

Neuroecology: On Causal Relations Between Brain Organization, Adaptive Behaviour, Consciousness and Cognition

PREFACE

The central observation in Neuroecology is that variations in brain architecture correlate with adaptive variations in behaviour. The correlation is particularly noteworthy with respect to a set of behavioural traits supported by what is referred to as 'executive' or 'cognitive' functions. Cognition allows the observing agent to create and control behavioural strategies that establish a particular functional relationship between the self and its surrounding. This relationship attributes perceived qualities to the world around us and provides us with the perception of choice, proposition and free will. Surroundings become environments with perceived properties and they become inseparable from the organism itself. However, the theme is complex and highly demanding. Correlative or associative relations as they typically emerge from brain and behaviour studies can be misleading and are often difficult to refine into causal insight. In addition the problem landscape is diverse, and some central ingredients in cognitive research such as the role of consciousness, the ever-lasting conundrum behind the subject/object dichotomy and, perhaps the role of physicalism in general, are an enduring matter of debate. In the face of this debate we have collected contributions that examine the field from quite diverse perspectives.

Thomas M. Gaetano, Margaret M. Yacobucci and Verner P. Bingman contribute evolutionary aspects and the important methods of comparative morphometries. Strange as it may appear at first glance, but the authors very competently apply novel allometries and imaging techniques based on endocasts to infer brain properties from extant species to extinct species such as *Archaeopteryx* and non-avian dinosaurs. From the shape and volumes of endocasts one can obtain estimates about the shape and volumes of certain brain geometries such as the nidopallium of the avian forebrain. Because the authors are well experienced with the question of telencephalic organization and its correlates with cognitive abilities, they can offer a plausible inference to the cognitive behaviour of dinosaurs.

Jesse Bettinger suggests an incorporation of the phenomenon of 'interoceptive affect and inference' for the role of adaptive strategies in neuroecology. Bettinger highlights neuro-visceral and limbic circuitries in the brain that together with modelling aspects involving predictive coding and free energy principles may account for several neuro-ecological signatures. This is a novel and challenging conception that adds a lot of spices to this field.

Richard König, Alexander Mirnig, Ludwig Aigner, and Thomas M. Weiger address the core of the challenging question of brain correlates with conscious experience. Is consciousness dissectible? A question that has been at the centre of attention since the onset of consciousness research in brain science. The authors base their answers on electrophysiological recordings obtained from acute brain slice techniques and conclude that brain slices might provide a certain correlate for consciousness, depending on the functional integration that the neuronal network in the slice can offer. Very interestingly the authors suggest that this inference is basically similar to the interpretation of conditional probabilistic correlates of neural field properties with mental states in intact brains of a conscious agent. In other words: The explanatory gap is the same for intact brains and parts of it.

My own contribution reviews evidence for a route from the multiscale signalling structure of the brain to quantum chemical properties in ion channels that are suggested to offer the primitives of experience and meaning. I discuss specific system-environment partitions that help to discern the unique organization that the brain offers. I argue that this organization is designed to causally combine the physics behind information processing in the brain with a physical character that is experiential under the micro-psychistic premise that if experience emerges from physical phenomena then these physical phenomena are themselves experiential.

Finally I want to acknowledge the cooperation and high calibre contributions of all authors and their efforts to contribute to this small but significant volume that deals with the very radical question of the world around us and

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