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Editorial

Special Issue of *Symmetry*: "Biological Psychology: Brain Asymmetry and Behavioral Brain"

Vilfredo De Pascalis [1,2]

[1] Department of Psychology, Sapienza University of Rome, Via dei Marsi 78, 00185 Rome, Italy; vilfredo.depascalis@uniroma1.it
[2] Faculty of Rural Medicine and Health School of Psychology, University of New England, Armidale 351, Australia

The study of brain asymmetry in humans represents a long-standing topic in the biobehavioral sciences and remains an attractive research domain with many potential applications [1]. Human behavior and dispositional traits are linked to neural networks, some of which rely on hemispheric specialization and integration employed by cognitive and emotional systems and contribute to adaptive goal-directed behavior [2]. Scientists are fascinated by the riddle of the left and right brain, their structural and functional differences, and how they are connected through cortical and subcortical circuitry underpinning complex perceptual, cognitive, and emotional functions. Research has shown that the lateralization of brain functions enhances capacity in cognitive processing [3], as postulated by early scholars of lateralization in humans a few decades ago [4,5]. Additionally, functional brain asymmetry is linked to several factors, including perceptual processing, cultural differences in preferences of objects' processing, and individual differences in dispositional approach, optimism, impulsivity, avoidance behavior, social interaction, and clinical factors.

The main goal of this Special Issue, titled "Biological Psychology: Brain Asymmetry and Behavioral Brain" has been to portray a sample of biobehavioral research on functional asymmetry spanning from perception to social interaction, dispositional behavior, insight, and hemispheric asymmetry in psychopathology.

Nine papers [6–14] were selected for publication: two literature reviews [7,9] and eight empirical studies [6,8,10–14]. The articles were prepared by neuroscientists working in leading universities and research centers in Israel, Italy, Japan, Kazakhstan, the USA, and Russia.

H. Nittono et al., in the paper "Which Side Looks Better? Cultural Differences in Preference for Left- or Right-Facing Objects" [6], starting from previous observations that an oblique view of objects is preferred over a frontal or lateral view, these authors conducted a behavioral study to highlight cultural differences (Japanese, Americans, and Israelis people) in preferences for left- or right-facing, three-dimensional objects. Interestingly, the principal findings were that Japanese participants (both vertical and left-to-right readers) and Israeli participants (right-to-left readers) preferred left-facing images over right-facing images. In contrast, American participants (left-to-right readers) preferred right-facing images over left-facing images. The study's findings suggest that the preferred facing direction of a symmetrical stationary object displayed obliquely is mainly influenced by cultural factors.

R. Leshem, in the paper "There are More than Two Sides to Antisocial Behavior: The Inextricable Link between Hemispheric Specialization and Environment", [7] has discussed the reciprocal links between environmental factors and hemispheric functioning in the context of antisocial behavior. Although research has outlined the association between specific environmental factors with antisocial behavior, none of them are proven to cause antisocial behavior in exposed individuals. Thus, the author concluded that to understand antisocial behaviors, we need further multidisciplinary research devoted to explicitly

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highlighting the causal links between the neural patterns and environmental influences associated with social functioning.

F. De Luca et al., in their paper "Asymmetric Contributions of the Fronto-Parietal Network to Emotional Conflict in the Word–Face Interference Task" [8], investigated to what extent the activity of the frontoparietal network modulates cognitive control necessary to resolve the emotional conflict elicited by emotional distractors in the word–face interference task. Two emotional stimuli—a target and a distractor—were simultaneously presented, and participants were required to respond to targets and ignore distractors. The authors tested if anodal transcranial direct current stimulation (tDCS) over the left dorsolateral prefrontal cortex (lDLPFC, involved in top-down attentional control) should reduce the interference from emotional distractors. The study findings demonstrated that anodal stimulation over the lDLPFC reduced interference from emotional distractors, but only when participants had already experienced the task. In contrast, having already performed the task only eliminated facilitation effects for positive stimuli.

A. Vecchio and V. De Pascalis, in the paper "EEG Resting Asymmetry and Frequency Oscillations in Approach/Avoidance Personality Traits: A Systematic Review" [9], presented a systematic review of the studies testing the potential link between EEG-frequency oscillation asymmetry and individual disposition to approach/avoidance behavior. The reviewed studies provide controversial and unclear findings on this relationship, suggesting that the effects of contextual and situational factors should be considered as potential factors to make future study findings more replicable.

V. De Pascalis et al., in the paper "Resting EEG Asymmetry Markers of Multiple Facets of the Behavioral Approach System: A LORETA Analysis" [10], performed cortical source analysis of resting electroencephalographic (EEG) recordings using eLORETA and found that a high behavioral approach system (BAS), except for impulsivity, was associated with greater relative left-sided activity in the superior frontal gyrus (BA10). Additionally, the authors used an isolated effective coherence (iCOH) analysis to correctly assess direct causal connections transmitting oscillatory information between cortical regions. This analysis of the resting EEG frequency activity (0.5 to 45 Hz) yielded that, in terms of beta activity (21 Hz), the high impulsive scorers showed that within each hemisphere, the frontal region was a sender to and receiver from the middle temporal region. In addition, highly impulsive individuals observed that both left and right middle temporal lobes directly influenced the activity of the left and right superior frontal lobes and an apparent decoupling between left and right superior frontal lobes. These findings could indicate reduced control by the supervisory system in more impulsive individuals.

Kustybayeva et al., in the paper "Major Depression and Brain Asymmetry in a Decision-Making Task with Negative and Positive Feedback" [11], add new data to understand the functional significance of lateralized brain processes in depression. The study investigated brain EEG asymmetry during a decision-making task performed in negative and positive feedback conditions in patients with Major Depressive Disorder (MDD) compared with a control group. The authors disclosed impaired mood prior to a performance and decreased confidence during a performance in MDD participants compared to the control group. Interestingly, task-induced alpha power and P100 and P300 amplitudes of the ERPs were high informative biomarkers of depression during decision making. The study demonstrated that alpha asymmetry and ERP amplitudes were consistent with dynamic changes during decision making. Finally, these original findings suggest that major depression is characterized by a lack of left dominance during the resting state and left hypoactivity during the task baseline and subsequent decision-making process.

C. Spironelli and A. Angrilli, in the paper "Complex Time-Dependent ERP Hemispheric Asymmetries during Word Matching in Phonological, Semantic, and Orthographical Matching Judgment Tasks", [12] studied information processing and concurrent time-dependent asymmetries occurring when a target word is compared with the previous prime one. They used a word pair paradigm of phonological, semantic, and orthographical matching judgment and analyzed the ERPs evoked by the target words. The authors reported a first negative wave peaking at about 120 ms that showed a typical left-lateralization over parietal sites (i.e., a greater amplitude at left sites) in all tasks. At frontal sites, only the phonological task showed left lateralization. Additionally, the N400 wave (300–450 ms) disclosed that match trials elicited more significant left asymmetry on frontal regions for phonological than semantic than visual-perceptual tasks. In contrast, mismatch trials induced an inverted asymmetry, distinctive of greater amplitude over the right-frontal sites, regardless of the task. Finally, the late N400 (450–600 ms) showed an overlapped pattern to phonological and semantic tasks, with left lateralization in the match and right lateralization in mismatch conditions.

M. Proverbio and A. Zani, in the paper "Hemispheric Asymmetry in Visual Processing: An ERP Study on Spatial Frequency Gratings," aimed to extend the known hemispheric asymmetry of global versus local visual information processing to low versus high spatial frequency gratings by using ERPs recorded in a group of healthy right-handed volunteers. The authors quantified and analyzed the C1 (60–110 ms) and P1 (110–160 ms) visual responses, as well as the later selection negativity (N2, 165–330 ms) and P300 (330–600 ms) waves of the ERPs. Overall, the performance was faster for the right visual field (RVF), thus suggesting a left-hemispheric advantage for the attentional selection of local elements. They found faster performance for the right visual field, suggesting a left-hemispheric advantage to the attentional selection of the local elements. Similarly, the analysis of the mean area amplitude of the C1 (60–110 ms) sensory response showed a more substantial attentional effect in the left occipital areas, thus suggesting the sensory nature of this hemispheric asymmetry.

G. G. Knyazev et al., in the paper "EEG and fMRI Correlates of Insight: A Pilot Study", [14] studied the insight defined as the sudden solution of a problem contrasted with a step-by-step analytical solution. The authors used the remote association test (RAT) as the most reliable task for studying insight. The RAT task is a trio of words for which the participant must find a fourth word that forms a stable phrase with each of the three. They recorded EEG and fMRI data during task performance of the RAT: participants were asked to report whether their solution was reached analytically or insightfully for each solved problem. The source localization techniques of the EEG data were analyzed in a 16 s fragment preceding the subject's response. The EEG data for insight, compared to analytical problem solving, during a time of 10–12 s preceding the subject's response, disclosed a high-frequency synchronization in semantic cortical areas of the left hemisphere. The fMRI data highlighted that insightful solutions were accompanied by increased activity in the frontal and temporal areas of the right hemisphere. Based on their EEG and fMRI results, the authors concluded that different cognitive processes are involved in insightful problem-solving.

We hope this volume will contribute to better integrating neurosciences, with different subdisciplines of psychology, social psychology, psychiatry, and neurophysiology, working together to unravel the great mystery of hemispheric asymmetry in the brain and beyond. Many of the results presented here can be very useful in highlighting new results.

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