

## True neuroscience



### The Physiology of Truth: Neuroscience and Human Knowledge

by Jean-Pierre Changeux (translated by M.B. Debevoise)

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Reviewed by Yadin Dudai

Most experimental scientists do not have a theory of truth despite being confident that they are diligent truth seekers. At most, the question “Is it a true fact?” evokes an answer of the type, “Sure, I used ANOVA” (or whatever favorite statistical test was unearthed for the occasion). Those few scientists who contemplate the issue a bit further usually end up using what philosophers might call a ‘recursive correspondence theory’. This is the belief—itself a loaded term—that our knowledge about an event or process is true if the behavior of that event or process in the world corresponds to the predictions of that knowledge, and if that knowledge integrates properly with other knowledge. Because this correspondence might break down when the analysis is pushed to its limits, research programs and academic careers are generated in an attempt to resolve the discrepancies. The new knowledge, alas, will generate new discrepancies; hence the recursiveness.

Many philosophers react to such pragmatism with a recursive intellectual estrangement; yet, there is much to say in its favor. First, it paved the way for intercontinental flight, e-mail, open heart surgery and Prozac, to name just a few dividends. It is difficult to argue with success. Second, it pleases scientists because they appreciate that the story will never end.

No discipline in experimental science is as haunted by the origin, value and criteria of the veridicality of knowledge as are the neurosciences. Whatever knowledge and truth are, the brain is bound to take part. Yet even neuroscientists of the intellectual type often shy away from the problem of how true is our knowledge about the world by hiding behind piles of gene chips or false-colored brain scans. It is therefore refreshing to encounter a leading neuroscientist who reminds us that the philosophical merit of this issue is relevant even for a pre-retirement investigator. If I had been asked who should tackle such a problem, Jean-Pierre Changeux would have clearly been on my short list. A pioneer of reductionistic neurobiology, master of enzymology and receptorology, at ease with philosophy and literature, and a professional painting connoisseur (items from his private col-

lection are on display at the Louvre), Changeux is a truly renaissance scholar at the cutting edge of scientific research.

*The Physiology of Truth*—I prefer the French title, *L’Homme de Verite*—is a monograph on the neuroscience of human knowledge (as its subtitle implies). It is not an essay on physiology, epistemology or semantics, but a *tour de force* covering selected chapters in neuroscience and their philosophical underpinning, colored by the author’s interpretation of the interaction of phylogenesis, ontogenesis and epigenesis.

The binding theme is the relationship of knowledge encoded in our brain with the world at large. The theory draws from forty years of research by the author and his colleagues, but as usual, it also rests on the shoulders of giants. In a nutshell, the brain is portrayed as a system that evolved to generate endogenous pre-representations of potential worlds. These pre-representations are selected by the extra-brain world by their suitability to account for stimulus-stimulus or stimulus-response contingencies. Those that best predict the world come to be more active and thus more stable over time, winning out over the less active ones, which destabilize and disappear. Our ability to act, react and comprehend is hence shaped by a Darwinian process, which selects among mutations generated in mental space.

This view has interesting implications. First, it generalizes evolutionary processes to the mental domain—internal representations are evolving species nested in the universe of biological machines. Second, it suggests that as far as the mental world is concerned, Dr. Pangloss, Candide’s faithful, supra-optimist mentor, was not so far off track: whatever is represented is there for the good of humankind, because in essence it is aimed at smoothing our interaction with the world.

If Changeux and his colleagues are correct, we shouldn’t worry too much about the validity of our basic picture of the world, because the world and our brain struck a deal, zillions of years ago, to enable them to comprehend one another correctly. An important caveat, though, is that this conclusion refers to the capabilities of our perceptual and cognitive faculties as a species, not to the veridicality of recall of specific episodes or of culturally entertained religious and political beliefs. In addition, we have no evidence that the brain-world interaction has evolved to an optimum. Could it have been led astray along the way? Finally, given that we were selected to function in a limited arena of the universe, our brain is probably blind to whatever is behind the scenes.

*The Physiology of Truth* is a useful pointer to intellectual repercussions of brain research, as well as the epitome of the ability to bring blessed subjectivity to scientific texts. Many discussions in the book are thought provoking. For example, the intriguing citation from Jacques Monod, who recounted his surprise at discovering that, in concentrating on a certain problem, he actually imagined that he was a protein molecule. Reading this brings to mind *Vico’s* maxim: the criterion of truth is to have made it<sup>1</sup>. *Vico* had in mind God and His Creation, but recent evidence, some of which Changeux cites, reinforces a secular version of this idea: for our brain, to understand means to be able to replicate the act. If this is so, our ability to know and evaluate the validity of that knowledge is *a priori* limited because even the most enthusiastic neuroscientist would never propose that our brain can do everything.

1. *Vico, G. On the Ancient Wisdom of the Italians Unearthed from the Origins of the Latin Language* (Cornell Univ. Press, Ithaca, New York, 1710/1988).

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