A review of “Being you: A new science of consciousness”

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Being you: A new science of consciousness by Anil Seth delivers the most up-to-date data, lessons, and theories in the emerging field of consciousness science [1]. The author delivers a swift, concise yet comprehensive tour of the scientific literature on consciousness: from major philosophical views of consciousness to the findings on different levels of consciousness, the contents of consciousness, then to the conception and perception of the self, and finally, the educated guesses on consciousness in non-human creatures such as octopuses and machines.

The first step that Anil Seth take is to reject the influential hard problem of consciousness, which says science will never be able to account for how the phenomenological properties of consciousness arise from material mechanisms. Then Seth proposes what is more useful and ultimately true is to assume the real problem of consciousness, which states that goals of consciousness science are to explain, predict, and control the phenomenological properties of consciousness. Such approach is the basis for his analysis and discussion of the theories and experiments in the book. In dissecting consciousness into smaller, measurable conscious experiences, such as the perception of one’s own body or the perception of a color, then finding their neural correlates and appropriate theories that account for these experiences, Seth believes the big mystery of consciousness will eventually fade away. Perhaps, one day, we can account for why consciousness arises in the universe in the first place.

Then Seth introduces us to various theories that attempt to establish a measurement of consciousness level. Two of the most prominent theories explained in the book are the measurement of perturbational complexity index (PCI) and the theory of consciousness as integrated information processing. The former measures the algorithmic complexity of brain electricity signals recorded by an EEG device when the brain is zapped with a transcranial magnetic stimulation (TMS). We then learn researchers have found very high level of correlation between the PCI magnitudes and a variety of conscious experiences. In medical setting, PCI has been used to rescue people who experiences locked-in syndrome from being wrongly diagnosed as being in the vegetative state. It is also fascinating that studies of consciousness and brain activities under psychedelic uses show that psychedelic uses led to higher PCI than a baseline of waking rest, while measures of PCI in sleep or disorder of consciousness led to a decrease.

The other prominent theory, the theory of consciousness as integrated information processing (IIT), proposes that “*a system is conscious to the extent that its whole generates more information than its parts.*” Seth introduces us to Φ , the Greek letter phi, which is the measure of consciousness proposed by IIT. More precisely, Φ measures the amount of information generated by a system as whole compared to the amount generated by each of its parts, which explains the logic of understanding consciousness as integrated information. Consciousness is information because

each conscious experience is unique compared to other conscious experiences, and it is integrated because our conscious experience is unified such that we don't experience, for instance, the view of a mountain as being separated experiences of color and shape and size, we experience all its perceptual characteristics as a whole. We then learn about the vibrant debates around IIT and its successes in accounting for some empirical observations as well as its strange implications.

Moving on from level to content of consciousness, we are introduced to one of the most fascinating theories about perception, which is the 'controlled hallucination viewpoint.' The central claim of such view is that that we do not perceive the world as it is, but as it is useful to us, thus epitomizing a deeply evolutionary logic. For example, according to this view, color is not a property of things-in-themselves and consequently, our perception is *not* about reading out such property, rather, color is the tool evolved to help us keep track of object under changing light conditions. As such, a white cat will always be perceived as white whether indoor or outdoor.

What is counterintuitive about this view is that our perception is not the process of *reading out* sensory signals from the world, but it is the continual process of *top-down prediction error minimization*. Prediction errors are the differences between what the brain expects to perceive and what it receives at every level of processing. Anil Seth explains the idea of minimizing prediction errors takes the Bayesian claims about what the brain should do with sensory data, and proposes the brain is approximating Bayes' rule by minimizing predictive errors everywhere and at all times. For example, if we walk down the street, our brain will form Bayesian best guesses about what it expects to see: houses, trees, peoples, vehicles, etc.; such expectations would prime the brain to expect certain kinds of perceptual signals in terms of color, movement, temperature, etc. of these objects. If the sensory data differ from what the brain expects, we will feel surprised.

Deriving from the controlled hallucination view is another counterintuitive fact that action and perception are inseparable, while our intuition dictates our interaction with the world follows the order of sense, think, and act. Here, Seth introduces the concept of active inference, proposed by Karl Friston, to understand how action helps minimize prediction errors. Active inference is defined as a process in which the brain collects sensory data "that makes its perceptual predictions come true" via generating actions. Generative models are crucial for active inference, because for active inference to work, it must depend on conditional predictions which is based on generative models' ability to predict sensory consequences of actions. The idea is the brain needs to know among countless of possible actions, which actions are likely to reduce sensory prediction errors.

Being informed by the controlled hallucination viewpoint, Anil Seth presents a series of ingenuous experiments that lends its empirical support: From how we perceive the world, i.e., colors, shapes, time, objecthood, etc., to how we perceive the self, i.e., our volition, body ownership, etc. Many experiments involved subjects wearing virtual reality headsets and interacted with virtual objects, which either behave like in the real world or not. The readers learn what the controlled hallucination viewpoint predicts, and what are the experimental results, how the results are interpreted. The discussion of these empirical experiments seamlessly blends with the discussion on well-known perplexing real-world phenomena such as the rotating snake illusions, the White-or-blue dress, the out-of-body experiences, the fact that our experiences of being a self seems to remain mostly stable through time. All to show us that all perceptions are inferences of the causes

of sensory data coming from the world, and there is a “deep structure of perception” that we can scientifically probe.

Toward the latter part of the book, Anil Seth introduces us his beast machine theory of consciousness through exploring our interoceptive experiences of being an embodied, living organism. Building on the theories of active inference, the controlled hallucination viewpoint, and the theories in the field of cybernetics, Seth argues interoceptive signals such as heartbeat, body temperature, etc. need to be drawn towards a particular range of desired values, expected by the brain to be signs of physiological viability. As such, moods, emotions, senses of valence or arousal, and our formless sense of being alive, can be viewed as “control-oriented perceptions which regulate the body’s essential variables.” Seth concludes “We are not cognitive computers; we are feeling machines.” It all comes back to the idea that our brain is not evolved to have abstract thoughts, its primary function is to move the body in a way that maintain a healthy balance of its physiological resources [2].

Central to this theory is that our conscious experiences arise from our material reality as being flesh and blood, as being made of cells whose imperatives are about protecting their physiological integrity. Based on such view, Seth sets out to discuss the scientific evidence and possibility of consciousness in other animals and in machines. Here, we encounter strange islands of consciousness such as that of the octopuses, or the fact that no monkey has passed the mirror test (i.e., the test for self-recognition, which only some great apes, dolphins, killer whales and an elephant have passed). Based previously mentioned theory and knowledge of perceptual experiences such as body ownership or color perception, Seth analyzes how a decentralized nervous system of the octopuses would perceive the world. For example, an octopus ‘sees’ with their skins as much as with their eyes given its light-sensitive cells in its skins, or it can distinguish what is itself and what is not, but not where its body is in the world, given its suckers act as semi-autonomous animals. Turning toward the possible mind of a machine, a logical inference from the beast machine theory is that given that the physical substrates of machines does not have the drive for self-preservation, unlike cells in any body, Seth finds it hard to believe computers, as we know of, can achieve consciousness. And much of his discussion on machine consciousness is to disentangle the muddy confusion between intelligence and consciousness.

In sum, Anil Seth’s *Being* has successfully presented a compelling story of the emerging science of consciousness. The readers are left pondering about the exciting future where new technologies and smart experimental designs can further deepen our understanding of the mind. Crucially, as Seth analyzes the theories and experiments based on the principles of the real problem of consciousness, i.e., any theories of consciousness need to explain, predict, and allow us to control for the differences between consciousness in various conscious states (e.g., general anesthesia, deep sleep, light sleep, normal waking, psychedelic experiences, etc.), the readers have come to think of consciousness not as a giant mystery of the universe, but a scientific problem that can be divided into manageable tasks and probed in ingenuous ways. As the mind is all that we have, we are better off believing that a mature science of the mind will gradually shed lights on one of the biggest mysteries in the universe, our inner light [3-5]. Thus, delivering the tools needed to improve our well-being.

References

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