

ERP effects of movement preparation on visual processing: attention shifts to the hand, not the goal

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Background

The premotor theory of attention claims that attentional shifts are triggered during response programming, regardless of which response modality is involved (Rizzolatti et al. 1994). In a series of earlier experiments we found ERP evidence for attention shifts during preparation for lifting either left or right index finger (Eimer et al. 2005; Eimer and van Velzen 2006). We also found evidence for enhanced tactile and visual, but not auditory processing at the response location during the preparation interval. In these experiments, effector location was also the response location. In the two experiments presented here we investigated whether lateralised ERP components during reaching movement preparation are triggered by effector selection or movement target selection. A second research question was whether preparation for a reaching movement induces spatially selective modulations of visual processing at the location of the effector and/or the goal location for the reaching movement.

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Method

Participants executed one of four possible movements (left/right hand towards left/right target). In experiment 1, a centrally presented visual cue indicated which effector to use in one condition, and movement direction in another condition. The imperative stimulus (Go-stimulus) contained the lacking information (direction or effector, respectively). In experiment 2, the cue conveyed full information (effector and direction). Task-irrelevant visual probe stimuli were presented randomly near the hand or the target location during response preparation. Multichannel EEG was recorded during the preparation interval, and to the visual probe stimuli.

Results

Lateralised ERP components triggered during covert response preparation (ADAN, LDAP) were similar to components previously found during attention shifts. In both experiments, anterior and posterior lateralised ERP components (ADAN, LDAP) were elicited contralateral to the selected effector and to the selected movement direction. The LDAP was more pronounced during effector selection. During preparation based on partial information, enhanced early visual components were observed in ERPs elicited by probes near the cued hand, but not near the target location. During preparation based on full information, visual processing was enhanced near the target location only when the effector and the target were located in the same hemifield.

Conclusions

These results are consistent with the hypothesis that shifts of spatial attention are triggered during covert unimanual response preparation. Furthermore, the effects



on the ERPs elicited by the visual probes suggest that during the covert preparation of reaching movements, spatial attention shifts to the starting location of the cued hand and not to the goal location.

References

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