

Sektion Funktionelle Sehforschung/ Elektrophysiologie: Mechanisms of ambiguous perception

Perceptual reversals of ambiguous figures

Fig. 1. (a) Necker lattice, (b) and (c) 2 unambiguous versions

Ambiguous figures (e.g. the Necker cube and Necker lattice; see Fig. 1) fascinate observers because they lead to spontaneous perceptual reversals although the stimulus itself stays unchanged. "Neural satiation in the early visual processing" (e.g. Köhler, 1940; Toppino & Long, 1987) and a "cognitive decision process" (e.g. Horlitz & O'Leary, 1993; Rock et al., 1994) are two approaches to explain the underlying mechanisms. Electrophysiological studies so far suffered from the lack of an external time reference of the reversal instance for EEG-averaging. Subject's reaction instances, used instead as reference, suffered from intraindividual jitter of about 200 ms (Kornmeier & Bach, 2004).

Fig. 2.

Our new experimental approach to investigate spontaneous perceptual reversals contained (1) the Necker lattice (Fig. 1a) as a new stimulus, (2) an improved time reference for EEG averaging (time-locking of the reversal instance with intermittent stimulus-presentation, Fig. 2), and (3) a comparison condition, where we induced physically orientation reversals of an unambiguous lattice (with depth-cues; Fig. 1c). With intermittent stimulus presentation (Fig. 2), we were able to improve time reference and thus to measure a series of ERP-components correlating with perceptual reversals (Fig. 3).

The earliest ERP component appeared around 100 ms after stimulus-onset ("reversal positivity") and had an occipital scalp-location. ERP components measured during the physical reversal of unambiguous lattices were comparable to the components in case of the ambiguous Necker lattice, but around 70 ms earlier. A reversal positivity, however, is missing.

In case of ambiguous figures, the perceptual process takes longer compared to unambiguous figures. The short latency and the occipital scalp-location of the reversal positivity suggest low-level processes as the causal factors for perceptual reversals. The characteristics of the subsequent components can help to estimate the instance of awareness of the stimulus' reversed orientation.



Fig. 3. Left: ERPs to the unambiguous lattice, right: ERPs to the Necker lattice. The arrows denote the Reversal Positivity at 110 ms, and the Reversal Negativity at 250 ms.

References

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