A conversation with Dr. James D. Rose, November 18, 2016

Participants

- Dr. James D. Rose – Professor Emeritus of Zoology and Physiology, University of Wyoming
- Luke Muehlhauser – Research Analyst, Open Philanthropy Project

Note: These notes were compiled by the Open Philanthropy Project and give an overview of the major points made by Dr. Rose.

Summary

The Open Philanthropy Project spoke with Dr. Rose of the University of Wyoming as part of its investigation into which types of beings should be of moral concern, and thus a potential target for the Open Philanthropy Project's grantmaking. This conversation focused on one particular factor plausibly relevant to whether a being should be of moral concern or not – namely, whether that being is phenomenally conscious, and what the character of its conscious experience is. The main topic of this conversation was whether a cortex (or perhaps a neocortex) is required for consciousness.

Cortex-required view of phenomenal consciousness

Dr. Rose agrees with Luke's summary of two main lines of evidence for the "cortex-required" view of phenomenal consciousness:

1. Studies of neuroimaging, lesions, anesthetics, etc., seem to demonstrate that there is a large amount of sub-cortical processing that can affect behavior, learning, etc., without subjects reporting conscious awareness of it. When subjects do report conscious experience of this processing, it appears that the association cortex of the frontal and parietal lobes is involved in that processing.
2. Cases in which a large portion of the cortex is destroyed, or communication between the thalamus or brain stem and the cortex is disrupted, cause a coma or persistent vegetative state that (presumably) results in loss of consciousness.

Dr. Rose emphasizes that there is convergent evidence from multiple sources for the cortex-required view, and he thinks that imaging research on its own can be over-interpreted or misinterpreted.

Steven Laureys' research

Professor Steven Laureys (University of Liège) has done particularly valuable imaging work observing the increases and decreases in neural activity that accompany the coming and going of phenomenal consciousness. The association cortex appears to be central to processing conscious awareness, particularly the

frontal lobe and part of the parietal lobe, though other cortical areas are also involved (e.g., the cingulate gyrus and the insula).

Professor Laureys' work seems to show that there is no conscious experience without activity in the association cortex. However, this appears to be dependent on the degree of activity; i.e., some activity can occur in the association cortex without consciousness, up to some threshold. Dr. Rose thinks that Professor Laureys would agree that without a sufficient amount of the right type of cortical activity, subjects will not have conscious experience.

Backward masking

In the "backward masking" technique, two images are flashed in rapid succession, and the second image can "block" conscious awareness of the first image in the subject. Such studies typically find that activity confined to a primary sensory cortex (e.g., the visual cortex) that does not reach the association cortex does not result in conscious awareness.

Similarly, presenting an emotional stimulus for a short duration (e.g. via a visual flash) activates the amygdala, but if the associational cortex is not also activated the subject reports no conscious awareness of the stimulus (although they may react as if their behavior was affected by the stimulus).

Response to Björn Merker

Dr. Rose has several replies to Björn Merker's arguments against the cortex-required view, including:

1. It seems probable that hydrocephalic children could exhibit many of their behaviors without phenomenal consciousness.

2. In cases of hydrocephaly, as well as lesion cases (where much of the cortex is destroyed or never develops), a high level of plasticity, especially in young brains, might account for the presence of behavior that Merker mistakenly takes to be conscious; i.e., extensive damage could be offset by the reassignment of functions to other areas. For example, children who lose their language cortex early on can still acquire language using a different part of the brain.

3. Merker argues that the midbrain superior colliculus could mediate consciousness in the absence of cortex because, like neocortex, it is laminated and receives multimodal sensory input. Dr. Rose thinks this is a weak argument in that no direct evidence supports it. The superior colliculus can be functional in humans who are clearly irreversibly unconscious due to cerebral cortex damage. The condition of progressive supranuclear palsy, which destroys the superior colliculus in humans, does not cause deficits in consciousness. There are other laminated brain structures, the cerebellum and olfactory bulb, for which there is no reason to believe that they could mediate consciousness. Lastly, Merker’s argument that brainstem structures

could mediate consciousness requires acceptance of the claim that the behaviors to be explained in children without much cortex reflect consciousness, and Dr. Rose doesn't agree with this claim.

Dr. Rose's own work

Most of Dr. Rose's research over nearly 40 years involved recording brain activity from single neurons in diverse species. Much of this work was done in freely behaving animals. As a result, he had the opportunity to spend thousands of hours looking inside the working brain. Dr. Rose believes the perspective that this kind of work provides is radically different from the view of the brain that people get by working solely with neuroanatomy, behavior or imaging methods. For instance, the brain of an amphibian, such as the rough skinned newt, which Dr. Rose studied for many years, shows very little spontaneous neuronal activity in the absence of movement. This is different from a mammalian brain, where spontaneous firing by neurons is common, even under anesthesia. Dr. Rose made some recordings from the newt's pallium, but there was little evidence of typical neuronal firing, comparable to mammalian cortex. Moreover, there is no neuronal activity at all in the newt brain under a surgical level of anesthesia. The same is true of fishes, which have to be immobilized by a myoneural blocking agent so the anesthesia can abate to allow neuronal activity. Apparently these organisms are so brainstem-dominated that unless the brainstem is shut down, they are not immobilized. This is radically different from mammals, in which many forms of anesthesia leave the brain quite active.

Other people to talk to

- Daniel Dennett (Professor of Philosophy, Tufts University)
- Bryan Kolb (Professor of Neuroscience, University of Lethbridge)
- John Allman (Professor of Neurobiology, California Institute of Technology)
- Clive Wynne (Professor of Psychology, Arizona State University)
- Stuart Derbyshire (Associate Professor of Psychology, National University of Singapore)