

# Reply to 'Neural signatures to emotion-related word stimuli may vary'

**Just et al. reply** — Dawson and Guberman's<sup>1</sup> thoughtful comments raise interesting issues. We concur with two of their prescriptive suggestions, namely that our study should be extended to a larger sample and that it should include other psychiatric groups. A larger study that includes these two goals is now underway.

However, their speculation concerning the reason for inaccurate classification of concepts in the initially excluded participants (both controls and suicidal ideators) is incorrect. They "question whether the inaccurate concept identification is indeed inaccurate or simply different for those [excluded] subjects." The accuracy measure utilized only the participant's own data, a measure completely indifferent to the similarity of the participant's neural representations to other participants' representations. By contrast, as we suggested, the ability to attend to the task, thinking consistently about a concept as it was presented on six different occasions, affects this accuracy.

We also disagree that the classifier was arrived at by trial and error. The choices of stimuli (generalized from Cha et al.<sup>2</sup>), the Gaussian Naïve Bayes classifier and analysis parameters (adopted from previous studies) were all specified a priori. However, the determination of the most discriminating word concepts was made a posteriori, as described.

Dawson and Guberman<sup>1</sup> question the assumption that there is considerable commonality in the neural representations of concepts across people. But several previous studies have found that a classifier trained on the data of a set of neurotypical participants can classify the concepts of a participant on which it has not been

trained, and within- and between-subject accuracies are typically comparable. This finding applies to different types of concepts, such as concrete objects<sup>3</sup>, abstract physics concepts<sup>4</sup>, numbers<sup>5</sup>, social interactions<sup>6</sup> and concepts in a sentence<sup>7</sup>. Furthermore, the commonality occurs across monolingual members of different language groups/cultures (English, Portuguese and Mandarin)<sup>8</sup>, which speaks to the issue of cultural diversity. The commonality also occurs across participants experiencing various emotions<sup>9</sup>.

A commonality of neural representations of social interactions was also found among participants with autism spectrum disorder (ASD)<sup>6</sup>, despite these representations being reliably discriminable between an ASD group and a control group. In summary, there is a considerable amount of evidence indicating commonality of neural representations among neurotypical participants, among participants with ASD and among those with suicidal ideation, as well as a difference between neurotypical and psychiatric samples for concepts related to the psychiatric disorder.

Of course there is some likelihood that the neural representation of a concept such as 'death' (including the emotion component) differs across cultures, and perhaps across age and socio-economic groups. In fact, we demonstrated one aspect of diversity measurable by our methods by reporting detectable neurosemantic differences between ideators who had made an attempt and those who had not. Another type of variation we reported demonstrated a correlation between degree of suicidal ideation (Adult Suicidal Ideation Questionnaire) and the degree of alteration of the neurosemantic signatures.

The variation of neural representations in suicidal ideation is an interesting issue for further study, and we are optimistic that our methods will be useful in assessing variation and providing diagnostic, therapeutic and biological insights into numerous psychiatric disorders. □

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## Competing interests

The authors declare no competing interests.