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Philosophy, or how I learned that neuroscience isn’t perfect

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The ancient philosopher Aristotle made some of the earliest scientific claims about the natural world while making philosophical claims about abstractions like happiness, virtue and the nature of reality itself. Centuries later, Watson and Crick elucidated the double helical structure of DNA. Although appearing strikingly different, scientists and philosophers ought to be equally conscientious of the dynamics of their investigations, taking notice to principles and causal interactions. Through history, science and philosophy have complemented each other and in fact share many core elements in their fundamental ideology despite investigating different realms of reality. Fundamentally, science aggregates knowledge by conjecture and experimentation to discover truths about the physical world, while philosophy investigates our world of abstractions with logic and rational argument. Collectively, the two disciplines and the efforts of their faculty strive to understand inward and outward reality, and have fundamental similarities and differences in their execution. Yet, philosophy remains imperative in scientific pursuit of reality's greatest questions and science equally complements philosophical investigations of the current human condition.

The modern investigation of the mind has complicated the relationship between philosophy and science quite significantly. Neuroscience is the forefront of the scientific investigation of the brain's structure and function. It strives to explain our minds and brains with functional, observable evidence. Much neuroscientific research is done through trials and task-based human and animal tests and investigation of neurophysiology and pathophysiology through examination of the brain itself, its electrical signals or metabolic activity. Furthermore, combining test data with neuroanatomy and patient experience has helped derive conclusions about brain structures and their proposed functional significance. Such pursuits have brought us to magnificent discoveries about the neural mechanisms of the senses, motor control, emotions and maintenance of involuntary processes like breathing and sleep that we are just beginning to understand.

Ethics, or moral philosophy, is a major field in the study of philosophy and addresses what we perceive as right and wrong and how we ought to act given certain circumstances. As neuroscience is a specialty of biology and psychology, ethics is studied as a specialization in philosophy, and investigates the moral dilemmas of abortion and war, our treatment of one another and ourselves, and many more moral questions. For example, ancient texts such as Aristotle's *Nichomachean Ethics* provide us with ethics based on virtue, while modern philosophy yielded Immanuel Kant's *Groundwork of the Metaphysics of Morals*, outlining a purely logical formula moral decision-making, both asserted with equally convincing logical argument. Still there are countless other ethical philosophies that investigate how we ought to act, and why we are obligated to do so based on the human condition. We continually refine our morality by experience, education and the intervention of society, e.g. religion, but also receive insight from biology on how we have evolved to make such complex decisions. We make these moral decisions almost naturally, but science complements this thinking with theory that alludes to how we come to make moral decisions.

Theory of Mind is a tenet of behavioral biology, qualified as the ability that allows one to understand what others are thinking and how they may act of feel in response to a given situation, i.e., the ability to understand others' mental states. The skill is obviously present in humans, but also has been demonstrated in animals, particularly crows and corvids, who will relocate food stashes if conspecifics with a known propensity for theft have seen their caching spot. Since Theory of Mind is used when we judge another's reaction to something, it is thus a de facto tool for moral decision-making. In fact, many ethical theories take such effects of one's actions on other people and the consequences into account in their logic. Thus, it is important to understand how others will be affected by our actions about humanity's current pursuits.

in order to establish basic moral principles and logically investigate how we should act given a specific situation. In this case, our biological ability to use Theory of Mind greatly contributes to our philosophical ability to write and argue ethics or philosophy in general, serving as a prime example for the intrinsic link between science and philosophy.

Moral philosophy has chronicled humanity's thought on how we ought to act based on logic and reason, but neuroscience raises new questions as scientists are beginning to suggest neural correlates of complex brain functions. Most interestingly, Rebecca Saxe, an MIT neuroscientist, has done some compelling work on Theory of Mind in humans. She designed and performed a series of experiments in which subjects were to respond to an array of moral dilemmas as a control, taking into account the motives and intentions of the characters in the scenarios. She then ran the same series of experiments with the addition of transcranial magnetic stimulation (TMS) to an area of the brain called the right temporo-parietal junction (RTPJ) in the subjects. On the second trial with TMS, decision making in the subjects was significantly affected and noteworthy enough to publish. Although the effects were not very dramatic, Saxe suggests that the RTPJ may be the "brain center" for moral decision-making, and this has far reaching implications. Her elucidations and other neuroscientific discoveries are grand, impressive and useful, and as such, neuroscience is progressing at lightning speed and challenging philosophy in an interesting way. Principally it begs the question, can and ought we reduce the mind to the components of the brain?

Both neuroscience and philosophy strive for the answer to the famous "hard problem of consciousness," which asks how physical phenomena give rise to mental phenomena and inner experience, i.e., the causal link between the physical brain and the metaphysical mind. Here, philosophy suggests that we mind the gap in the hard problem of consciousness. In the 1700s, David Hume proposed the Is-Ought Problem, which calls for caution in making statements about morality or what *ought to be* based on extrapolations of what is empirically or ontologically and argues that what ought to be does not necessarily follow from what is. Hume's idea is applicable to the hard problem of consciousness and neuroscience in that it reminds us that pieces of the brain may discretely correlate with infinitely complex functions like morality, but this does not imply a casual relationship. Just because the RTPJ is active during moral decision-making does not mean that it controls morality, that the process is localized to a discrete brain region, or that our complex mental function arises from only chemicals and electrical impulses. Reducing our infinitely rich human experience to synapses and action potentials seems foolish, although they are the only observable physical phenomena that we have to work with at the present time. In this sense, science falls short with empiricism where philosophy can provide help through reason. This is not to say that philosophy is greater than science or vice versa, but it is important that we think about our nature both inside and outside of empirical data. There are some things that empiricism and science simply cannot answer, and the nature of the mind and consciousness may be one of these things. We may never know what really underlies our human essence even with the physical phenomena under our microscopes. In the context of the mind, there is an equal playing field in the pursuit of truth for both neuroscience and the "neurophilosophies," e.g. philosophy of mind, perception and phenomenology.

In this back and forth between neuroscience and philosophy, there is truth to be known for the scientist and philosopher. In science, philosophical deliberations and understanding is crucial for logical consideration of empirical data, especially in neuroscience. Correlations are wonderful output for science experiments, yet it must be conserved that such statistics are not necessarily elucidating causal relationships between the mind and brain. In spirit of Hume's Is-Ought Problem, the scientist must be philosophically well informed in order to infer the proper conclusions from experimentation based on the data itself. For example, while brain structures are active during specific tasks, one ought not suggest that that biological activity in a brain region is the sole cause for a mental event. Rather, the correlation should be stressed and investigated further with an air of uncertainty. For the philosopher, understanding the motives and progression of modern science allows one's logic and reason to parallel such progress and remain relevant to the classic and modern questions of the human condition, and the modern development of philosophy manifests this principle. Science augments philosophy in this way, enabling far reaching abstract thought about humanity's curent pursuits. This is especially

relevant to Philosophy of Mind, which must pay close attention to developments in the cognitive and neurosciences to bolster and enhance arguments and theories. This being said, the bolder claims of causality by neuroscientists ought to be reserved for philosophy because there is simply not enough evidence to prove their validity or falsehood.

Neuroscience is providing us a picture of what is happening in the brain, but also some unsettling implications that the brain itself is suggesting what ought to be, or that the brain alone is the executive controller and the essence of our experience and existence. Although we would not exist without our brain, our perceived power of free will and thought about our physical and biological nature is evident, implying that the metaphysical has an equal or larger role in explaining the nature of reality. There is a causal link missing between the brain and the mind, and philosophy calls us to be conscious of that while neuroscience presses on deeper into our brain matter for an answer that may not be in the flesh. In a practical sense, philosophy has the foothold in the neurophilosophical debate, and when posed with questions of the intrinsic nature of the mind and the missing causal link, philosophy can provide us with the most useful answers. Empirical evidence for causal relationships is sparse, and while brain scans and studies may be sources of insight on physical mechanisms of thought, they can never tell us what ought to be, or provide us with the answer to the hard problem of consciousness. Neuroscience is an empirical endeavor at its core, and only in conjunction with or lead by philosophy will it shed light on the truth of our inward reality.

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