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Special section: Editorial

Out of the body, but not out of mind

Peter Brugger^{a,*} and Christine Mohr^b

^aDepartment of Neurology, University Hospital Zurich, Switzerland

^bDepartment of Experimental Psychology, University of Bristol, UK

“... some of the delusions of the insane have their origin in what may justly be called motor hallucinations; a disorder of the nervous centres of the motor intuitions generates in consciousness a false conception or delusion as to the condition of the muscles, so that an individual lying in his bed believes himself flying through the air, or imagines his legs, arms, or head, to be separated from his body, just as he has hallucinations of sense when the sensorial centres are disordered.”

(Maudsley, 1876; pp. 1482–483)

What Henry Maudsley wrote more than 130 years ago is remarkable in several respects. First, it shows that out-of-body experiences (OBEs), defined as the sensation of a separation between body and observing self, have been discussed in the medical literature long before they were labeled as such. Second, the brief passage makes clear that an OBE is more than a mere hallucination and more than a purely visual-perceptual phenomenon. Rather, it reflects a disorder of central “motor intuitions”, or in a broader sense, a disturbance in the representation of information about the current state of one’s body - its posture, kinaesthetics and gravitational orientation. Importantly, it is already recognized that there are “partial OBEs”, i.e., an illusory reduplication not of one’s entire body, but of just an arm or a leg. Finally, and perhaps most importantly in the context of the present *Special Section*, Maudsley recognized that only knowledge of the cognitive mechanisms underlying OBEs in the mentally sane will eventually allow an understanding of the complex and sometimes bizarre distortions of corporeal awareness reported by psychotic patients.

Even if it is true that 19th century psychiatry and neurology were not entirely blind to the phenomena associated with OBEs, the scattered contributions did not form a proper

literature. The key descriptive work on OBEs had its origin out of the body of the mainstream sciences. Stimulated by folk-psychological beliefs, surprisingly invariant across cultures and times (Mead, 1919; Sheils, 1978; Metzinger, 2005) spiritualism and occultism embraced the idea of a separate existence of body and mind. While some of the early work contains observational details, potentially revealing even from a current-day perspective (Durville, 1909; De Rochas, 1895, 1896), literally hundreds of monographies on the “projection of the astral body” (Fox, 1962; Muldoon and Carrington, 1929), “escomatic experiences” (Green, 1968), or “soul travelling” (Fischer, 1975) propagated interpretations that are far from being compatible with a scientific view of body, mind and corporeal awareness.

Around the middle of the 20th century, Austrian psychiatrist Menninger-Lerchenthal (deceased in 1966), set out to bridge some of the gaps between parapsychological and neuropsychological accounts of the OBE. In a series of publications on heautoscopy (i.e., the *doppelgänger* experience as a precursor form of an OBE) he noticed that esoteric notions of a second, subtle body and neuropsychiatric models of an illusory separation between self and body can be reconciled with reference to the concept of “body schema” (Menninger-Lerchenthal, 1946). In particular, Menninger-Lerchenthal emphasized the similarities between the phantom limb as it manifests itself after peripheral or central lesions and phantom body, i.e., the experience of oneself as detached from the physical body (e.g., Menninger-Lerchenthal, 1954, 1961) and as “flying through the air”, in Maudsley’s description (see also the cover illustration of this issue of *Cortex*). He was convinced that “the value of a scientific explanation [of heautoscopy and OBE] for the science of the mind (*die Seelenkunde*) cannot be overestimated” (Menninger-Lerchenthal, 1961, p. 745). We have to assume that language barriers are to be blamed for the fact that Menninger-Lerchenthal’s ideas have

* Corresponding author. Department of Neurology, University Hospital Zurich, CH-8091 Zurich, Switzerland.

E-mail address: peter.brugger@usz.ch (P. Brugger).

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not let to an earlier acceptance of OBEs as a respectable and even valued topic within the neurosciences.

Today, esoteric views on OBEs still sell, and even among apparently educated quarters there is an embarrassing tendency to mystify clinical reports (Brugger, 2003, for a critique). Yet, although healthy persons' OBEs may still be subsumed under the heading of "paranormal" or "anomalous" experiences (Brugger and Mohr, 2008), a growing number of studies have illuminated the cognitive mechanisms that contribute to a transient breakdown in the feeling of embodiment. Conceptually, OBEs are considered that particular variant of autoscopic phenomena (Brugger et al., 1997; Blanke et al., 2004), in which the observer's perspective appears to be shifted towards the illusory duplicate of one's body. The resulting "alter-ego-centered" perspective (Brugger, 2002) probably reflects an impairment of parietal (Blanke et al., 2005) and medial temporal lobe structures (Lambrey et al., 2008). Apart from failures in maintaining a stable, body-centered visual perspective, a disintegration between vision and proprioception may be responsible for the core feeling of a spatial separation from the seen body. Experimentally, an appropriate mismatch between the two senses can be induced by mirrors (Altschuler and Ramachandran, 2007), in adaptation of a procedure previously developed to enhance the motility and vividness of phantom limbs. Alternatively, fooling the brain into feeling one's own self at a detached location can be brought about by the visual observation of felt touch on an image of one's body (Ehrsson, 2007; Lenggenhager et al., 2007). Also this latter procedure originated in work on "out-of-limb experiences" (Botvinick and Cohen, 1998) and took advantage of the conceptual equivalence of phantomization processes on the level of single limbs and those on the level of entire bodies (Mikorey, 1952; Brugger, 2006).

The brief collection of original studies on OBEs contained in the present *Special Section* follows the *Special Issue* (issue 10, 2008) on *The Paranormal Mind*, also guest-edited by ourselves (Brugger and Mohr, 2008). The focus of that special issue was "How the Study of Anomalous Experiences and Beliefs may inform Cognitive Neuroscience", and contained papers discussing possible cognitive and brain correlates of paranormal beliefs (Fleck et al., 2008; Raz et al., 2008; Schultze and Papousek, 2008; Sumich et al., 2008) the neural and neuropsychological substrates associated with violation of expectancies (Bressan et al., 2008; Fyfe et al., 2008; Lindeman et al., 2008) and detailed studies on "anomalous" experiences (Dubal and Viaud-Delmon, 2008; French et al., 2008; Wackermann et al., 2008). The current section on OBEs complements our original aim of discussing how investigations of anomalous experiences could inform cognitive neuroscience.

The OBEs section is organized as follows: Wade (2009, *this issue*) presents an historical overview on phantom limb phenomena as special instances of out-of-body sensations. Both out-of-limb experiences and OBEs illustrate the projective aspects of perception. Both can be considered "productive symptoms" of the perceptual system - a functional loss is accompanied by a perceptual gain. However, while loss of function follows an obvious loss of structure in the case of the phantom limb after amputation, it is less clear which functional loss brings about the sensation of a spatial separation between body and self. Although OBEs in the narrow sense are

only briefly touched upon, Wade argues that their study may stimulate current-day neuroscience as much as the phenomenon of the phantom limb has intrigued the psychology of perception in the past.

The contributions by Cheyne and Girard (2009, *this issue*) and Terhune (2009, *this issue*) demonstrate the usefulness of a careful phenomenological analysis of OBEs for the development of neurological models of body representation. Cheyne and Girard's statistical analyses of self-report data provided by more than 12 000 respondents to an *Internet* survey supported what Maudsley (1876) had suggested on the basis of his clinical experience: the feeling of disembodiment seems to directly result from illusory movement sensations. A particularly important trigger is the vestibular experience of floating in the air (see cover illustration), whose role in the generation of a visual image of one's body the authors investigated. Autoscopia during an OBE (interestingly only experienced by about half of the survey's respondents) may be considered the corroboration of the feeling of bodily detachment by the visual sense. Also Terhune's findings emphasize strong connections between the feeling of being out-of-body and the visual qualities of an OBE. An *Internet*-based study asked participants about OBEs, sleep/dream related experiences, synaesthesia and visual cognitive style. Those healthy individuals, whose OBEs had a visual quality (some 70%) were also more likely to have had synaesthetic experiences than those whose feeling of disembodiment was not accompanied by any visual impressions. This observation constrains theories of image generation during OBEs and seems to suggest a synaesthetic origin of what is seen from an illusory vantage point from what is felt or heard.

Easton et al. (2009, *this issue*) investigated healthy individuals' performance on a task requiring mental rotations of the own body. Similar tasks were previously used to show involvement of the inferior posterior parietal lobes in egocentric perspective transformations (e.g., Blanke et al., 2005), and impaired performance was found related to the frequency of a participant's spontaneous body scheme alterations as experienced during everyday life (Mohr et al., 2006). Importantly, in the present study task instructions demanded switching between a within-body and an out-of-body perspective after a variable number of trials. Easton et al. tested subjects with a history of OBEs and subjects without personal knowledge of the phenomenon. The former showed an impaired task performance exclusively on trials which required a perspective shift. This result is interpreted as an indication for OBEs as a sign of a deficient cross-talk between the parietal lobes and prefrontal cortex.

Overney et al. (2009, *this issue*) close the collection by presenting the case of a man with daily OBEs in the course of tetraplegia due to a demyelating disease predominantly affecting the cervical spinal cord. OBEs were only elicited, however, after the consumption of cannabis, prescribed to alleviate painful spasticity. In a perspective transformation task similar to the one administered by Easton et al. (2009, *this issue*), the patient showed an aberrant response pattern; his reaction times to back views of human bodies were longer than those to front-views, irrespective of whether testing was done before or after cannabis intake. This is interpreted by the authors as a consequence of the frequent perspective shifts

experienced during autoscopia while feeling himself out-of-body. Overney et al. emphasize the potential of perspective transformation tasks for differentiating patients with autoscopic hallucinations and those with OBEs. As to the spinal lesion predisposing the patient to OBEs, the authors favor a symptom-oriented over a lesion-localization approach and note the important role of a loss of motor function also in other conditions where OBEs are reported (sleep paralysis, general anaesthesia). As supernumerary phantom limbs are rare, but impressive manifestations of multiple sclerosis (Mayeux and Benson, 1979), frequent OBEs can even precede the first signs of numbness and motor impairment by years (Zurfluh, 1981; see also <http://www.oobe.ch/>).

Together, the five papers exemplify the usefulness of a methodologically broad approach that may eventually lead to a neuropsychological understanding of OBEs. Single case analyses may be as illuminating as are large-scale surveys and group studies with patients (not considered here are neuroimaging approaches and methodologies that allow the simulation of OBEs). Subjects' performance in laboratory tasks relevant to the localization of the self in space may be particularly revealing if analyzed as a function of an individual's history of spontaneous OBEs. Last but not least, there is an obvious philosophy-of-mind interest in the illusion of a separation between body and observing self. Some relevant questions are briefly taken up in Metzinger's (2009, this issue) concluding commentary.

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