Perception of a touch-induced visual illusion correlates with changes of oscillatory activity in human visual and somatosensory areas

Joachim Lange, Robert Oostenveld, Pascal Fries

F.C. Donders Centre for Cognitive Neuroimaging, Radboud University Nijmegen, The Netherlands

When a brief visual stimulus is accompanied by two brief tactile stimuli, subjects often perceive a second illusory visual stimulus [1]. We investigated the neural mechanisms of this illusion with whole-head 151-channel MEG-recordings in 22 subjects. Subjects received visuo-tactile stimulations and were instructed to indicate the number of perceived visual stimuli while ignoring tactile stimulations. Stimulus parameters were adjusted to obtain the illusory second flash in 50% of those trials in which stimulation conditions permitted the illusion. We contrasted illusion and non-illusion trials and analyzed differences in spectral power in somatosensory and occipital sensors.

In occipital sensors, the illusory percept was accompanied by a bilateral de-synchronization before stimulus onset (-400 to -200 ms) in the alpha-band (7.5-15 Hz). Moreover, the illusion triggered enhanced power in the gamma-band (70-130 Hz) contralateral to stimulus presentation. Interestingly, the visual illusion is also associated with changes of oscillatory activity in somatosensory cortex, although subjects were instructed to ignore tactile stimulation. In somatosensory sensors, the illusory percept was accompanied by an increase of spectral power for low frequencies (5-15 Hz) around stimulus onset and a decrease of spectral power at ~400-850 ms in the beta-band (25-30 Hz).

In somatosensory areas, decreased neuronal oscillatory activity in the beta-band has been related to increased attention to tactile stimulation [2]. Enhanced activity in the alpha-band correlates with better performance in tactile detection tasks [3]. Also, pre-stimulus de-synchronization in the occipital alpha-band reflects similar processes in visual areas [4]. We therefore hypothesize that the observed effects for illusion trials relate to higher processing capabilities of somatosensory and visual areas. This may lead to enhanced inter-sensory information transfer. Higher attention to tactile stimulation in illusion trials may thus enhance the impact of somatosensory gamma-band activity on visual areas. These findings provide new insights in the dynamic interactions between different sensory areas during multimodal integration.

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References