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Thesis abstract

Conscious and not-conscious processing of visual mismatch negativity

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The general aim of my thesis is to investigate conscious and not-conscious processing of sequences of stimuli that yield visual mismatch negativity (vMMN), a well-established brain signature of prediction and prediction-error. vMMN is typically observed in the oddball paradigm: an infrequent visual stimulus—a deviant, is randomly and unpredictably presented in a sequence of more frequent visual stimuli—the standards. vMMN is a negative component of event-related potentials (ERPs), and is seen most clearly in the difference wave: the ERP for the deviant minus the ERP for the standard, between 150 and 400 ms after stimulus onset.

To investigate conscious and not-conscious processing of vMMN, I conducted four electroencephalography (EEG)/ERP experiments. In Experiment 1, I showed that it is easier to find neural correlates of visual consciousness—differences in brain activity between conscious and not-conscious visual stimuli, with cardinal gratings than with oblique gratings. In Experiment 2, I showed that a source of information about which we are not-conscious, eye-of-origin (utrocular) information, yields a reliable vMMN. In Experiment 3, I hid my deviants from visual consciousness using binocular rivalry suppression, and found that the size of vMMN is smaller to that elicited by the same stimulus when it is conscious during binocular rivalry dominance. In Experiment 4, I hid my standards and deviants from visual consciousness using continuous flash suppression (CFS), and found that the size of vMMN is bigger than that elicited by the same stimuli when they are conscious.

My results are consistent with the notions that our brains establish predictive models of visual perception about regular visual input, that our brains are constantly testing the reliability of these models, and that our brains update these models when something unexpected occurs. My results also show that these processes are independent of visual consciousness. I conclude that visual consciousness is not necessary to elicit vMMN, confirming that vMMN is an automatic brain response.

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