REPLY TO YANG ET AL.:
Multilayer network switching and behavior

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Yang et al. (1) comment on the link between interindividual variation in network switching and sleep quality that we report (2). We appreciate the keen interest in our work and thank the authors for clarifying our description of the sleep quality index. We believe that asking participants how much they slept on average during the month, rather than the day, before the scan may potentially provide a more reliable index of sleep quality, sleep deprivation, and chronic fatigue.

Yang et al. (1) also query the interpretation of the elastic net regression that we performed. To clarify, we included network switching data as a dependent variable and the 50 behavioral tasks as independent variables. This is stated in the Results section of ref. 2 (p. 13379): "We used elastic net regression (27) to test whether any of the 50 behavioral domains (independent variables) predicted whole-brain averaged network switching (dependent variable)." We acknowledge that this regression is thus formulated to test whether behavior predicts network switching, rather than whether switching predicts behavior, as expressed in parts of our paper. Moreover, we recognize that the term "prediction" is increasingly implied to indicate validation with respect to an independent cohort. However, we contend that the issue highlighted here does not detract from our key findings. In particular, our conclusions remain the same: 1) Network switching and connectivity dynamics are inversely related; 2) functional connectivity is typically reduced during network switching epochs; 3) regions that switch networks frequently are positioned within association cortices and exhibit high temporal complexity; and 4) network switching and interindividual variation in behavioral measures are related.

Finally, we emphasize that our computer codes and the neuroimaging data used for our experiments are publicly available, thus allowing other researchers to replicate our findings.

1 Z. Yang, Q. K. Telesford, A. R. Franco, T. Xu, S. Colcombe, M. P. Milham, Concerns regarding the prediction of behavioral measures from multilayer network switching. *Proc. Natl. Acad. Sci. U.S.A.* **116**, 16672 (2019).
2 M. Pedersen, A. Zalesky, A. Omidvarnia, G. D. Jackson, Multilayer network switching rate predicts brain performance. *Proc. Natl. Acad. Sci. U.S.A.* **115**, 13376–13381 (2018).

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The authors declare no conflict of interest.

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