

Book review

Evolution of thought and emotion

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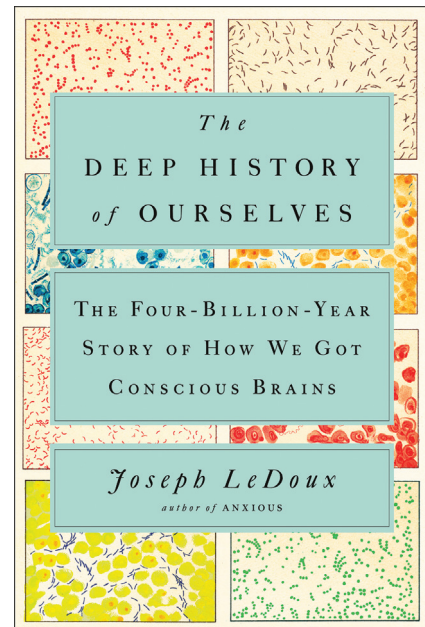
The Deep History of Ourselves: The Four-Billion-Year Story of How We Got Conscious Brains

Joseph LeDoux
(Viking, New York, NY; 2019)
ISBN: 978-0-735-22383-7

What started as a self-scrutinizing exercise turned into an extraordinary volume on a journey in search of the origin of survival mechanisms and consciousness. Joseph LeDoux — the undisputed guru of emotions and the Henry and Lucy Moses Professor of Science at New York University — declares in *The Deep History of Ourselves* that the notion of an ‘amygdala fear center’ that became not only a scientific doctrine but also a cultural meme is dead wrong. Since his writings contributed to this mischaracterization, LeDoux feels that he has some explaining to do. He does this in the form of beautifully composed prose of 400 pages. Without hesitation, he tells the reader up front that, in order to accomplish his goals, a “radical approach is needed”. This is done in the form of two interconnected journeys, the first of which is the evolution of survival circuits: “there is indeed good evidence that the same brain systems control survival behaviors in humans and other mammals”. However, these are not the systems that are responsible for the conscious feelings that we experience when we engage in such behaviors and, therefore, he postulates the need of another system that is uniquely human. To contrast these two lines of ideas, the author reaches back through four billion years of natural history. The elaborate discussion on our long past is done not for the sake of cataloguing facts but to seek answers to a complex problem: the origin of our phenomenal or access consciousness. In the process, two new LeDouxes unfold: LeDoux the evolutionary biologist, evo–devo guy and a consciousness expert.

To understand the brain, first one needs to know about the body it controls. And bodies are complex too, even if they started out simple. Living things must borrow energy from the physical world to survive and prosper. This fundamental survival strategy began way before cells with organelles and protective boundaries developed, initially using the simplest forms of chemotaxis and tropism before adopting more elaborate approach–avoidance strategies. LeDoux — the naturalist — shows impressive expertise in the development of everything that matters to life. We learn how bacteria adapted to changing temperature and oxygen levels by acquiring “internal molecular representations of environmental conditions”. He teaches us that memory is already present in unicellular protists — no need for a complicated brain — in the service of maintaining energy supplies, balancing fluids and osmolarity, and defending against harm. These are the deep roots of the “survival states”. He delves into the debate about the priority of DNA versus RNA, explains how compartmentalization of complex molecules eventually gave rise to subcellular units, and guides us through the emergence of archaea, bacteria, the merging of existing life forms, and the advantages of sexual multiplication. I particularly enjoyed the discussion on the continuity of the general Bauplan (body plan) that sets the architectural features common to many members of the same phylum, and along the way I learned to respect simple organisms even more than before. LeDoux is a patient and skillful teacher who is well familiar with the reader’s attention span and the need to pause for thought, contemplate, and get ready for the next chunk of novel information. Chapters consisting of typically two to four pages and half a page of blank paper are good reminders to take a deep breath and internalize the presented material. His story is greatly enhanced by uniform illustrations from the same artist, an effective aid to ease the reading.

By the end of the first part, the author had convinced me that “a key part of our story is [...] how nervous systems came to be”. Yet, as I had just been educated about evolution by my



recent readings of David Quammen’s *Tangled Tree* and David Reich’s *Who We Are and How We Got Here*, I kept wondering how much I would have missed if I had skipped the first half of the book. Once we get to the second part, things accelerate at a rapid pace from neurons to the brain and then on to discussions of deliberation, memory, language, consciousness, and emotion. It is here where the author explains his new model about the distinctness of survival circuits and brain circuits that support conscious thoughts and feelings. This distinction is of paramount importance for LeDoux because “in animals, all we can measure are the behavioral consequences”. Shivering we can see, but feeling cold is another matter. Research on survival circuits alone — for example, describing the physiological features of the amygdala or prefrontal cortex of animals in response to a threat, or even interfering with such behaviors — is not going to lead us to treatment of anxiety and PTSD. “This effort has been so unsuccessful at finding new medications that some major pharmaceutical companies are ceasing to search for new treatments”. Different circuits are needed for inducing feelings, which he equates with the “cognitive interpretation of the situation”. For LeDoux, the survival circuits influence but do not define

the content of emotional experience: “the idea of unconscious emotion is an oxymoron: if you don’t feel it, it’s not a feeling, not an emotion”. Thus, the Freudian idea of subconscious emotions — allegedly supported by subcortical mechanisms — has no merit. Instead, circuits and mechanisms of consciousness need first to be developed. LeDoux distinguishes between lower-level ‘noetic’ consciousness (*nous* = mind) and higher-level auto-noetic (i.e., self-centered or phenomenal) consciousness, and the latter is a prerequisite for feelings: “for me, human emotions are auto-noetic conscious experiences”. Emotions are thus the highest quality evolutionary product that has come *after* cognition in the outward growth of the tree of life. In his program, he goes so far as to offer anatomical substrates for these distinctions: the amygdala is part of the survival circuit but has nothing to do with fear, which is a feeling. The medial prefrontal, orbitofrontal, anterior cingulate cortex and insula are needed for noetic conscious cognition. In contrast, auto-noetic consciousness and emotions require structures of the lateral prefrontal cortex and frontal pole that are uniquely human. The book’s most important take-home message is this: “the human brain is the only physical system that unequivocally possesses consciousness”. “No self, no emotion”.

As is the case with all great books, I expect LeDoux’s new manifesto will stir up a productive debate. Let me start it. The book beautifully illustrates the continuity rule of the Bauplan: evolution of everything. Therefore, it comes as a *deus ex machina* when he makes an exception and proposes a jump: the “evolution of a new cognitive capacity” that is solely human. He defends the exception by suggesting that “we haven’t, like most organisms, simply evolved by adapting our Bauplan to the world as it changes; we have used our cognitive abilities to change the world”. Where does this statement leave the *umwelt* concept of Jacob von Uexküll? Simple animals build homes, dams, and traps, and in the process they change *their world*. Humans are not special in such skills. Instead, I prefer the view that tiny cognition allows for tiny emotion and

this loop gets more complex during evolution. After all, while the frontal pole and lateral prefrontal cortex might be most elaborate in humans, all mammals share their evolutionary Bauplan and the same kind of neurons. It is hard to accept that the sole job of these regions is to support auto-noetic consciousness and emotions. Rather than discrete ‘kinds’ (subconscious, noetic, and auto-noetic) being served by different substrates, perhaps the same circuits with different levels of complexity support ever more elaborate functions. An example is the relationship between navigation in the real world and its internalized version, mental travel (memory and imagination) — different names but involving the same structures and neuronal algorithms. To confront these views, we need to examine the physiological *mechanisms* of brain circuits, the discussion of which is conspicuously missing from the book. Linking psychological concepts to brain anatomy alone rarely provides a convincing case.

What I missed most from *The Deep History of Ourselves* is a discussion on the cultural evolution of the ideas. What is the relationship between self and experience and among *psyche*, *anima*, *soul*, and *mind* whose meanings have changed dramatically over the past 2,000 years and vary across different cultures. Aristotle’s *psyche* (distinguishing living from non-living) is different from the Christian soul, which in turn differs from the post-Christian mind. For the ancient Greeks, even a flower had a *psyche* or consciousness, but its meaning was different from what we interpret it as today. Similarly, emotion and motivation underwent multiple reforms over the centuries. For the Greeks, passions were tied to the body, the scholastic doctrine brought them closer to the soul, while Descartes separated them from rational thought. These early views were updated again in the Newtonian mechanics-centered framework, which claimed that everything must be pushed (or in the case of living things stimulated) to become active, and this notion explained why positive and negative passions move the body in opposite directions. The new term ‘emotion’ (from the Latin *movēre*: displace)

replaced older words. LeDoux poses the question of whether emotions are movers and he rejects it: “I think there’s a different explanation”. A rodent jumps off the hot plate not because of the pain it feels. Pain as a feeling is in a different basket, governed by auto-noetic conscious circuits. Should we assume that there is a universal emotion that is recognized as the same entity in different cultures or is it a historical formation? Going beyond the dominant Western framework, our notions of perceiving, feeling, thinking, deciding, and acting have a single phrase in Buddhist philosophy described by the Sanskrit word ‘cit’ or ‘budh’. Are emotion and feeling (and the German *gefühl*) replaceable synonyms? ‘Auto-noetic’ is a quite recent term, a product of Western thinking. The word ‘self’ was synonymous with ‘sinner’ and ‘Anti-God’ a few centuries ago (think of selfish).

Did psychology become a captive of the vocabulary it inherited? Should we pretend that, by today, we have cleaned up and objectified these terms and, therefore, we are ready to launch a program to understand how they arise from the brain? Isn’t there a certain arrogance in regarding human-constructed concepts as natural kinds and giving the task of figuring out their mechanisms to neuroscience? This outside-in framework assumes that such historically inherited concepts and terms exist independently of the science whose objects they are. Some of us believe that this cannot be right (Buzsáki: *The Brain from Inside Out*).

I am sure that other readers will praise aspects of *The Deep History of Ourselves* that I have missed and may pose different objections. There are many ways to carve nature at its joints. I believe that LeDoux’s motivation to write his masterpiece was exactly this: to ignite discussion on the most complex topic we humans face. Who are we, why do we feel distinct from others, and what is our role in this endless universe? He has done his part with admirable scholarship, now it is our turn to show our cards.

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