-scale models of reality". Via learning, the brain internalizes a new aspect of reality, adjusting its neural circuits to master a new domain.

Recent neuroscientific research suggests that the initial activity is unconscious. Only if it spreads to the distant regions of the *parietal lobe* and *prefrontal cortex* does conscious experience occur — a sudden transition toward a higher state of synchronized brain activity.

Most artificial neural networks only implement the operations that our human brain performs unconsciously, in a few tenths of a second, when it perceives an image, recognizes it, categorizes it, and accesses its meaning. However, the human brain *explores the image consciously*. It formulates symbolic representations, explicit theories of the world that we can share with others through language. Our brain is much more flexible than the strongest AI today. However, computer scientists, such as MIT professor Josh Tenenbaum and his team, are attempting to incorporate this type of self-organization into AI as well.

Learning[1] is grounded on some basic principles: focus, patience, a systematic approach, a tolerance to error. Human learning possibilities are almost infinite and not (yet) matched by the learning abilities of smart machines.

[1] See Dehaene (2014, 2020); and Dehaene, Le Cun & Girardon (2018). For executives, we emphasize focused attention, active engagement, positive feedback on mistakes (inherent to any trial and error approach), and the need to consolidate what has been learnt.

Born clever

Our brain is molded with all kinds of assumptions. Babies are delivered organized and knowledgeable. Only specific parameters from different contexts remain to be acquired. Natural evolution and cultural nurturing are intertwined, not opposed. There is apparently some innate knowledge that constitutes our human cortex that the human species has internalized as it evolved. The intuitive logic with which their brains are born allows infants to constantly experiment. As any parent knows, kids are endlessly curious and their favorite utterance is often "why?" Their scientist brain ceaselessly accumulates the conclusions of their research.

Plastic brains

Babies are "learning machines during their first years because their brains are the seat of an ebullient synaptic plasticity. The dendrites of their pyramidal neurons multiply at an impressive speed[2]." Enriching a young child's environment helps her build a better brain. As we age, our brain plasticity diminishes. Learning, while not completely frozen, becomes more difficult. But as adult executives we can still broaden our perspective and embrace different and unusual views. We can get better at resolving contradictions, dilemmas, paradoxes, and business challenges in general.

When it comes to the plasticity of our brains, neuroscientists have observed a fascinating phenomenon. In the case of certain individuals who suffered injury to their brain's left hemisphere, the right automatically took over some of the lost synapses.

The enticing aroma is coming from the machine just down the corridor. Sarah, a senior executive, has quite literally just smelled the coffee. The first stages of sensory, relatively fast processing of the smell take about 200th of a second, operating in a mainly unconscious manner in her brain. The subsequent conscious, slower, and reflective part of her learning process allows her to deploy reasoning, inference and flexibility.

"That coffee smells of vanilla. That's new. I doubt if it's Fair Trade? Should we check it's in line with our CSR policy?"

Seeing meaning and communicating it

Unlike a computer, humans recognize the essence of an (abstract) object. We can question our beliefs and refocus our attention on those aspects of an image that don't fit our first impression. Human learning is not just about setting a pattern-recognition filter, as an artificial neural network function does. It's about forming an abstract model of the world. This simulation lets our brain impose meaning on the statistical noise, selecting what is relevant and ignoring the rest. In every waking moment, the human brain uses past experience (stored in our memory), organized as concepts, to guide our actions and give meaning to specific sensations.

What about language? Hardwired in *homo sapiens* is not so much language itself, as the ability to acquire it. Noam Chomsky suggested that our species is born with a language acquisition device, a specialized system. These innate *"brain highways"* are automatically triggered in the first years of life. Baby brains come with an instinct to learn any language.

[2] Dehaene 2020: 103

In the next chapter, we'll meet our statistical brain team.

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