The tuning of human visual cortex neurons as reflected by fear conditioned neuromagnetic oscillatory responses

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Abstract

Fear conditioning renders a previously neutral stimulus as motivationally relevant as the individual learns by associative processes that the previously irrelevant stimulus now predicts an aversive event. Thereby, perceptual processes are enhanced for the conditioned stimulus in order to prioritize the acquired fear relevant stimulus over irrelevant ones. With respect to the underlying mechanisms, there is increasing evidence that short term neuro-plastic changes in sensory cortices tune feature-selective neurons towards the characteristics of the fear conditioned stimulus. Here, we present some fear conditioning studies in humans that are in line with the notion that orientation sensitive neurons in visual cortex tune their orientation selectivity towards the angle of fear conditioned gratings (sine gratings or Gabor patches) commonly used as visual conditioned stimuli. Further, we will present some evidence that this process may be implicit and not rely on contingency awareness and attention. Finally, we will also demonstrate that computational models of learning such as the classic Rescorla-Wagner Model predicts activity profiles in the visual cortex during learning and is compatible with response patterns as explained by short term plasticity changes of orientation-sensitive visual cortex neurons.