Neural correlates of 2D and 3D biological vs non-biological object perception: psychophysics, and neurophysiology

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Event related potential studies can provide important insights into the understanding of how and when the human brain differentiates between visual stimulus categories. Here, we ask the question whether ERP components related to object recognition show category specific responses. Many studies have concluded that faces elicit such category specific responses, based on the demonstration of a 'face–specific' negative ERP potential termed the 'N170', which is more pronounced for faces than for other visual stimuli. In the present study (8 participants), using static stimuli (photographs of faces and chairs and mooney faces) and manipulating their salience by different levels of masking, we found that the amplitude of the N170 could be modulated by the saliency of the stimuli. Hence, whether the N170 of faces was larger than for non-faces simply depended on the saliency level of the stimuli. Additionally, using structure-from-motion (SFM) defined face and chair stimuli , we found an object-related negative peak at 250 ms whose amplitude could be modulated by varying depth of the respective stimulus categories ('flattening' the stimuli leading to increasingly smaller amplitudes)). Moreover, a comparison between stimulus categories (faces, chairs and coherent motion) revealed that the N250 peak has a significantly larger amplitude for SFM chair stimuli than for SFM face stimuli (even for normal/optimized depth values in the two categories) and hence failed to show a face-specific effect. The object-sensitive N250 elicited by the SFM stimuli peaked around 80 ms later compared to the N170 in the static face condition, which can be well explained by a perceptual delay in perceiving SFM stimuli, i.e. the time needed in order to detect an object from the moving dot pattern. We therefore speculate that the N250 we found for SFM stimuli is a perceptual analogue of the N170 for static faces. Support for this claim comes from our finding that the N170 for static faces/chairs can also be shifted depending on the exact time of their presentation (in an experimental condition in which static stimuli become detectable later in the stimulus period, simulating the SFM condition). Taken together, these findings demonstrate a strong dependence of object-related ERP signals on depth/saliency of the respective stimulus category and a lack of an unambiguous relationship between the amplitude of object-sensitive ERP components and object categories.