Visual Awareness Negativity correlates with small changes in conscious experience

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Abstract

The Visual Awareness Negativity (VAN), an event-related difference wave, has been proposed as a neural correlate of consciousness (Koivisto & Revonsuo, 2010). The Perceptual Awareness Scale (PAS) was created by subjects who were instructed to develop a scale to rank visual experiences on a gradient ranging from any other point on the scale (Ramsey & Overgaard, 2004). It contains four points: NE = no experience, WG = weak glimpse, ACE = almost clear experience, CE = clear experience. PAS has since been used in several experiments (McElligot et al. 2011; Ongur et al. 2009; Fransson et al. 2009). Some of these experiments suggest that PAS is a more sensitive indicator of consciousness than other current methods (Sandberg et al. 2010). We tested the hypothesis that VANs would be found between PAS-ratings, which would corroborate that VAN is a candidate for an NCC. To investigate this hypothesis, we ran an experiment using magnetoencephalography (MEG) to obtain event-related fields (ERFs) for each of the PAS-ratings. Based on the sensor space data, we successfully trained a classifier to discern between the four PAS-ratings. VANs were found for the planned contrasts, and we found negative evidence for differences between ratings in source activity and source localization. In conclusion, we found evidence for VANs between the different ratings, and thus evidence for VAN being an NCC that does not only correlate with whether the subject is aware or unaware, but also with experienced difference in conscious content.

Introduction

The search for neural correlates of consciousness (NCC) has been extensive, but mostly these endeavors have assumed that visual experiences are dichotomous – either you see something or you don’t. Visual Awareness Negativity (VAN), the Visual Awareness Negativity correlates with small changes in conscious experience. The fact that the classifier can find differences between the PAS-scores, which we do not find in the sensor space analyses, points towards that the signals that encode information about differences in conscious experience are not localized, but rather distributed over the brain and especially over the occipital regions.

Summary of multivariate classifier analyses

Classification accuracy and number of significant classifications increase with the distance between PAS-ratings. Occipital sensors are best for successful classification, i.e. accuracy and no. of significant classifications are both higher than for the other types of sensors, including “all” sensors. Of the source groups, occipital sensors have the most significant features.

Conclusions

There is good evidence for VAN being a robust NCC, i.e. it is sensitive to small differences in conscious experience. Occipital sensors seem to be the most important sensors for explaining small differences in conscious experience. Furthermore, there seems to be a tendency of classification accuracy decreasing the more frontal the sensors used for classifications are.