The Neural Processing of Natural Stereoscopic Images. An EEG Study.

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We investigate cortical mechanisms of depth perception under natural conditions. We acquired 29 high-resolution stereo images and concomitant laser range scans of natural scenes. In addition we generated 'Pink Noise' stereo images with identical second-order statistics but random phase spectra, and 'White Noise' images. However, the stereo images in both artificial categories contain the same binocular disparity as the 'Natural' images. The participants rated the intensity of their scenic 3D perception, and rated 'Pink Noise' significantly lower than the other two.

These three types of images were presented to 7 human participants in 2D and 3D conditions and, we recorded a 32-channel EEG simultaneously.

We found out that neural activation in 3D significantly differs from 2D in central occipital electrodes at around 200 ms after stimulus onset

in all categories. Activation of lateral occipital electrodes, in contrast, predicts whether the stimuli are able to induce scenic

stereoscopic perception, as there is a highly significant activation in the 'Natural' and 'White Noise' case, but solely a moderately significant activation in the 'Pink Noise' case (see figure for the case of O2 electrode). In addition, frontocentral activity is sensitive to differences in second-order statistics at about 400 ms after stimulus onset: here, 'Natural'and 'Pink Noise' scenes elicit a significantly different activation than 'White Noise' scenes.

Concluding, our results demonstrate a category-invariant effect of stereovision in occipital recording sites at 200 ms after stimulus presentation that is modulated by top-down processes in lateral occipital electrodes, as well as category-specific effects in fronto-central recording sites, at 400 ms after stimulus onset.