Paper ID: 17442
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SPACE LIFE SCIENCES SYMPOSIUM (A1)
Poster Session (P)

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COGNITIVE EFFECTS OF STAR-FIELD ROTATING BACKGROUND : AN ERP STUDY

Abstract

Background The effect of different constant velocity rotation star-field on early visual cognitive processing in tasks with different mental loads was explored in this study. Methods Twenty university volunteers (half male and half female) aged 18-24 participated in this study. Visual background was white or star field constructed by rotating red, yellow or blue dot outside a circle region in the center of the screen. Star field background rotated at 30deg/s, 45deg/s or 60deg/s. A yellow dot flashed in the center of the circle region. Red or green dot with equal probability randomly flashed at the right or left side of the yellow dot 5cm away. The flash interval of the red or green dot was in the range of 1500 2300ms with an average of 2000ms. Subjects performed three different mental load tasks with visual fixation on the center flashed yellow dot. (1) No response task (NR). (2) Selective switch choice task (SSC). Subjects responded to the flash position (left or right side of the yellow dot) of the target dot by pressing the button in the corresponding side. (3) Selective mental arithmetic task (SMA). Subjects did summation according to the flash position of the target dot. Event–related potentials in each task were derived and analyzed. Results It was found that in contrast to performing tasks under white background, P1 had higher peak amplitudes and quicker P1 latencies under rotating background. N1 presented highest peaks in white background. P1 and N1 latencies in NR task were shorter than that in SSC and SMA task. And P1 latencies in SMA task were shorter than that in SSC task. Peak P1 amplitudes in SMA task were higher than that in NR task. Peak N1 amplitudes in NR task were lower than that in SSC and SMA task. Peak N1 amplitudes in SSC task were higher than that in SMA task. P1 latencies was the shortest during 45deg/s rotation in NR and SSC task and peak N1 amplitudes under 45deg/s was significantly higher than that under 60deg/s rotation background in NR, SSC and SMA task. Conclusion Rotating background facilitated the signal detection and decreased the effort in active filtering or discrimination. And there was an interaction between mental load and early cognitive processing effects of rotating background. Rotating background effect presented in each mental load task and the optimal early cognitive processing presented in 45deg/s rotating background.