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Brief report

Self-construal priming modulates visual activity underlying global/local perception

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Abstract

Behavioral studies suggest that self-construals play a key role in modulation of cognitive processing styles, leading to context-dependent or -independent mode of processing. The current work investigated whether the neural activity in the extrastriate cortex underlying global/local perception of compound stimuli can be modulated by self-construal priming that shifts self-construal towards the Eastern interdependent or Western independent self in Chinese participants. After primed with independent or interdependent self-construals, subjects were asked to discriminate global/local letters in a compound stimulus while event-related potentials (ERPs) were recorded. We found that, while the independent self-construal priming resulted in enlarged P1 amplitude to local than global targets at lateral occipital electrodes, a reverse pattern was observed after the interdependent self-construal priming. Our findings provide electrophysiological evidence that self-construal priming modulates visual perceptual processing in the extrastriate cortex.

Keywords: Extrastriate cortex; Visual processing; Global/local; Self-construal

1. Introduction

Human visual perceptual processing is efficient and flexible. It is well known that visual perceptual processing can be substantially modulated by internal attentional state of observers and the affective properties of stimuli (Vuilleumier and Driver, 2007). Recent cross-cultural studies also show evidence that perceptual processes are greatly influenced by cultures (Nisbett and Miyamoto, 2005). By comparing behavioral performances from participants with different cultures, Nisbett and colleagues found that, relative to European Americans, East Asians' performance of judging the orientation of line segment in a frame showed stronger tendency to be influenced by the frame (Ji et al., 2000). In addition, Americans were better in detection of changes in focal objects whereas Japanese were better in detection of changes in the field (Masudaz and Nisbett, 2006).

Cultural influence on perceptual processes has also been demonstrated in one culture group using cultural priming procedure. While Western cultures result in independent self that is characterized as a self-contained and context-independent entity, Eastern cultures breed interdependent self that is regarded as a member in a group highlighting belonging to and dependence upon a context (Markus and Kitayama, 1991), all individuals are expected to flexibly define themselves as relatively more independent or interdependent depending upon current situations (Gardner et al., 1999). On the basis of these propositions, researchers used self-construal priming, which asks subjects to circle the independent (e.g., I, mine) or interdependent (e.g., we, ours) pronouns in an essay to switch the self towards Western independent or Eastern interdependent styles (Gardner et al., 1999), to investigate cultural influence on perceptual processes. Kühnen and Oyserman (2002) reported that subjects exposed to the independent self-construal priming responded faster to a local than global target in a Navon-type compound stimulus (Navon, 1977), whereas a reverse pattern of performance was observed in subjects exposed to the interdependent self-construal priming. We also found evidence that self-construal priming facilitated global or local perception

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in the same group of subjects who showed faster response to global targets after the interdependent-self priming but faster response to local targets after the independent-self priming (Lin and Han, submitted for publication).

While the previous research suggests interactions between cultures and perceptual processing, the conclusions were made mainly based on behavioral measurements. It remains an open issue if the neural activity in the visual cortex underlying perceptual processing is modulated by self-construal priming. The current research tested this by measuring event-related potentials (ERPs) to global and local targets in compound letters (Fig. 1). Previous ERP and brain imaging studies found that the extrastriate activity was modulated by global/local perception of compound stimuli. Specifically, a lateral occipital positive activity peaking at about 100 ms after stimulus delivery (P1) was enlarged to local than global targets (Han et al., 1997, 1999, 2000). In addition, enhanced activity in the right and left extrastriate cortex was, respectively, linked to the global and local perceptual processes (Fink et al., 1996; Han et al., 2002). These findings demonstrate that the extrastriate activity is involved to differentiate global and local perceptual processes of compound stimuli.

Here we used the self-construal priming procedure to shift the self towards the independent or interdependent styles in Chinese subjects before they performed tasks of discrimination of global/local targets. Because the early ERP components such as the P1 arise from the extrastriate cortex (Di Russo et al., 2001; Martinez et al., 2001), variation of the P1 amplitudes to global/local targets as a function of self-construal priming would provide evidence that self-construal priming modulates the perceptual processing in the extrastriate cortex. In addition, because increased scope of visual attention facilitates global processing and decreased scope of visual attention facilitates local processing (Stöffer, 1994; Han and Humphreys, 2002) and the interdependent and independent self-construal priming increases and decreases the scope of visual attention respectively (Lin and Han, submitted for publication), we would expect that the interdependent and independent self-construal priming would respectively facilitate global and local processing indexed by increased extrastriate activity to global and local targets.

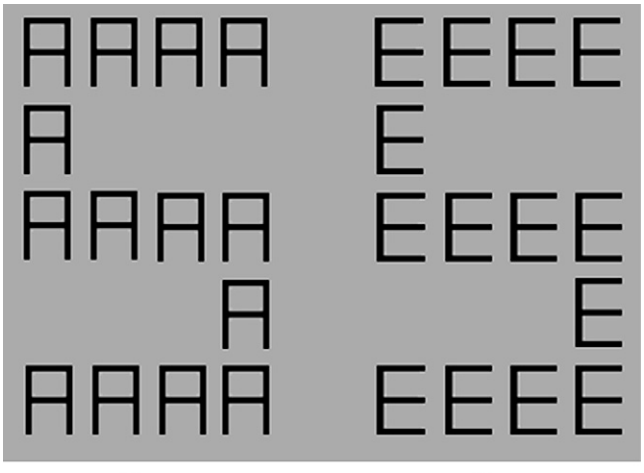

Fig. 1. Illustrations of the compound letters used in the study. In both (a) and (b), target (S) appears at the global level whereas local letters (A and E) are non-target.

2. Method

2.1. Subjects

Twenty students (9 males and 11 females) were recruited in this study as paid volunteers from Peking University, aged between 19 and 25 (mean = 21.6 ± 2.0). All were right-handed, had normal or corrected-to-normal vision and gave informed consent. This study was approved by a local ethic committee at the Department of Psychology, Peking University.

2.2. Stimuli and apparatus

Stimulus displays were presented on a 21-in. monitor controlled by PC computers in a dimly lit, electrically shielded, and sound attenuated chamber. The stimuli were global letters made up of local letters in an invisible 4 × 5 matrix on the screen, as illustrated in Fig. 1. Each global letter was 3.2° wide and 5.1° high and each local letter was 0.57° wide and 0.80° high at a viewing distance of 100 cm. Adjacent local letters were spaced 0.29° apart, with lines approximately 0.06° thick. Stimuli were black (0.1 cd/m^2) against a gray background (44.0 cd/m^2). Letters "H" and "S" served as targets while letters "A" and "E" served as distractors. Each stimulus contained one target either at the global level (i.e., global/local letters were H/A, H/E, S/A, or S/E) or at the local level (i.e., global/local letters were A/H, A/S, or E/H, E/S), resulting in eight stimulus figures in which target letters never appeared at both levels in each stimulus display.

2.3. Procedure

A 3 (Priming: subjects were exposed to the independent-self, interdependent-self, or control priming essays) × 2 (Target level: a target appeared at the global or local level) within-subject design was used. Before recording ERPs to global/local targets in the visual discrimination task, subjects were exposed to one of the three types of self-construal priming, similar to those in Gardner et al. (1999). Nine Chinese essays were used in the priming procedure. Each essay consisted of two paragraphs describing a trip to countryside. Three essays contained independent pronouns (e.g., I, mine) and three essays contained interdependent pronouns (e.g., we, ours). Subjects were asked to read each paragraph and to circle the pronouns. Three essays were used in the control priming condition and did not contain pronouns. Subjects were required to read each paragraph and to circle specific nouns in it.

Immediately after reading each essay, subjects performed a global/local letter discrimination task that contained one block of 120 trials after 64 trials for practice. Thus each subject completed 9 blocks of 120 trials in total. Each trial began with the presentation of a fixation cross with a duration that varied randomly from 800 ms to 1200 ms. A global letter consisting of local letters was then displayed for 400 ms. While being asked to fixate at the central fixation cross, subjects were required to discriminate the target letters that appeared at either the global or local level of the compound stimuli by pressing one of the two buttons using the left or right index finger. Instructions emphasized both response speed and accuracy. Subjects were given 10-min break between two successive blocks of trials. Each subject was randomly assigned to an order of the priming materials containing interdependent pronouns, independent pronouns, or no pronouns.

2.4. ERP data recording and analysis

The electroencephalogram (EEG) was continuously recorded from 64 scalp silver/silver-chloride electrodes located according to the international 10–20 system. All electrodes were referenced to an electrode at the right mastoid and re-referenced off-line to another electrode at the left mastoid. The horizontal electro-oculogram (EOG) was recorded bipolarly from two electrodes placed