

# Top-down and bottom-up processes of attention in humans reporting anomalous experiences

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## Introduction

As part of the clinical and physiological studies at the *Institut für Grenzgebiete der Psychologie und Psychohygiene e.V.* we were interested in the processing of attention in subjects reporting anomalous experiences (AE) like, e.g., telepathy, precognition, or psi-dreams. Beside a variety of other characteristics, people with AE were supposed to have different ways of stimulus classification and to show less habituation to novel stimuli.

To test this hypothesis we used a novelty-oddball paradigm. In such a paradigm, the target P300 is known to represent top-down aspects of information processing, whereas the novelty P300 is discussed to be induced by involuntary, bottom-up directed ways of stimulus processing (Debener, 2002). To test possible differences between auditory and visual stimulus processing, we used both kinds of modalities.

As the inhomogeneous group of subjects reporting AE is only poorly described in terms of personality traits, which might be related to the reported phenomena, and as schizotypia is known to be associated with both AE and alterations of the target P300 (Klein et al., 1999), we were also interested in the ratings in schizotypia and absorption of the participants.

## Method

21 subjects reporting multiple AE (7 male; mean age 34 years) were compared to 19 control subjects without such experiences (9 male; mean age 24 years).

All subjects absolved a randomised series of four separate novelty-oddball tasks using tones, consonant-vowel syllables, letters, and line-drawn faces.

The EEG was recorded from 21 electrodes according to the standard 10-20-positions, replenished by VEOG and HEOG. Impedances were kept below 5 kΩ, and linked mastoids (A1, A2) served as reference. Data were filtered to 0.1-15 Hz, digitized and sampled at 500 Hz. After ocular correction, artefact rejection and baseline correction, the P300 amplitude was measured as the peak amplitude obtained within a time window of 250 - 600 ms after stimulus onset.

Statistical analysis was performed with vector-normalized data using the general linear model with the between-subjects factor "Group" (AE, Control) and the within-subject factors "Modality", "Electrode Position" and "Third of the course" (1st, 2nd and 3rd).

All subjects were also assessed using the Schizotypal Personality Questionnaire (SPQ-G), the Tellegen Absorption Scale (TAS) and the "AE-Questionnaire" for anomalous experiences.

## Event Related Potentials

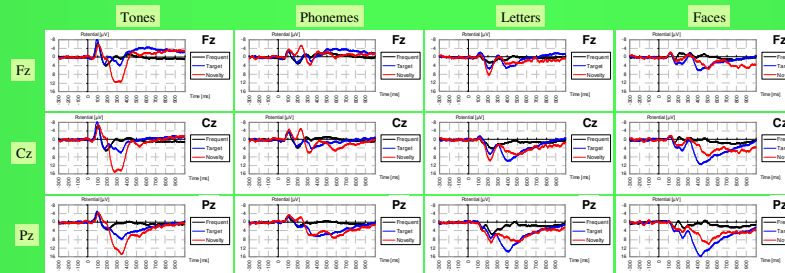


Figure 1. Grand average ERP activity of the three stimulus categories in the four modalities at Fz, Cz and Pz electrode sites. Data are collapsed across groups. Stimulus onset was at 0.0 seconds on the time scale. Units in microvolts (µV), negativity up.

## P300 Mean Amplitude

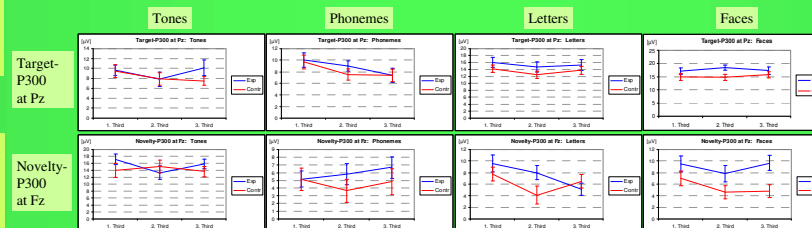


Figure 2. Mean amplitude of the target P300 at Pz and the novelty P300 at Fz electrode site in the three thirds of each course of the four stimulus modalities for AE and control group. Error bars represent standard error of the mean. Units in microvolts (µV), negativity up.

## Questionnaires

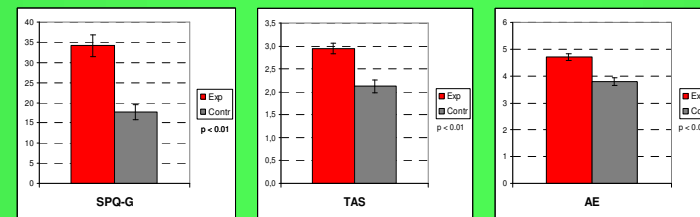


Figure 3. Mean ratings of SPQ-G, TAS and AE (anomalous experiences) - questionnaires for both groups. Error bars represent standard errors of means.

## Results

The **target P300** showed different ERP topographies for the different oddball tasks (*Modality x Electrode Position*:  $F_{(3,18)} = 3.34$ ,  $p < 0.01$ ) but no difference of the topography between groups. Overall, target P300 declined from the first to the last third of each session ( $F_{(1,2)} = 5.48$ ), but in separate t-tests for the different modalities this was found only in the phoneme modality ( $t_{(1,38)} = 2.83$ ,  $p < 0.01$ ). For target P300, there was no group difference in habituation (*Third of the course x Group*:  $F_{(2,1)} = 0.32$ ).

Also evaluation of the **novelty P300** showed an interaction between *Modality and Electrode Position* ( $F_{(3,18)} = 4.36$ ,  $p < 0.01$ ) but no difference in task-specific topographies between both groups. In the overall ANOVA, novelty P300 declined from the first to the last third of each session ( $F_{(1,2)} = 4.03$ ,  $p < 0.05$ ) without difference between both groups (*Third of the course x Group*:  $F_{(2,1)} = 0.10$ ), but separate calculation of t-tests for the different modalities revealed habituation only in the letter condition ( $t_{(1,38)} = 3.05$ ,  $p < 0.01$ ).

Evaluation of the three questionnaires showed largely enhanced scores in SPQ-G, TAS and AE-questionnaire for the AE-group ( $t_{(1,38)} = 4.85$ ; 4.71; 4.93; respectively;  $p < 0.001$  each).

## Discussion

Largely enhanced scores in the SPQ-G and TAS questionnaires for the AE subjects support the assumption that people reporting AE have a high readiness for intensive emotional experiences and increased schizotypia. The investigation and differentiation of personality traits in persons reporting AE should be continued.

Analyses of both novelty and target P300 suggest that there exist different cortical networks for stimulus discrimination in auditory and visual tasks. But the expectation that neuronal sources underlying these networks are different in AE and control subjects could not be supported.

The assumption of impaired habituation to novel stimuli in AE subjects as a possible sign of altered bottom-up processes of attention could not be confirmed either.

A group difference in processing of target stimuli - representing top-down aspects of attention - could not be found, so that the prior finding of a smaller target P300 in persons with higher schizotypia scores could not be transferred to the subjects reporting AE.

### Literature:

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