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Critical Comments on the Sensorimotor Approach to Consciousness

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Critical Comments on the Sensorimotor Approach to Consciousness

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Abstract- Cognitive neuroscience and contemporary physicalist philosophies of mind typically hold the view that minds somehow reduce to brain activity. This is achieved through representations that evolved to map reality and are subjected to computational activity. The received view has been criticized mostly through thought experiments that rely on the notion of qualia, but philosopher Alva Noë follows a different approach, called the "sensorimotor theory". Unlike the orthodoxy, Noë argues that our minds are not inside our bodies; they are better seen as a dynamic process of embodied cognition. This means mental activity emerges from our engagement with the world around us. Noë's thesis is grounded on original arguments that are both empirical and philosophical in nature.

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I. Introduction

Cognitive neuroscience is the discipline that merges two influential ideas:1) The mind is an information-processing engine that builds representations of the world and 2) The brain is the locus of all mental activity. Scientists in this field expect to obtain a comprehensive account of our cognitive capacities through the use of imaging techniques such as PET (positron emission tomography) and fMRI (functional magnetic resonance imaging). The idea is to take advantage of such resources in order to understand how the brain implements mental functions. The brain is seen as hosting a kind of mapping of reality that is continually updated and elaborated through computation and external input. Put another way, the brain is a kind of biological computer.[1] The relevant computations are operations that relate representations. As a representational engine, it (very roughly) correlates sets – the representing set is causally and reliably correlated with the represented one. This allows an organism to cope with the represented set (the environment).[2] Patricia Churchland puts this idea thus: "Brains are buffers against environmental stress and variability."[3] Higher organisms are equipped with brains because evolution has exploited the advantages conferred by predicting and planning for future events that are biologically meaningful.[4]

One of the strengths of cognitive neuroscience is its ability to empirically justify its claims about the representational nature of the mind. Experiments concerning how rats navigate a maze strongly suggest capacities that cannot be explained by conditioning alone. Similar conclusions can be drawn from experiments that test the cognitive abilities of ravens.[5] These hypotheses are strengthened by a sense of continuity with the behavior of "lesser" organisms that nonetheless possess analogous skills. Even the humble jumping spider would seem to exhibit representational abilities (more specifically, it is alleged to represent spatial relations when hunting).[6] Thus, representation appears to be widespread in biological systems.

It is thought thateach and every human cognitive ability, understood abstractly or psychologically, has a correlate in neurophysiology. Philosophers of mind tend to be especially interested in the so-called NCCs (neural correlates of consciousness) and their potential to shed light on the nature of conscious phenomena, such as sensory perception and voluntary action. Fortunately for its proponents, among whom one finds many scientifically-minded philosophers, the search for NCCs has led to testable and predictive theories of phenomena such as visual perception, and this seems to vindicate the framework within which the issues are defined and dealt with.[7]

Philosopher AlvaNoë, a professor at The City University of New York, says the whole conception described above is, despite all its apparent success, overhyped. Indeed, he says it is overhyped to the point of being presented to audiences worldwide as a stunning novelty, when it has in fact held educated people in thrall for decades. In his latest book, *Out of our heads: why you are not your brain, and other lessons from the biology of consciousness,* Noë claims mainstream cognitive neuroscience has not and cannot achieve its goals, for it rests on false assumptions, some of which are philosophical in nature (pp. 5-7; 98-99).He argues firstly that it is misleading to see biological minds as information processors; secondly (and most

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[1] BROOK & MANDIK, 2004.
[2] *Origins of objectivity* (BURGE 2010), p. 9. Burge believes this is not a correct account of representation, but in any case it is the one assumed by cognitive neuroscience
[3] *Brain-wise: Studies in neurophilosophy* (CHURCHLAND 2002), p. 274.
[4] Ibidem.
[5] Idem, pp. 87, 276-277.
[6] BURGE 2010, pp. 514-517.
[7] *The cognitive neuroscience of consciousness*(DEHAENE & NACCACHE 2001)

importantly), that our minds are not located *within* our bodies, as the search for NCCs implies. Mental activity is rather a holistic process that extends to the organism's environment. Higher animals are not conscious and intelligent due to the possession of a map that passively and intellectually represents the world. Their consciousness, like most of their mental faculties, interacts *dynamically* with the world. This brings us to Noë's main point: People cannot be identified with their brains (p.24). Brain activity can only give rise to a mind when situated in a biological and cultural context of action and skills. It is high time we gave up the idea that neurological activity per se is sufficient for consciousness, which seems to imply the absurdity of consciousness in a petri dish (p.12).

At this point, readers may have noted how much Noë owes to American psychologist James Jerome Gibson. As Noë acknowledges, Gibson's innovative work pioneered an approach that matches minds to their ecological habitats.[8] Perception-endowed creatures have a viewpoint due to their ability to match sense information to the possibility of action. Consider how this relates to the meanings we grasp in things around us: E. Bruce Goldstein says that someone's initial "reaction to a flight of stairs may, in fact, be 'here is a way to go up'rather than 'here is a series of surfaces'." [9] Gibson first had the idea after noticing that contemporary studies in depth perception lacked realistic considerations about the perceiver's environment.[10] Unfortunately, he was never able to present much empirical data to support his hypothesis.[11] Noë's work can be seen, then, as an attempt to bridge this gap.

So let us look first at the negative arguments Noë advances. Those whose sympathies lie with mainstream cognitive neuroscience might think brain scan technology gives us a clear-cut picture of cognitive activities in the brain. Not quite, says Noë. The definition of a baseline relative to which one can detect neural correlates of cognition is problematic. For starters, the brain is never at rest,and comparing the baseline with the target activity involves the assumption that there are no feedback mechanisms from the latter to the former. Given the fact that there are indeed such loops in certain brain systems, one must not jump to conclusions about brain imaging data (pp.20-22). Furthermore, brain scans cannot at present tell us how metabolic activity relates to the mental goings-on of patients in persistent vegetative state. One might think that reduced brain metabolism explains impaired mental functions in vegetative patients; astonishingly, though, "it would appear that global metabolic levels remain low even after full recovery" (p.18). The upshot is that we ought not to get carried away with alleged discoveries of NCCs by cognitive neuroscientists. It is just not about looking and observing what is going on.

Another point against the identification of conscious phenomena with NCCs has to do with neural plasticity. The view that the mind is a set of dedicated information-processing modules predicts the existence of specialized systems for each sensory modality, and is supported by the apparent discovery of an area that represents faces specifically (p.110-117). Nonetheless, Noë mentions (pp.53-56) experiments with ferrets where the animals' eyes are wired up to brain structures normally used in hearing. If there were something in the visual cortex that made experiences visual, and something else in the auditory parts making experiences auditory, the ferrets would "hear with their eyes" (p.55). But this is not the case. The ferrets see with their supposed "auditory brains". This implies a malleable connection between brain structures and the qualitative character of experiences. For this reason, itis ill-advised to equate a given conscious phenomenon with activity in this or that part of the brain. The structure of the "auditory brain" is not the key here; what explains its role in the experience is its connection to a certain *source* of information. Moreover, it has been shown that depriving cats of sight during a given period in their infancy destroys their ability to see. Experimental data strongly suggests, then, that "sensory stimulation produces the very connectedness and function that in turn make normal consciousness possible" (p.49). Here is a good reason for considering the possibility that the visual character of experience is determined by interaction with the environment, and not just by activity in this or that brain structure.

So how does Noë convert the insights above into a theory that actually explains the data? In a nutshell, he claims that perceptual experience happens when organisms apply their mastery of the laws of sensorimotor contingencies (pp.47-65). Put another way, conscious beings have subjectivity in virtue of their use of special skills which constitute a kind of non-propositional knowledge. They can skillfully exploit certain potentialities to get information from the environment. Creatures that are capable of seeing, for example, have mastered the lawful dependence relation between their actions and visual input, a relation determined by the character of their visual apparatus. As Noë says, "how things look depends, in subtle and fine-grained ways, on what you do. Approach an object and it looms in your visual field. Now turn away: it leaves your field of view" (p. 60). Furthermore, conscious animals tacitly understand the sensorimotor contingencies determined by visible objects and attributes such as shape, color and size. The visual character of a shape, for example, is the set of all potential distortions that occur when a given object is

[8] *Action in perception* (NOË 2004), pp. 20-21.
[9] *The ecology of J. J. Gibson's perception* (GOLDSTEIN 1981), p. 193.
[10] Idem, p. 191.
[11] Idem, p. 194.

moved relative to the subject, and vice-versa. As Noë has written elsewhere[12] , "to see a spatial feature such as the size or the shape of an object is to explore the way the look of the object varies as we move." Visually perceived objects possess appearance properties (that is, they have relational properties that boil down to how they look from the viewer's position) that vary according to the perceiver's position. They seem subjective to philosophers precisely because they are viewpoint-dependent; in other words, they are "relations between objects and their environment."[13] Unsurprisingly, Noë sees this is a way of explaining qualia away. Appearance properties should not be seen as intriguing mental objects of some kind; they are nothing but relations things have objectively. [14]In any case, visual perception draws its contents from action. Suppose you see a circular object, such as a plate, from an angle that makes it look elliptical. The actual shape of the object is grasped when we understand how the plates' appearance (a relational property like those just described) will change as we move around it.[15] One needs to know how to interact with the environment to perceive the shape in question. Location can be handled analogously. Experience something as off to the left means knowing that pointing to it would involve the moment of a hand and arm to the left, knowing that looking at it would involve turning one's head in the same direction, and so on. Mastering the range of actions that bring us into contact with the object gives rise to perception of it.Similarly, the sensation of color is determined by the way a surface changes the light when it moves relative to the observer or light sources. The structure of such changes is lawful, and integrating the activities that rely on knowledge of the relevant laws in planning, reasoning and speech is experiencing color. At this point, the reader may have noticed that one need not posit anything over and above a physical base to commit to the theory. Therefore, Noë's approach has the major advantage of fitting physicalism (even if there is no local supervenience on neurophysiological activity, it appears that there is global supervenience relative to the whole environment where the organism is embedded[16]) while doing justice to intuitions that are contrary to reductionism. This is reassuring because so much evidence suggests that physicalism is a much better-behaved metaphysics than the dualist alternative. At present there is no better way of minimizing conceptual and empirical problems.[17]

Noë uses perceptual plasticity, the phenomenon revealed by the ferret experiments above, to positively support his thesis. The argument involves the introduction of a device by engineer and psychologist Paul Bach-y-Rita to help the visually challenged, or as Noë rather bluntly puts it, "enable blind people to see (p. 56)."Bach-y-Rita exploited the idea that "the eyes are a channel for getting information to the nervous system" to invent a substitute that can provide the same kind stimulus. A camera was connected to vibrators on the subjects' thighs or abdomen. Visual input from the camera caused the vibrators to stimulate the subject's skin. So a given pattern of visual information would correlate with a specific pattern of vibration. These vibrations, according to Noë, generate activity in the same brain structure (the somatosensory cortex) that coordinates ordinary vibrations. Yet, the result is not a new way of "touching with a camera" (again, note the analogy with the ferret experiment); it is a renewed ability to see. Bach-y-Rita's subjects could discriminate the features of objects in a fair distance just like a seeing person would. Interestingly, they were able to coordinate their movements well enough to hit a Ping-Pong ball. All it took was a few hours of getting used to the device (it would seem it is not more widespread as a therapeutic device because of its sheer size) (pp. 56-57).

So here is the main lesson to be drawn: we need plasticity to explain the sensory substitution phenomenon. This is so because there is not enough time for the "full-grown and therefore relatively nonplastic adults" to rewire their brains (p. 58). So there is nothing intrinsic in the supposed "touch area of the brain" that makes it process and represent tactile stimuli. All it takes for it to become a vision enabler is getting visual stimuli. This suggests brain structures are not the key to understand perception, visual or otherwise. Bach-y-Rita's device can make blind people see because it enables them to adjust their actions to stimuli just like a seeing person. Stimulation changes very specifically as the subject moves around. Occlusion cuts off the subject from stimuli and approaching an object results in improved resolution. Turning the camera off means contact with distant things ends. When the subject manages to master the skills that enable them to interact with the world like a "normal" person does, he sees again (pp. 63-64).

The remaining sensory modalities are individuated by sets of laws that are unique to each of them. Consider auditory sensorimotor contingencies: eye movements or blinks make no difference to them, whereas head rotations do (when we move our heads

[12] *Action in perception*, p. 84.
[13] Idem, p. 83.
[14] Idem, pp. 79-84.
[15] Ibidem.
[16] As philosopher David Chalmers (1996, p. 33-34) writes, "B-properties supervene *locally* on A-properties if the A-properties of an *individual* determine the B-properties of that individual" while "B-properties supervene *globally* on A-properties, by contrast, if the A-facts about the entire *world* determine the B-facts: that is, if there are no two possible worlds identical with respect to their A-properties, but differing with respect to their A-properties". I gather the individual that is relevant to our consideration is the brain, while the whole organism and its acting in a given environment plays the role of a "world".

[17] See HOLLANDA 2011.

towards a sound source, we change the amplitude of the input). [18] By the same token, tactile information is not obtained from a viewpoint, and is not dependent on light sources. The relevant transformations depend on contact with the objects, that is, a particular use of our bodies. Touching allows us to perceive an object's shape when we have a sense of the movements "allowed by the object's contours" (p.61). This is another Gibson-inspired insight; the latter's work described how sensations of touch arise from "an observer who actively explores the surfaces of objects".[19]

What is the brain's role in all this? According to Noë, the brain is a key element in consciousness because it "coordinates our dealings with the environment" (p.65). Without an environment to ground such dealings, though, there is no interaction and therefore no experience. Perception is like dancing with a partner; when dancing, one moves this or that way because the partner has made a given movement. Brains are analogously connected to their environment. This implies the falsity of the neuroscientific account of a brain that generates consciousness through representational activity alone. Indeed, it is misleading to see the mind as a set of representations. The world is its own model; we do not need a map of it inside our heads because the environment is accessible to those that have the sensory motor skills described above (p.141).Again, this is a Gibsonian claim. Gibson argued that the world in which we live in provides information that is readily available. Perception typically requires no elaborate computations or symbol manipulations in addition to input (think of the problem – here seen as a pseudo-problem – of figuring out distances and depth from the retinal image).[20] This claim is supported by change blindness data. The relevant experiments show that we fail to perceive major changes in our visual environment when not attending to the fleeting elements themselves. Noë concludes that "it is untrue that we enjoy detailed, stable internal depictions of the external world" (p.142). Consequently, the search for NCCs pursued by cognitive neuroscientists is futile. The target representations are simply not there! It is about time we realized that instead of neural representations doing the job on their own, "it is the world itself, all around, that fixes the character of conscious experience" (p. 142). Gibson's admittedly radical framework[21] is thus vindicated.

Unsurprisingly, there are some gaps in Noë's recent writings on perception. Those familiar with his earlier work[22] will probably notice Noë fails to mention how his view can unify a range of phenomena from blindsight to visual agnosia to color vision (although prosthetic perception and perceptual stability are mentioned). This is a rather curious omission, since discussing the phenomena above would considerably strengthen the case for a sensorimotor approach. Another gap is the vagueness inherent to saying that the brain "coordinates our dealings with the environment" and leaving it at that. One would obviously like to know what this means exactly. Trivially, it cannot in this context mean that the brain is a representational engine, so what is it a nexus of? Further weaknesses can be found in the negative arguments against the mainstream view. It is certainly interesting to learn about the shortcomings of brain scanning techniques, but is it not premature to criticize neuroscience for not being able to see directly what is going on? Science, after all, does not necessarily depend on direct observations. It has been argued (rather persuasively, in my view) that direct observation is not even the typical situation in obtaining data for science.[23] Nobody has ever directly observed a neutrino, for example, but that does not make neutrino research less credible. It is taken quite seriously in part because we can infer the target phenomenon through its effects on things we can straightforwardly perceive (particle scientists can perceive bubble chamber photographs, for example). By the same token, cognitive neuroscientists can make inferences about representational activity in nervous systems through a range of techniques whose power is independently corroborated (but not – and this is crucial to Noë's criticism – conceptually neutral). The fact that these observations are theory-laden also shows very little, unless one is prepared to cast much of science in a suspicious light.In any case, cognitive neuroscientists can complement brain imaging evidence with novelexperimental predictions, and this has been done.[24] Another weakness on the book is Noë's portrayal of neuroscience as a science of picture-like representations (p.140). The mainstream view does not need mental snapshots. It can use vector coding, for example, to explain representation in a more abstract way.[25] Some philosophers sympathetic to the mainstream view are also aware that mental activity needs a wider environment that provides a context. Christopher Hill's account, for example, claims that representational content is determined by interaction with the environment in an evolutionary context.[26] This means Hill is quite ready to concede that it is impossible

[18] See *A sensorimotor account of vision and visual consciousness* (O'Regan e Noë 2001), p. 941.
[19] GOLDSTEIN 1981, p. 193
[20] Ibidem.
[21] Ibidem.
[22] See, for example, O'REGAN & NOË, 2001.
[23] See *Saving the phenomena* (BOGEN & WOODWARD 2001).
[24] DEHAENE & NACACCHE, 2001, p. 18-22.
[25] Vector coding is a technique that analyses representation in a quantitative, abstract way. It has been applied to face perception, the sense of taste and color vision, for example. It is thought that faces can be represented by vectors that stand for the relevant features, such as distance between the eyes and nose width. See CHURCHLAND 2002, p. 290-302.
[26] HILL, 2009, p. 148-153.

to have consciousness in a petri dish (there is no straightforward supervenience of mental properties on neurological goings-on), while holding a view where internal representations are key. Readers are also advised to compare Noë's bold perspective with that of Tyler Burge, who also develops a theory of perception that is critical of the brain-centered approach and is claimed to be biologically realistic. Unlike Noë, however, Burge goes to great lengths to nurture the idea that the mind is representational in nature.[27]

What is the main lesson to be drawn here? The main point in favor of Noë's view (as expressed in *Out of our heads*) is its concern with problems that are internal to the relevant science, but highly engaging to philosophers at the same time. Notions such as qualia and zombies have often been used in a way that is hardly constructive; it is arguably futile to look for a positive role they can play in formulating theories. Little is offered in return for the rejection of physicalism urged by writers such as David Chalmers or John Searle. More specifically, critics of physicalism owe other researchers a progressive research program that predicts new phenomena and unifies known but apparently unrelated facts.[28] Noë, however, manages to present an intriguing alternative to the mainstream theory that is built with materials outside the box of metaphysical thought experiments, qualia and zombies. This is accomplished without losing sight of typical philosophical preoccupations such as the nature of appearances and mental content. This is important for philosophy, since such problems are part of its tradition and cannot straightforwardly be taken over by purely scientific theories. Noë's work, then, can be seen as a benchmark in terms of highlighting philosophical insights.[29] More philosophers should emulate this approach. One hopes more philosophers will exploit the theoretical opportunities in the coming clash of reductionist approaches versus sensorimotor ones.

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[27] BURGE 2010
[28] See, for example HOLLANDA 2011.
[29] For more on the relevance of philosophy in the age of naturalism and physicalism, see HOLLANDA 2011.

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