Emotions And Face-Selective Processing. ERPs Correlates

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Introduction

Face is an important social stimulus in human interactions. From face stimuli we are not only able to derive information concerning the person's likely age, sex, and so on, but we are also able to interpret the meaning of their facial expressions. Neuroimaging studies have demonstrated that the visual presentation of emotionally charged stimuli activates not only emotion-specific brain areas but also areas in the extrastriate cortex more than that of a neutral stimulus (Fredrikson et al., 1995; Linkenkaer Hansen et al., 1998; Marinkovic et al., 2000). Moreover, recent electroencephalographic studies have supported the hypothesis that the process of facial expression recognition starts very early in the brain, by about 180 ms after stimulus onset (Balconi & Pozzoli, 2003; Maurer et al., 2002; Streit et al., 2000).

Methodology

Subjects. Eighteen healthy volunteers took part in the study (eight women, age 19-25) after giving informed consent. They were students of Psychology at the Catholic University of Milan, with normal or corrected-to-normal visual acuity.

Material. Stimulus materials were taken from the set of pictures of Ekman and Friesen. They were black and white pictures of a male actor, presenting respectively a happy, sad, angry, surprised, fearful or neutral face. The stimulus was presented for 500 ms on the monitor with an interstimulus interval of 1500 ms. He/she was seated in sound-attenuated, electrically shielded room and was asked not to blink during the task. Prior to recording ERPs, the subject was familiarized with the overall procedure (training session).

Erp measure. The EEG was recorded with a 32-channel DC amplifer (SYNAMPS system) and acquisition software (NEUROSCAN 4.0) at ten electrodes (four central, Fz, Cz, Pz, Oz; six lateral, F2, F3, T2, T3, P2, P3) (international 10-20 system) with reference electrodes at the mastoids. Electrooculograms (EOG) were recorded from electrodes lateral and superior to the left eye. The signal (sampled at 256 Hz) was amplified and processed with a pass- band from .05 to 50 Hz and was recorded in continuous mode. Impedance was controlled and maintained below 5 KΩ. An averaged waveform (off-line) was obtained from about ten artifact-free (trials exceeding 50 μV in amplitude were excluded from the averaging process) individual target stimuli for each type of emotion. Peak amplitude measurement was quantified relative to 100 ms prestimulus.

Results and Discussion

To analyse the effect of different facial expressions, the peak amplitude and the latency measurements were entered into separate two-way repeated-measures analysis of variance (ANOVA) with the stimulus category and electrode sites as repeated-measures factors.

The ERP profiles observed in the emotional face-expression decoding showed a negative deflection, peaked at approximately 230 ms, for each of the five emotional face expressions. We hypothesize that this deflection is strictly related to the decoding of emotion facial-expressions, as revealed in previous ERP researches (Streit et al., 2000). Interestingly, we observed a more posterior distribution of the peak for all of the expressions. Nevertheless, we observed that the negative variation is different among the five emotions in terms of peak amplitude. The different profiles of the ERPs as a function of the emotional valence of the stimulus may indicate the sensibility of the negative-wave variation N230 to the "semantic" value of the expressions (Jung et al., 2000). Very similar potentials, with identical early latency and amplitude, were observed for happy and sad expressions, differentiated from the negative high arousal emotions (fear, anger and surprise). In fact a more negative peak characterized respectively fear, anger and surprise than the positive (happiness), low arousal expression (sadness) and neutral stimulus.

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