Temporary inhibitory tagging at previously attended locations: Evidence from event-related potentials

YANG ZHANG,[a] XIAOLIN ZHOU,[b,c]

ATTENDED CATIN TEPAI CIN TE TIEPNE APPIN EE E CINED TE CETAET PAADI IT TE TP TA AND EAED EVENTEATED PTENTIA EPNE T TE C A C D PEENTED AT TE PEVI ATTENDED CED NATTENDED NCED CATIN E ND TAT TE CNICTEATED EECT EEED ATE AND AD A AE IE AT TE CED TAN TE NCED CATIN E VEA EPNE T TE TAET ED E AND APITDE AT TE CED TAN TE NCED CATIN T TE EECT A EECT DECIENT PECEPTA PCEIN TE TAET TE DEA TE ET TAT TE IN ETEEN PECEPTA PCEIN AND EPNE ACTIVATIN IEE

of the earlier impaired perceptual processing. Inhibitory tagging should slow down access to the response code associated with the target word and thereby delay the processing of the con ict between color and word meaning and delay the appearance of the

fractional area technique in combination with the jackknife procedure (Kiesel et al., 2008). Peak amplitudes, mean amplitudes in the selected time windows (570 5 0 ms and 520 540 ms, respectively, for the uncued and cued conditions), and onsets of the N450 were submitted, respectively, to repeated-measures two-way ANOVAs with cueing (cued vs. uncued) and electrode (CP3, CPz, CP4, P3, Pz, and P4) as factors.

The F values of the latencies were adjusted using the equation $F = F/(\ -1)^2$ to correct for the artificial reduction of error variance caused by the jackknife procedure (F and denote the corrected F value and the number of observations, respectively; for details, see Kiesel et al., 2008; Ulrich & Miller, 2001). Furthermore, the Greenhouse Geisser correction procedure was applied when appropriate.

To reveal the neural generator of the N450, a standardized low-resolution brain electromagnetic tomography analysis (sLORETA; Pascual-Marqui, 2002) was performed on the difference waves (incongruent minus neutral). Following an 8-Hz, zero-phase-shift FIR low-pass filter (West, Bowry, & McConville, 2004), the sLORETA was carried out within the time windows of 484 to 584 ms and 514 to 614 ms for uncued and cued trials, respectively. The topographic distributions of waveforms for different conditions at these time windows were very similar (data not shown here). For each of the two types of trials, the signal-to-noise ratio was determined as the mean squared voltages over the time interval of interest, divided by the variance of voltages over the baseline period (–200 to 0 ms) and was then used for the regularization parameter λ. To provide converging evidence for the sLORETA analysis, two further dipole analyses were performed on the difference waveforms for the cued and uncued trials independently with an isotropic standardized FEM model (BESA 5.2, conductivity ratios = 0).

Results

Beha ioral Performance

Response times. As shown in Figure 2b, RTs were faster when the target was presented at the uncued location (63 ms) than when it was presented at the cued location (648 ms), $F(1,14) = .5$, $< .01$. There was also a significant main effect of congruency, $F(2,28) = 32.81$, $< .001$, with slower responses to incongruent than to neutral or congruent trials (670, 630, and 631 ms for the three cueing conditions, respectively). That is, we observed a typical Stroop interference effect (incongruent vs. neutral) without a facilitatory effect (neutral vs. congruent). Importantly, the interaction between cueing and congruency was significant, $F(2,28) = 3.367$, $< .05$. Further simple effect analysis revealed that this interaction was due to a greater Stroop interference effect for uncued (47 ms) than for cued (34 ms) trials, $(14) = 2.27$, $< .05$.

Error rates. Only the main effect of congruency reached significance, $F(2,28) = 3.34$, $< .05$, with more response errors to incongruent (3.1%) than to congruent (2.32%) or neutral (1. %) trials. Thus the pattern of error rates was consistent with the pattern of RTs, with lower error rates being associated with faster responses.

E ent-Related Potentials

The P1 and N1 components. The main effect of cueing on P1 amplitude was significant, $F(1,14) = 4.73$, $< .05$, indicating a stronger P1 in the uncued condition (0.37 μV) than in the cued condition (0.08 μV). No other effects on P1 amplitude reached significance. For N1 amplitude, no main effects of experimental manipulations were found but there was an interaction between cueing and electrode, $F(2,28) = 11.\ 4$, $< .001$. Further simple effect tests revealed that the N1 amplitude was reduced for cued trials relative to uncued trials over the right and central occipital regions (O2, Oz), $< .05$, but not over left occipital region (O1), $F < 1$. No effect reached significance in the analysis of P1 or N1 latency (all $F < 1$).

The P300 latenc . As shown in Figure 3 (the lower part), there was no significant effect of cueing on the P300 latency, $F < 1$. And consistent with previous ERP studies (Duncan-Johnson & Donchin, 1 82; Ilan & Polich, 1 ; Rosenfeld & Skogsberg, 2006), the main effect of congruency was not significant, $F < 1$. The interaction between cueing and congruency was also not significant, $F < 1$. Thus no effects were observed on the P300 latency for any manipulations.

The N450 component. As shown in Figure 5, the differenceAs As

significant, $F(5,70) = 2.74$, $< .05$. Further simple-effect analysis revealed that the cueing effect was significant on Pz and P4 ($< .05$), with uncued stimuli eliciting greater N450 amplitudes than cued stimuli. The significance of the cueing effect increased when the peak amplitudes were used as the dependent variable. Here the main effect of cueing was significant, $F(1,14) = 8.41$, $< .05$, indicating a larger N450 for uncued trials (−1. μV) than for cued trials (−1.5 μV).[1]

Source Anal sis of N450

Figure 6 shows the sLORETA localization results. The strongest

Further evidence of the inhibitory tagging theory comes from the source waveform results of N450. According to the theory, the inhibitory tagging would postpone the occurrence of conflict processing and thus predict that the cueing effect of N450 should mainly happen in the ACC, a brain region demonstrated to be involved in conflict monitoring (Kerns et al., 2004). The prediction is consistent with our finding that the cueing effect of N450 is mainly observed in the ACC rather than the PFC source waveforms (Figure 7).

inhibition of return in early visual cortex. *J C N* , *19*, 587 5 3. doi:10.1162/jocn.2007.1 .4.587

Najemnik, J., & Geisler, W. S. (2005). Optimal eye movement strategies in visual search. *N* , *434*