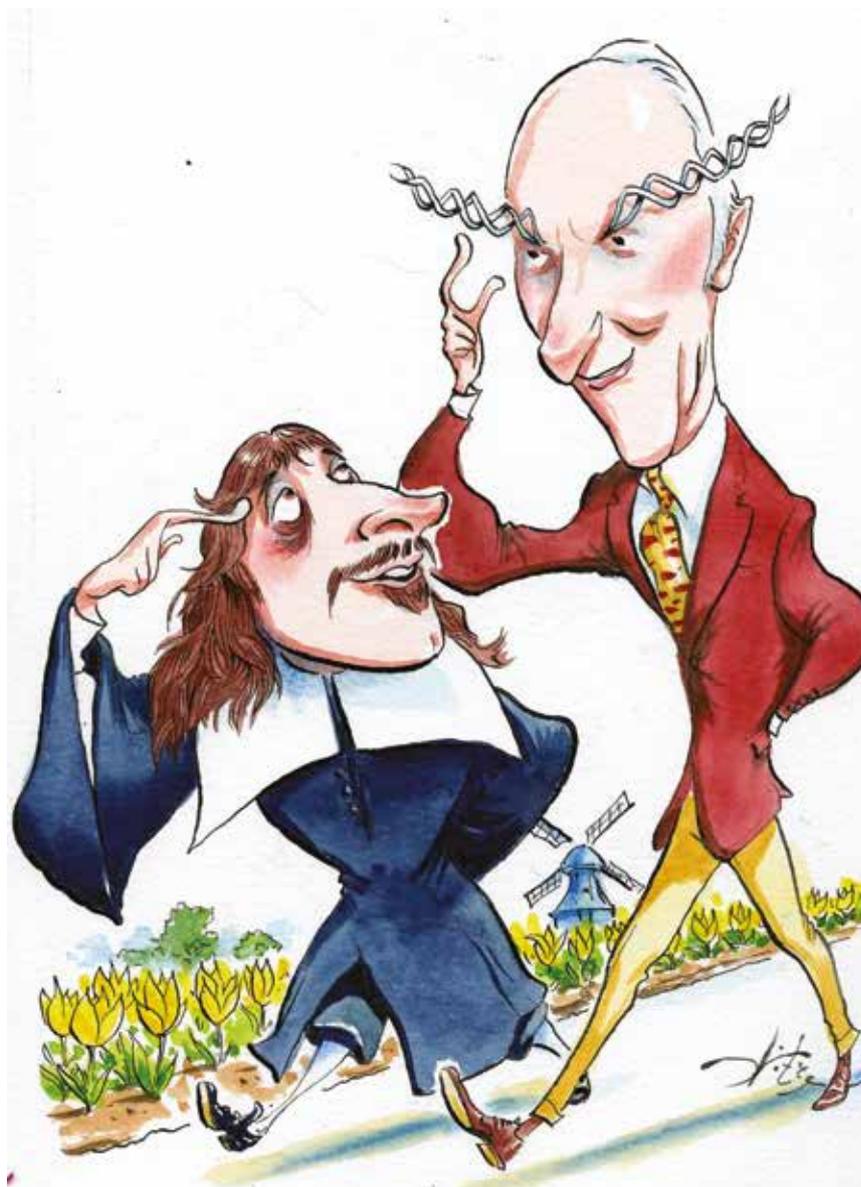


A DEBATE

Two Natural Philosophers, Centuries Apart, Converse about the Mind

Can you guess who they are?

In the Dutch countryside, a tall, older man, dressed in a maroon sports coat, his back slightly stooped, stands out because of his height and a pair of extraordinarily bushy eyebrows. His words, inflected by a British accent, are directed at a middle-aged man with long, curly brown hair, penetrating eyes and a dark, scholarly gown, who talks in only a halting English that reveals his native French origins. Their strangely clashing styles of speaking and mismatched clothes do not seem to matter to them as they press forward, with Eyebrows peering down



intently at the Scholar. There is something distinctly odd about the entire meeting—a crossing of time, place and disciplines.

Eyebrows: So I finally meet the man who doubts everything.

The Scholar: (*not missing a beat*) At this time, I admit nothing that is not necessarily true. I'm famous for that!

Eyebrows: Is there anything that you are certain of? (*sotto voce*) Besides your own fame?

The Scholar: (*evading the sarcastic jibe*) I can't be certain of my fame. Indeed, I can't even be certain that there is a world out there, for I could be dreaming or hallucinating it. I can't be certain about the existence of my own body, its shape and extension, its corporality, for



BY CHRISTOF KOCH

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again I might be fooling myself. *But now what am I, when I suppose that there is some supremely powerful and, if I may be permitted to say so, malicious deceiver who deliberately tries to fool me in any way he can?* Given this evil spirit, how do I know that my sensations about the outside world—that is, it looks, feels and smells in a particular way—are not illusions, conjured up by Him to deceive me? It seems to me that therefore I can never know anything truly about the world. Nothing, *rien du tout*. I have to doubt everything.

Eyebrows: So what's left after your lucubrations dissolve everything?

The Scholar: Ah, but I only doubt to establish with more absolute certainty one fact that cannot be denied: I exist! For there is something that does the perceiving and the thinking. *I am therefore precisely nothing but a thinking thing; that is, a mind or intellect, or understanding, or reason. I think, therefore I am.*

Eyebrows: Yes, in my own time, schoolchildren learn all about your “*je pense, donc je suis*.” The only direct acquaintance you have with anything in the universe is with your own conscious sensations and thoughts. Everything else, the existence of your body, of other bodies, animals, trees and the heavens has to be inferred. I've taken the liberty to reformulate your phrase as “I am conscious, therefore I am.” Some have called this deduction of yours the most famous one in Western thought.

Scholar: (*flushing with pleasure but unflinching in his arrogance*) Yes, yes, I'm not surprised. But even better, I can also prove the necessary existence of God.

Eyebrows: (*curtly*) Never mind—that proof didn't amount to much. (*then tauntingly*) But tell me your thoughts on the relationship of this I, this self, this mind with the body that it inhabits.

The Scholar: Speaking as a *physician*, that is, as a natural philosopher ...

Eyebrows: Yes, what I would call a scientist ...

The Scholar: (*testily*) Pray, can I continue without interruption? Speaking as such a scholar, I have shown that the bodies and brains of animals and humans are entirely made out of material stuff that has extension and weight and can exert force. This corporeal substance I call *res extensa*. Like flowing water that powers the moving statues of

and warning cries like animals. And unlike animals, men have an immortal soul. My conception of *res cogitans* explains all of that. This thinking substance is responsible for speaking, imagining and sensing, remembering and reasoning. Two substances explain it all. Everything is either physical or mental. Quite elegant, if I might say so.

Eyebrows: But let me tell you that in my time they build mechanical contrivances, machines that reason, recognize, count and remember based on something called algorithms, mathematical

EYEBROWS: OUR ONLY ACQUAINTANCE WITH THE UNIVERSE IS WITH OUR OWN CONSCIOUS SENSATIONS ... EVERYTHING ELSE HAS BE TO BE INFERRED.

gods, satyrs, tritons, nymphs and heroes in the fountains at the court of the king in Versailles, animal spirits flow through the arteries, cerebral cavities and nervous tubules of all creatures, making them move. In this manner, the way animals and people run, climb, burrow, chew, move their eyes and otherwise act can be explained mechanically. Based on my dissections of the brains and bodies of animals, their behaviors are caused by the action of particles distinguished by their size, shape and motion. This is also true of the dumb movement and reflexes of men, which can be explained by thinking of their bodies and brains as machines. But I don't accept, as do the libertines, that the animals have minds like those of men.

Eyebrows: (*interrupting*) And women, too, I suppose.

The Scholar: (*with irritation*) Anyhow, men differ in that they have true language and not just simple utterances

recipes or procedures that break down any task into minuscule steps, each one well specified and fully detailed. Starting with some input, a precise command—such as “Add these two ‘numbers’” or “What is a large city in Europe?”—an algorithm will take that input and transform it, using the language of 0's and 1's, into some output. After an uncountable number of such elementary operations, the algorithm will come up with an answer, the sum of the two numbers or maybe simply just “London.” You don't need thinking stuff to get a machine to add or to reason.

The Scholar: (*with surprise*) These be wondrous automatons, like the chess automaton that I have heard the Turkish sultan has in his palace. But tell me, Englishman—these simulacra of human brains, these machines that you talk of, can they truly speak?

Eyebrows: Yes, you can speak to them, and they answer back in a voice that has

a certain tinlike, mechanical quality to it. Our artisans excel at building these wondrous machines so small that they fit into the palm of one's hand, made out of glass and copper and sand. But more important is that the existence of these speaking machines implies that your kind of dualism is wrong. We don't need your ethereal thinking stuff to explain how men talk and reason. We have algorithms that can recognize a picture, play chess, drive a carriage, learn from experience, search for things on the world's marketplaces, determine how much taxes you owe the queen and reason about logical puzzles. People are but intricate machines made out of nothing but matter, your *res extensa*.

The Scholar: (*with urgency*) But where does this leave the divine soul, the immortal soul that God himself placed into each man and each woman?

Eyebrows: Sir, I have no need of that hypothesis.

The Scholar: Heathen! Atheist! Amoralist!

Eyebrows: (*condescendingly*) Well, you know better. (*then quickly, to quiet his companion's discomfort*) But tell me your ideas concerning the import of the pineal gland.

The Scholar: Well, the nature of each of our sensations or experiences is unitary. When I look at the full moon at night, I don't have two experiences, one of a bright disk and a second experience of the color yellow. Rather I see the yellow moon. And, of course, I have but one



will. I know from my dissections of cadavers that everything in the brain comes in pairs: there are two hemispheres inside the skull, and they, in turn, consist of smaller structures, such as the cerebral ventricles, that come in pairs, matched on the left and on the right. So they can't be the places where the thinking substance acts. But there is only one pineal gland, right at the center of each brain. This is where the *res extensa* meets *res cogitans*; this is the seat of the soul.

Eyebrows: (*admiringly*) Very clever. Linking a structure in the body to a spe-

cific function. I, too, in my youth, made such a structure-function inference about the molecule of life and became famous for it. But, unfortunately, you got your anatomy wrong. For when you look with a microscope ...

The Scholar: (*interrupting*) Yes, I heard of this wondrous instrument, invented not far away from where I live, but I don't have one.

Eyebrows: Anyhow, when you peer through a microscope, you see two pineal glands, one for each hemisphere, interdigitated. And when you lose your pineal gland, neither life nor consciousness leaves the body. It's neither the pineal gland nor the fluid circulating in the ventricles that do the job. In my time, we learned from doctors and scientists that it is the gray matter of the cortex that is the seat of perception, intelligence and reason. It is in the catacombs of the cere-

THE SCHOLAR: THERE IS ONLY ONE PINEAL GLAND AT THE CENTER OF EACH BRAIN. THAT IS THE SEAT OF THE SOUL.

bral cortex, made out of billions of tiny specialized organs called nerve cells, that any one conscious sensation is born. I myself thought for a while that I had discovered the footprints of the conscious mind in the brain—that a particular type of vibration in the activity of nerve cells located deep in the windings of the cere-

bral machine whose structure makes it think, sense, and have perceptions, we could conceive it enlarged, keeping the same proportions, so that one could enter into it, as one enters into a mill. Assuming that, when inspecting its interior, we will only find parts that push one another, and we will never

EYEBROWS: I THOUGHT I HAD FOUND TRACES OF CONSCIOUSNESS—AN ERROR SIMILAR TO ASSUMING THE SOUL IS IN THE PINEAL GLAND.

bral sheet was the imperial purple, the signature of mind. But more recent experiments suggest that these oscillations are linked to the effects of paying attention to a particular event and not of becoming conscious of the event. So my pretty oscillation hypothesis looks to be as wrong as your pineal gland guess.

The Scholar: So we were both wrong. (*then triumphantly*) But wait—how do you squeeze incorporeal consciousness, a sensation, out of matter, out of physical stuff? Your theory lacks something essential.

Eyebrows: (*engagingly*) Ah, therein lies the rub. For you are right—whether it is the pineal gland, 40-hertz spiking patterns of layer 5 pyramidal cells projecting to the frontal part of the cortex (never mind, you wouldn't understand), or something far stranger—why does THIS mechanism give rise to feelings, to subjectivity, but not THAT mechanism? It seems arbitrary. For nowhere in physics does consciousness appear, yet the brain—a physical object—is conscious. A famous German scholar wrote a bit after you: “*Moreover, we must confess that the perception, and what depends on it, is inexplicable in terms of mechanical reasons, that is, through shapes and motions. If we imagine that there is a*

find anything to explain a perception.” In my times, philosophers refer to this as the Hard Problem, with a capital H, forever unsolvable by science. But they underestimate the power of natural philosophy, of science, to fully plumb and measure the world and render it comprehensible to reason.

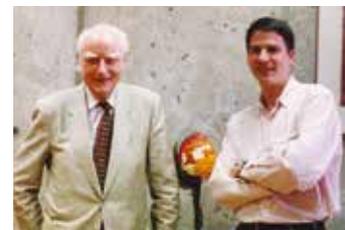
The Scholar: Your world appears to worship at the altar of science. I hope this science has given all of its citizens peace and happiness. Yet you still haven't explained consciousness, how the soul comes into the body. Maybe I was wrong about the need for special thinking stuff; maybe machines can reason or speak without it. But do they feel anything when they do reason or speak?

Eyebrows: (*sobering*) I must admit my ignorance. Today we have a concept called information. We can quantify how much information a message contains, such as a letter or cypher communicated by lanterns between ships, and how to send this information across the globe. A modern Italian doctor and natural philosopher, an intellectual descendant of Galileo Galilei with whom you are well familiar, has invented something that he calls integrated information—the difference that makes a difference to the brain itself, from its

own intrinsic perspective, that might solve the seemingly insurmountable difficulty of explaining how matter is linked to sensation, how the water of the brain is turned into the wine of conscious experience.

Not understanding much of this last bit but mollified by the metaphor from the New Testament, the Scholar and Eyebrows continue their learned disputation, walking slowly off into the Dutch countryside, the home of the Scholar, until gradually we lose sight of them. **M**

This imaginary dialogue takes place between biologist Francis Crick, the explorer of genes and neurons, and mathematician and philosopher René Descartes, the exponent of dualism, that metaphysical teaching that the mind and brain are two separate magisteria. The italicized parts of the Scholar's speech are verbatim translations from Descartes's texts. The famous citation about the mill is from Gottfried Leibniz, the mathematician, scientist, lawyer and philosopher who invented binary numbers and co-invented calculus. The last reference is to Giulio Tononi's integrated information theory.



Eyebrows (left) and Koch. Many years ago Koch graduated from a high school named after René Descartes, and he worked closely for years with Francis Crick.

FURTHER READING

- **The Astonishing Hypothesis: The Scientific Search for the Soul.** Francis Crick. Scribner, 1994.
- **Meditations on First Philosophy.** René Descartes. <http://bit.ly/1AG0u00>