Reply: Differential functions of ventral and dorsal striatum

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Sir,

In their letter concerning our recent report, Drs Zeighami and Moustafa discuss several previous studies investigating the functions of the ventral and dorsal striatum and the dissociation between action-value and stimulus-value learning. They note that in light of much of this previous work, our findings regarding Patient XG—who suffered bilateral lesions to dorsal striatum and is impaired at stimulus-value but not action-value learning—are quite surprising. We could not agree more, and had undertaken our studies of Patient XG with the hypothesis that he would be impaired at both forms of learning. We think this surprise reinforces the complementary and converging evidence that lesion studies in humans can provide.

Functional MRI and single-unit recording have shown that dorsal striatum might contribute to action-value learning, but our study suggests that dorsal striatum is not necessary for action-value learning, at least in humans.

Zeighami and Moustafa (2015) also suggest that Patient XG’s intact ventral striatum mediates his intact learning, and that his impairment in stimulus-value learning is due to impairment in state representation rather than stimulus-value learning per se. We believe this explanation to be less likely. First, we are aware of work linking orbitofrontal cortex to state representations, but are not aware of work linking dorsal striatum to such representations. Second, the action-value and stimulus-value learning tasks we used did not differ in the number of possible states (each had two) and differed only slightly in the number of possible trial types (one for action-value and two for stimulus-value). Third, we did test Patient XG’s working memory and executive function, which might be associated with state representations, and he is not impaired (and in many cases above average) on these tests. Nonetheless, we agree that further tests of this potential explanation are merited, and see this as just one example of the kind of future research that we hope our surprising report now motivates.

Reference