Changes in the facial expression: An EEG/MEG study

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Introduction

The expressive characteristics of emotions in voice, face, gesture, and posture serve an important function in communicating emotional state to others. Already Darwin stressed the major significance of facial expressions of emotions as signals of behavioral intention and their role in social interaction.

Research focused on questions such as when people show which pattern of facial activation treats the encoding of facial expression. On the other hand, research trying to understand how people perceive facial expressions and how they make judgments deals with the decoding of facial expressions. Such processes have to do with how people perceive complex visual stimuli in general and how they draw inferences.

Neuroimaging techniques use emotional faces as stimuli to learn when and where brain activity takes place during emotional processing. A number of studies have shown a strong link between those systems involved in producing emotional behaviors and those involved in recognizing the same emotions in others. Therefore, research on perception of emotions opens a window to explore emotional states itself.

In the present study event-related potentials (ERP) and magnetoencephalography (MEG) were used to examine brain activity during presentation of happy and neutral faces in an oddball paradigm.

Methods

Five male subjects, age 22-28 years, participated in the study. Neutral face was the deviant (ND, P=0.13) and a happy face of the same person was the standard (HS, P=0.75). The task was silent counting of the second deviant (face with glasses, P = 0.12). Stimuli subtended a 2.7º x 2º visual angle and were presented at the center of the visual field for a duration of 150 ms. Onset-to-onset inter-stimulus interval was 600 ms. Total of 300 neutral face deviants were presented. The ERP was recorded with a 60-channel MEG-compatible electrode cap in the parallel with a 306-channel whole-scalp MEG system in a magnetically shielded room.

Results

Mismatch activity was evident in most of the EEG channels starting in lateral posterior channels and then spreading medially and anteriorly with a maximum value around 280 ms (Fig. 1). Reliability of the observed effect was evident during the time course of the experiment, i.e. negativity did not disappear because of the habituation. Similar effect was manifested in MEG recordings.

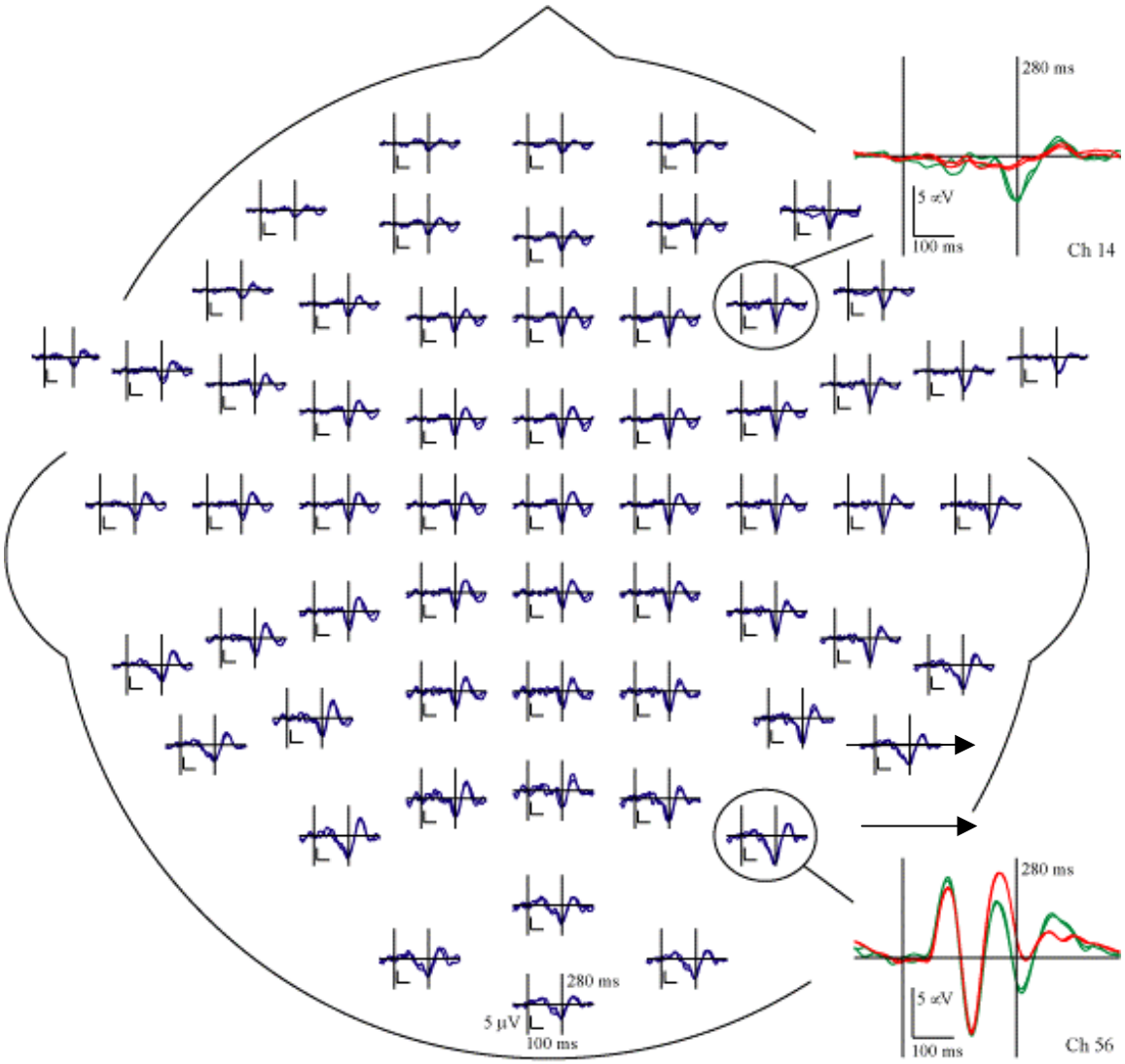

Figure 1. ERP grand-averaged difference waveforms (blue) obtained by subtracting HS from ND. ERP responses to HS (red) and ND (green) in the right frontal channel 14 and the right occipito-temporal channel 56 are given for illustration of observed effect.