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Parashkev Nachev, *et al.*  
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# Comment on “Detecting Awareness in the Vegetative State”

Parashkev Nachev<sup>1\*</sup> and Masud Husain<sup>2</sup>

In a report of a single patient in a persistent vegetative state, Owen *et al.* (Brevia, 8 September 2006, p. 1402) claimed that the presence of task-specific brain activation in response to verbal command implies both covert conscious awareness and a capacity for intention. We argue that neither can be securely inferred from the evidence presented.

In a recent study about detecting awareness in the persistent vegetative state (PVS) Owen *et al.* (1) drew far-reaching conclusions about the neural basis of consciousness from data that—although of great interest—arguably do not support those conclusions. The authors studied the brain activity, in response to auditory cues, in a patient who satisfied established criteria for a PVS. The cues were verbal instructions to imagine performing one of three tasks: playing tennis, exploring a house, or simply relaxing. In comparison with the “relaxed” condition, functional magnetic resonance imaging showed instruction-dependent brain activation similar to that observed in healthy, awake participants obeying the same instructions. From the similarity of brain activation the authors inferred an identity of cognitive states: essentially that the patient was consciously

imagining playing tennis and exploring a house in much the same way that the control participants were.

This inference makes the unjustified assumption that the association between a behavior and a pattern of brain activation implies the converse. It does not. Owen *et al.* correctly state that the absence of brain activation in functional imaging is not proof that the associated behavior is not taking place. However, it is also the case that the presence of brain activation is not sufficient evidence for the associated behavior—here, supposedly consciously mediated behavior—unless one has also shown that the same activation cannot occur without it.

Indeed, as the authors concede, there is an extensive literature demonstrating involuntary and elaborate activation of task-specific brain areas in response to passive exposure to stimuli associated with a specific action, with or without conscious awareness. This objection cannot be dismissed by appeal to the complexity of activation or, given the dynamics of the blood oxygen level-dependent response, to the duration of the functional signal. The key conditions

of playing tennis and exploring one’s home were not even matched to the baseline condition for the semantic associations of the individual words. For example, instead of comparing responses to the instructions to “imagine playing tennis” with “relax,” the authors could have compared “imagine playing tennis” with “do not imagine playing tennis.” All the activation reported in the patient could therefore have been wholly automatic and unconscious.

Owen *et al.* (1) also assert that the task-specific brain activity indicated the patient’s “decision to cooperate,” thereby demonstrating a clear “intention.” However, one cannot speak of a decision when there is no evidence of choice (2). Had there been no functional brain response, Owen *et al.* would not have concluded that the patient had not cooperated but merely that she had been unaware. The hypothesis of whether or not this patient can choose—to cooperate or anything else for that matter—has not been tested.

The question of conscious awareness in the vegetative state has relevance far beyond the limits of the neuroscience community, with an impact on individual lives that is hard to calculate. Although we appreciate that PVS presents formidable challenges of interpretation, it is imperative that alternative data interpretations be carefully considered before making radical inferences.

## References and Notes

1. A. M. Owen *et al.*, *Science* **313**, 1402 (2006).
2. P. Nachev, G. Rees, A. Parton, C. Kennard, M. Husain, *Curr. Biol.* **15**, 122 (2005).
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