

Translated excerpt

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Eine kurze Geschichte von Gehirn und Geist. Woher wir wissen, wie wir fühlen und denken

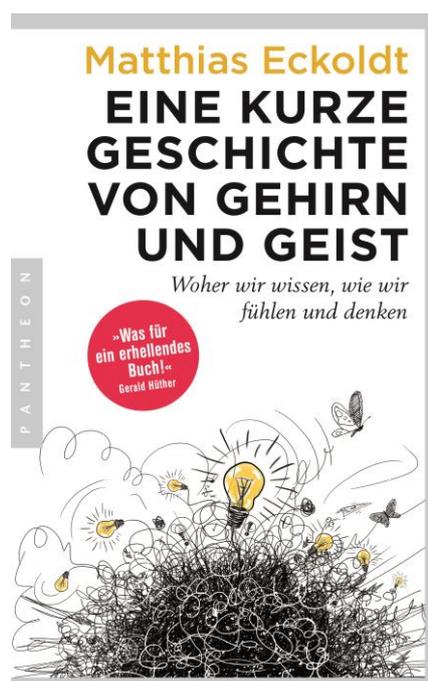
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***A Brief History of the Brain and Mind.
How we know how we feel and think***

Translated by Jefferson Chase



Preface

We can only guess at why, one day, our early ancestors stood upright. Had they gotten cocky after having left their earlier natural environment in the trees? Were they simply bored? Or anatomical reasons make the idea basically unavoidable? Arms that no longer have to swing the body from tree limb to tree limb automatically grow shorter, and perhaps it became increasingly difficult to squat and move on all fours. Why not walk on two legs? It was worth a try.

The problems with balance experienced by babies around one year of age, as they go through the decisive process of becoming human beings, offer only a partial idea of how difficult standing upright must once have been. There's no overestimating the risks involved with lurching through the forests out of control. It would hardly have been possible in such a state to flee enemies - to say nothing winning any battles. Nonetheless our early ancestors stuck with this form of locomotion. Walking upright must have offered some benefits three million years ago that overshadowed all the effort and danger it entailed.

Two advantages spring to mind: expansion of the field of vision and liberation of the front limbs from the task of locomotion. Together, these two factors allowed for a new form of perception that went beyond the exclusive concentration on finding food and reproducing. Hands investigate whatever they can get in their grasp, while the eyes support, register and inspire. Moreover, other developments further promote this symbiosis. When carried vertically, the skull is relieved of pressure and requires fewer of the sorts of muscles that limit growth. The result is prefrontal release. The forehead is freed – in both the literal and metaphoric sense. The new horizon opened by the cooperation of the hand and the eye both requires and enables increased growth of the brain. In addition, the upright head cools off somewhat, which allows for more high-energy neuron activity under the cranium.

The hands try out what they can do as tools and are soon augmented by useful objects. Other animals, of course, use hard items to break open things like that fruit skins, but their entire attention is consumed by how to get a meal, whereas their two-legged comrades are also interested in how to take care of and improve such implements. The upright inhabitants of the earth aren't physically superior to any other creatures. They can't run particularly fast, nor do they possess above average muscle power, clamping teeth or poison sacs with which they can command respect. In fact they are full of shortcomings and have no special qualities except for a curiosity unprecedented in the animal kingdom, a curiosity with which these strange beings would explore the world and ultimately overcome even the fear of fire.

Anyone who sees his reflection in a smooth water surface will immediately realize that it is indeed a reflection. Monkeys do this too. If a smudge is made on their foreheads while they're under sedation, they'll wipe it away if they're given a mirror when they wake up. But that's the end of their interest in their alter ego. By contrast homo sapiens begin a never-ending process of self-discovery the first time they look in a mirror.

For at least 12,000 years, humans' interest in their own being has focused on the head. That's shown by human skeletons from the mid-Stone Age. Some of the skulls have symmetrical holes that cannot be the results of accidents, but rather must be the products of intentional surgical operations. The skulls of these unfortunates were tampered with while they were still alive and fully conscious, assuming that they didn't mercifully pass out. In any case, the remains of the people from the Stone Age make clear that the patients of the very first brain surgeons survived these so-called trepanations. The sharp edges of the punctures in their skulls were rounded off, which is only possible if new bone formed. Under a microscope, we can observe this process of healing and draw conclusions about how long the victims of such operations lived on. It wasn't infrequent for them to survive ten years or more. But what we know about trepanations are nothing but more or less plausible hypotheses. Surveys of people who still live in archaic tribal societies today suggest that medicine men may have wanted to release evil spirits from people's heads in this particularly violent fashion.

In Ancient Greece, the belief in spirits gave way to the idea of the spirit or mind, as Greek philosophers asked the great questions about human cognition and knowledge. Our short history of the human brain and spirit starts at this point, examining how the human mind began to reflect about itself. In the beginning, it was by no means certain that thoughts were truly formed in peoples' heads. Speculations that the brain was there to cool down overheated blood seemed equally plausible. Moreover, the human soul posed constant conundrums. Was it truly immortal, and did it wander from body to body? What became of all the experiences it had made as an earthly being? Or did it pass away together with the human body? Could the soul be likewise profane enough to simply decay into dust? From the moment in the third century BC that inquisitive people began to open up others' skulls to satisfy their curiosity, the body-soul dualism was formulated as a question about the relationship between the brain and the human spirit or mind. At what precise point does a thought about moving a hand become material reality? And how does it do so? Or conversely how do many various external stimuli coalesce into a perception?

These questions have never been definitively settled. This book relates the diverse attempts, undertaken over the centuries, to find answers. It emerges that at its core, human thought is less concerned with trying to find answers than with making the questions more and more precise. A wide spectrum of ideas concerning the structure and function of the human brain, as brilliant as they may have been, have fallen by the wayside because of this process. Things that once seemed proved beyond a doubt have often been contradicted a short time later. Consequently, there is no such thing as a constant progression from ignorance to absolute truth, but rather what philosopher Niklas Luhmann describes as the redistribution of the pressure to solve certain problems. One and the same phenomenon always needs to be explained differently because discrete historical epochs are defined not by events but by differing conditions of perception. The perspective of Antiquity upon the world and, with it, the human brain deviates substantially from that of the Middle Ages, which in turn differs from that of modernity. But changes in the way people view things don't happen because they have accrued knowledge. Human beings do not know more over the course of history. They know different things. On the contrary, technological innovations are what suggest the specific ways in which a given age perceives the world.



Human skulls were already being opened up for examination around 12,000 years ago. There is evidence that the victims of trepanation survived such massive physical invasions.

It's no accident then that the models developed by research into the brain mirrored each age's iconic technology. For Romans, the brain worked like their ingenious system of water distribution. For them, the *spiritus animalis* flowed through various cranial receptacles, changing in quality so that it can direct a broad variety of activities. Descartes, in turn, broke

the nearly thousand-year silence of the Christian-dominated Middle Ages on questions of the body and tried to explain mental processes with reference to the mechanical engineering that was all the rage in the seventeenth century. Beginning with Descartes, the brain functioned like a musical organ with air pressure, release valves and keys. By contrast, the nineteenth-century brain was more like a telegraph office connected by nerves to recipients throughout the body, just as telegraph cables are linked with the entire world. At the same time, geography was also very popular, leading people to surmise that the brain could be mapped out. In any case, the cerebral cortex was large enough to locate its abilities in set areas like stretches of land, coast and oceans on a piece of paper. In the twentieth century, there were further alternative proposals for how to view the brain. Now it was believed to function like a chemical laboratory, with the neurons acting as miniature chemical building blocks. In the cybernetic age, the brain is perceived as a computer in which nerve cells function according to the rules of logic. And with the advent of the Internet, brain researchers conceive of this organ as a network of disparate intelligence sources.

These metaphors reflect not only the many facets of the brain's activity but also humankind's changing self-image. The way human beings describe their brains is how they see themselves, be it as mechanical cogs in a larger machine, as slaves to their mental chemistry or as networkers in a team. The images provided by science highlight the ways in which we think and feel.

This book invites readers to delve into the history of research on the brain. It does not view the epochs it discusses in light of what we know today, even if the resonance of past and present knowledge is always there. On the contrary, it attempts to encounter the researchers of the past on a level playing field and to understand their questions about how the brain works within the horizons of their own ages. The curious nature of some of their explanations is not evidence for how confused this or that scientist may have been. Instead they retrace the labyrinthine paths of human thought. No one age is ever exempt from the mocking incomprehension of future generations, and that is certainly the case for our own.

Antiquity

How the Spirit Escaped the Well

No Electricity, No Nerves

Imagine a world with no electricity. There are no power plants, cables, electrical outlets, light from lamps, vacuum cleaners, computers radios or anything of the kind. In addition, there is no expression for nerves. If you said the world, you'd be greeted with shrugged shoulders and skeptical looks. So how did people talk about the brain in an epoch in which neurons were yet to fire, no one had thought to prove the existence of action potential, and no nervous systems ran through our bodies?

The brain played no role at all in Ancient Greece, nor were there any brain researchers. Antiquity didn't even have natural scientists or experts in the humanities since the universe of human knowledge had yet to be split along those lines. Nor did people maintain the modern distinction between fact and fiction. For the Greeks, Homer's epic poems were real, even if the Greek concept of reality didn't correspond to our own. The all-too-human conflicts of the gods had for Greeks roughly the same importance that history has for us. They were episodes from past times, which no one in the present had witnessed personally but from which people tried to explain parts of their own existence and culture - although the concept of explanation meant something different. The ancient Greeks didn't see speculation and analytic thought as opposites.

The Greeks regarded contemplation as the highest level of mental activity. People squinted into the sun, lay down at table, talked, debated and exercised their rhetorical muscles whenever they had the opportunity. Back in those days, a bold thesis was worth more than diligent empiricism. Why should people use their hands when they could use their thoughts? But where do thoughts come from? What is it inside a person that thinks? Wherein does the uniqueness of the soul reside?

The point of asking such questions is not to localize and thus diminish the story of the world of the mind but to appreciate and encounter it on equal footing. The great master of this and a role model for centuries to come was Socrates (469-399 BC). Socrates was everywhere to be found on the public squares of Athens because he preferred that to staying at home with his quarrelsome wife. He lured his fellow citizens into endless dialogues - at least according to his disciples, who depicted him as an irresistible debater. Socrates described himself as the honest midwife's son, seeing his calling as helping his conversation partners give birth to thoughts. Socrates cast doubt upon all certainties, persisting for as long as it took for his

partners in dialogue to acknowledge the one and only certain human truth: the realization that, ultimately, we know nothing. Thanks to Socrates knowing that we knew nothing became humanity's greatest insight.

To acknowledge that we *don't* know, we need humility. At stake here is the categorical inability to base knowledge on a solid, universally valid foundation. Those entering into a dialogue with Socrates quickly realized that they had mistaken knowledge for the appearance of knowledge because the human soul has no material basis. Thinking and opinions directed externally out of concern with material goods fail to live up to the standard, set by whom- or whatever, of the great human gift of reason. The most elevated thing our rational minds can do is to reflect upon thought itself, and consequently the pinnacle of knowledge is self-knowledge. That, at least, is the message of the oracle at Delphi to Socrates, who from that moment on seeks to reorient his fellow citizens away from worries about wealth and success to concerns about the soul, by ensnaring them in their own contradictions. The ground under the feet of the ancient Athenians grows shaky when they are forced to admit that they seek happiness in material goods and fulfillment in public offices. After all, people have no influence whatever over such external things. What kind of happiness is it that can disappear together with wealth? How lasting is an existential sense that can unravel if someone loses a public office? Those who put their faith in external things miss out on life. Attuned to their wealth, their souls cannot function in knowledge and reason. In their ignorance, their souls fall victim to what is bad and will never experience bliss.

By the end of his life, Socrates is able to cite his poverty as evidence of his virtue. He has forced himself to exercise self-knowledge and not to waste time accumulating wealth and fame. For this reason, he can take his final steps with the utmost calm. Condemned to death for allegedly blaspheming against the gods and corrupting Athens' youth, he drinks the cup of hemlock of his own free will, though not before asking his would-be executor about how to take the poison so that it's most effective. This is how Socrates proves how little human beings need depend on the material world, if they lead their lives, in keeping with the capabilities of the soul, according to reason and intellect. They can even abandon their own physical bodies. Terror in the face of death fades away. Before his execution, Socrates speaks to his friends what are probably the most relaxed last words any person in his situation has ever said: "The hour of departure has arrived, and we go our separate ways—I to die, and you to live. Which is better God only knows."

With his kind of philosophizing, Socrates inaugurated the examination of what thinking is. He brings to a conclusion that epoch we describe today as "pre-Socratic," in

which thinkers speculated in materialistic fashion about the fundamental principles of the world and the initial causes of all the processes in it. Socrates created a place for contemplation among and of human beings, introducing the great project of self-reflection. With that, implicitly if not explicitly, the questions of where perceptions reside and how the mind functions have been posed. They only needed to be formulated.

How the Soul Became Immortal

Plato (428/427-348/347 BC) was one of the crowd of disciples who followed Socrates through Athens. Unlike his teacher, who never wrote a single line in his life, Plato noted down all of his thoughts and constructed a philosophical edifice to which every thinker who came afterward would refer back. Two-and-a-half thousand years later, the British philosopher Alfred North Whitehead (1861-1947) would declare that the entire philosophy of the Occident consisted of a series of footnotes to Plato. Plato expressed his admiration for Socrates by giving him the lead role in his philosophical dialogues.

The *Timaeus* in particular is about the nature of the soul, which Plato thinks is divided into parts. Here we encounter again the most important themes of the Athenian city-state. The first was the courage which the individual was constantly expected to demonstrate since in times of war for dominance in the Mediterranean men could be called to arms at any time. Like all earlier and later civilized peoples, the Hellenes were concerned with how to deal with the desires that already led the gods in Homer's epics into ruination on more than one occasion. Nonetheless, desire is not categorically rejected because it is essential to ensuring survival. Something within human beings thirsts for knowledge and insight, of which the life of Socrates provided such a luminescent example.

Where is courage located? Or to pose the question differently: which human organ reacts most strongly when courage is called for? Which part of the body proudly rises up to resist adversity and danger? It is certainly the chest, Plato writes, which is filled with the wildly beating heart as soon as courage is demanded and quivers with euphoria, once a dangerous situation is past. Thus, Plato ascribes the courageous part of the human soul to the heart.

And desire? Where did people under the Hellenic sun feel lust? The only candidate for Plato here is the groin. There, the strength of the human loins simmers, always ready to emerge.

Where else but in the head could the knowing part of the soul be located? Do we not put our heads in our hands and rub our knitted brows, when we try to find a solution to a

difficult problem? Here Plato, who had little connection to the empiricism of the practical world, calls upon Hippocrates of Kos (480-379 BC), the great father of medicine, whose oath mandates that doctors act in the interests of patients and whose influence is still felt today. Hippocrates may not have had a high opinion of the organ in “the spacious head cavity,” which was “white and crumbly” and had for him, at most the status of a gland. He granted that the brain functioned as a conduit of reason, but Hippocrates saw air as the cause of all intellectual flights of excellence. Air contained all of the higher mental qualities. It was what gave the brain the capacity to have insights since the head was where air first entered the body in its purest form. Plato followed suit in locating the knowing part of the soul in the head. Although he didn’t think much of the idea of air as the intellectual medium, he attached a special importance to the thinking substance of the brain because he surmised that it was the seat of the immortal soul.

Plato identified an ascending quality of parts of the soul. The torso is the home of desire and voracity, which makes human beings resemble animals and can drive them out of their minds, but which is crucial to the survival of humans as a species and as individuals since it provided both offspring and food. One step higher up is the heart with its courage, which gives human beings the strength to persist. But courage can turn into foolhardiness, if it isn’t accompanied by reason. Thus, the knowing part of the soul necessarily thrones above all others. It is what gives direction to both courage and desire.

Plato sees the brain as a higher authority capable of governing the two lower parts of the soul and creating harmony, just as in political and social sense, a just state (and only a just state) does. In his dialogic investigation, the *Politeia*, Plato describes three estates that are analogous to the three parts of the soul. The producing classes represented the desiring and providing part (*epithymetikon*) required by the rationally thinking leadership. Plato sees the latter as philosophers, which is why the only state he considers just is one in which philosophers are kings and kings philosophers. The soldiers and protectors, the equivalent of the courageous part of the soul (*thymoeides*), also follow the orders of the philosopher-kings in Plato’s just state and are directly subordinate to the knowing part of the soul (*logistikon*).

Plato is only marginally interested in the mechanisms that allow the body to function, but he knows that blood flows throughout the body, and that if people are injured, it doesn’t take long for their wounds to turn red. Thus what substance would be better suited to distributing sensory impressions throughout the entire body and to transmitting orders from the head to the lower parts of the soul? Why should blood in particular be such an omnipotent medium? Plato is more interested in speculations about why we have bodies in the first place.

After all, the immortal soul only requires a head, whose round form imitates that of the universe. Yet in order for such a sphere not to roll around and get itself into “insoluble difficulties,” it avails itself of limbs capable of dealing with potentially dangerous uneven terrain. To prevent the more ignoble areas of the body from influencing the immortal part of the soul in the head, the neck serves as a kind of congesting barrier, a “border between the head and the breast.”

For Plato, the immortality of the soul can be demonstrated with a simple but irrefutably logical proof. How is it possible, Plato asks, that we immediately agree on how houses must be constituted in order for them to be called houses and to exclude other things from that category? How can that be, if no one house is identical to any other? We don't even have to think twice about it. Even with objects that we have never seen in our lives, we can immediately say: That's a house. It's a virtual miracle. But miracles have no place in - and indeed are an offense to - the logical mind. Plato finds an elegant solution. There must be a realm of ideas, he posits, in which their original visible forms are stored. Behind or perhaps above all the individual things that reveal themselves to our perception in the world, there is an idea of things. The idea is what makes the most diverse organisms into animals. Ideas cannot be perceived directly. Otherwise we wouldn't see individual badgers, mice and squid but rather the original images of such. Ideas are, however, accessible to the thinking part of the soul. It has already seen these ideas in a realm of being beyond this one, although the soul forgot them when it entered the body. Only the order of things in the world of perception, which allows us to recognize the most varied forms of life as animals and diverse structures as houses, recalls the pre-existence of these ideas. And since the knowing part of the soul has seen ideas before it entered the body, it must have an existence independent of physicality. Moreover, if the soul existed before the body, there's no reason why it shouldn't live on after the body's death. Thus the knowing part of the soul is immortal and is a tenant of the head for the life span of the body.