



LETTER TO THE EDITOR

## Conscious Mind as a Field

In the Special issue on “Mind and Matter”, the paper by Lindahl & Århem (1994) presented an interesting and provocative discussion of “mind as a force field”. This was based on the proposal by Karl Popper (Popper *et al.*, 1993) that minds have important similarities to recognized physical forces. Popper hypothesized that “electro-magnetic wave fields (produced by neural activities) . . . represent the unconscious parts of our minds, and that the conscious mind—our conscious mental intensities, our conscious experiences—are capable of interacting with these unconscious physical force fields . . .”. Lindahl & Århem (1994) faced up to and fruitfully dealt with a number of philosophical issues raised by the proposition of a “mental force field”.

I had myself proposed the hypothetical existence of a “conscious mental field” (CMF; Libet 1993b, 1994). The CMF would emerge as a function of appropriate neural activities in the brain; it would have the attribute of conscious subjective experience; it could act back on certain neural activities and therefore affect the behavioral outcome, as in a willed action; it would account for the unity of subjective experience even though the latter emerges from the myriad of activities of billions of nerve cells and their synaptic and non-synaptic interplays. The CMF, like the subjective experiences constituted in it, would be accessible only to the individual having the experiences; it could not be directly observed by any external physical device except indirectly, by any effects it introduces on behavioral outcomes (just as conscious will is evidenced). I would like to analyse some aspects of Popper’s proposals, as elaborated by Lindahl & Århem, and contrast them with my CMF proposal.

I like Popper’s idea of viewing the mind as a kind of force field. My CMF could also be viewed in that way; such a CMF force would then have to be different from all known physical forces. Popper’s hypothesis does not appear to spell out any attributes of that conscious force field except its ability to interact with another entity, the brain’s electro-

magnetic field which belongs to his physical World 1. Popper’s view, that this electromagnetic field represents the unconscious aspects of mental function, is doubtful based on the evidence available. We have demonstrated (Libet *et al.*, 1991) that the transition between an unconscious and a conscious mental operation can simply be a function of a longer duration of similar cerebral activations to achieve awareness. Furthermore, the “need for what we call attention” was similar in all our experimental trials, whether the mental event was an unconscious or a conscious one, so that the attention process does not necessarily distinguish between the two mental states. Electrophysiological activities and responses accompany both unconscious and conscious mental functions. However, these recordable activities must go on for a longer period of time in order for awareness to appear. In the case of sensory input from the skin, production of the slower late components of the evoked cerebral potentials (lasting 0.5 s or more) is necessary for the input to elicit a conscious sensory experience (Libet, 1973; Libet *et al.*, 1967, 1975). Although stimulation of a single mechanoreceptor unit in the hand may elicit a sensation (Ochoa & Torebjörk, 1983), that single peripheral nerve impulse would have to lead to a 0.5 s cascade of early and late electrophysiological responses in the cerebral cortex to have produced a sensory experience. In short, it would appear that both unconscious and conscious mental events could be correlated with or represented by electromagnetic fields of brain activity. Popper’s distinction between conscious and unconscious functions by representing the unconscious ones with a physical electromagnetic field seems to be meaningless.

Popper’s proposal of a conscious mental force field arising as a distinctive entity (his World 2) of the physical brain (World 1) is a more supportable one. Indeed, that proposal can be considered similar to my proposed CMF. However, there is no reason to regard such a field as one which is not correlated to specific electromagnetic manifestations of neural

activity. Electromagnetic fields for conscious functions would differ from those for unconscious functions. Evidence suggests that conscious functions involve some special neural activities that are simply added to those involved in unconscious functions (Libet, 1989; Libet *et al.*, 1991). If Popper was thinking of an electromagnetic field that broadly overarches the brain representing unconscious functions in a distinctively unified fashion, one would have to say that, at present, there is no experimental evidence for such fields.

There are, the more intractable mysteries of (i) how subjective experience and the proposed conscious field arise out of neural activities and (ii) how a conscious mental force could act back on the physical brain to influence neural outcomes, as in a willed action. These mysteries apply both to the Popperian "conscious mental force" and to my CMF (conscious mental field) hypotheses. For both (i) and (ii), there is the problem of relating a mental field entity to the enormously complex array of activities in billions of nerve cells. Even if small changes in electric fields could conceivably lead to modulating the output of large neural groups [as Lindahl & Århem (1994) properly argue] there is then the question of how the mental field recognizes such selective sites for its action, and how a non-electromagnetic entity could produce an electromagnetic change. These questions may be metaphysical and ontological in nature.

The important scientific challenge would be to produce experimental evidence for the proposed two-way interactions between a conscious field and the physical brain without attempting to answer why and how such interactions exist. I have proposed an experimental test of these putative attributes in the CMF (Libet, 1993, 1994). The test is elaborate and difficult, though feasible in principle. Perhaps the same type of test could apply to the conscious force field in Popper's hypothesis. Whether electromagnetic fields are representative of unconscious mental functions could be tested, in principle, by experimentally distorting, disrupting or modifying such fields, in the putative relation to unconscious functions. Sperry (1947) had attempted to test whether unifying electromagnetic fields could be involved in organizing integrated *motor* actions of the cerebral cortex. The test consisted of making numerous vertical cuts into the sensorimotor cortex of a monkey, which, Sperry argued, should cause extreme distortion of any electric field forces. As the cuts produced negligible effects even on fine manipulative movements of the hand and arm, Sperry concluded that the results failed to confirm theories of mass (electric) field

forces. However, Sperry's vertical cuts in the cortex may not have affected larger field currents, as electrical pathways over and below the cuts were still present; a potential role for over-arching electric fields therefore remains possible. In any case, the results for motor coordination in the monkey need not have any bearing on electric fields as potential mediators of a substrate for unconscious mental functions. Experimental distortions or modifications of electromagnetic fields in relation to unconscious and conscious mental functions would still remain potentially useful as a test for these aspects of Popper's hypothesis.

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