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EDITORIAL

How to reconcile brain and mind?

Brigitte Röder · Dietrich Manzey

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This special issue is published in honor of Prof. Dr. Frank Rösler. It consists of papers presented during a symposium on the occasion of his retirement at the Phillipps-University Marburg, Germany, in January 2009. The topic of the symposium was "How to reconcile brain and mind?" and addressed the question of how two views of the presumably same ontological entity may be unified. While the first view, i.e. the view from brain research, provides a description of the functions of the brain in terms of anatomical structure and neurophysiological processes, the second view, i.e. the view from psychology, describes basic processes of the mind and human behavior often in less objective terms and on a more macroscopic level, e.g. perception, attention, memory, etc. Psychological and brain sciences as well as philosophy have strived for a long time to identify the function which would allow to superimpose or to unify both levels of description. This has also been the main driving force behind the scientific work of Frank Rösler. From the very beginning of his academic career, Frank Rösler has tried to understand psychological (cognitive) processes by investigating their relation to neurophysiological processes (see Rösler, 2011). In his first book which was published in 1982 he described a research program which he referred to as "Cognitive Psychophysiology" (Rösler, 1982) and which to some extend anticipated what is called "Cognitive Neuroscience" today.

During the symposium in 2009, colleagues, companions and friends of Frank Rösler were invited to present their view on how to reconcile brain and mind based on examples of their research. Whereas most of the contributions comprised examples from psychophysiological research, others included approaches of psychology, neuroscience and philosophy to study the relation of brain and mind.

This special issue presents a sample of these contributions. It starts with a review by Frank Rösler which specifies the problem of how to unify psychological and physiological processes. The author comes up with suggestions of how scientists may approximate a mapping of psychological concepts onto physiological and anatomical concepts.

Kliegel, Dambacher, Dimigen, Jacobs and Sommer review new methodological developments for testing models of reading. They demonstrate that the simultaneous measurement of eye movements and event-related potentials can inform models of cognitive functions. Since both measures have different temporal characteristics, the combination of the two techniques allows conclusions about how perceptual and higher cognitive aspects of a complex function are coordinated.

Heuer and Sülzenbrück similarly distinguish between physical (output) and mental phenomena such as movements and perception. In their review, they focus on motor intentions and their modulation by post-intentional processes that are partially out of conscious control and allow for precise movements. While Heuer and Sülzenbrück consider the perception of sensory changes resulting from the movement as the basis for the generation of the next motor intention, Zwickel and Prinz review how motor intentions

B. Röder (✉)
Biological Psychology and Neuropsychology,
University of Hamburg, Von-Melle-Park 11,
20146 Hamburg, Germany
e-mail: Brigitte.Roeder@uni-hamburg.de
URL: http://bpn.uni-hamburg.de

D. Manzey
FG Arbeits-, Ingenieur- und Organisationspsychologie,
Technical University Berlin, Marchstraße 12, Sekr. F7,
10587 Berlin, Germany
e-mail: dietrich.manzey@tu-berlin.de

change perception even before the movement has been executed. They discuss new findings that allow them to predict whether specific interference effects between action and perception result in assimilation or contrast phenomena in perception with respect to action.

Based on their electrophysiological and brainimaging results in completely paralyzed patients Birbaumer, Piccione, Silvoni and Wildgruber argue that neural representations of motor intention need a peripheral feedback in order to be maintained. Reviewing the history of brain computer interfaces (BCI), the authors demonstrate how BCI research can inform the brain-mind relation.

Another approach to investigate the relationship between cognitive functions and brain processes is to investigate the cognitive consequences of the brain being in a different processing mode such as during sleep. Born and Wilhelm review recent notions on functional principles and neural correlates of memory formation during sleep. At the end of their article, they speculate how sleep transfers implicit knowledge into explicit consciously available knowledge.

Recently, researchers have taken a developmental perspective to study how cognitive processes map on physiological and anatomical processes of the brain. These researchers assess brain maturation and cognitive development in parallel. Friederici, Oberecker and Brauer applied this strategy to syntax acquisition and showed both anatomical and physiological correlates of syntax acquisition. Thus, in the present contribution they postulate that the functional organization of an adult's neurocognitive system is the presumably optimal result from developmental adaptation.

Güntürkün takes an evolutionary perspective. He discusses how, despite major differences in the cytoarchitectonic organization of the brain of birds and mammals, highly similar functional architectonics emerge that allow for higher cognitive skills. He shows that not any cognitive function can be mapped on any neuroarchitecture, suggesting that the brain-mind relation has to obey certain constraints.

The question of how brain and mind might be reconciled is often taken to be intimately linked to the question of whether or not a free will exists. In her article, the philosopher Longuenesse suggests that this question is related to the use of the first person pronoun "I". She distinguishes between first and second order free will, the freedom of action and the freedom of will, respectively. She proposes the existence of a first order free will and doubts the existence of a second order free will.

Fellbrich, Nager and Münte employed a typical psychophysiological research strategy to study number representations. They recorded event-related potentials while participants had to judge whether a central presented number was larger or smaller than five. At the same time, participants had to ignore the flanking either compatible or incompatible distractor numbers. The combined electrophysiological and behavioral results suggested an automatic processing of number magnitude along a spatially organized number line.

Leonhard, Bratzke, Schröter and Ulrich show how quantitative models help in understanding the functional organization of cognitive functions. The authors tested model predictions about the processes affected by warning signals. Based on their experimental results, they rejected the model and came up with a new mechanism implemented in a modified model. This article illustrates how functional systems can be segregated based on behavioral methods alone.

The current special issue, though not completely answering the question of how to reconcile brain and mind, provides at least insights into psychological, neuroscientific, developmental, evolutionary, and philosophical approaches aiming at revealing the function that will finally link both conceptual levels and will allow for a glimpse of a unified neurocognitive system.

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