Rapid Interactions between Lexical Semantic and Word Form Analysis during Word Recognition in Context: Evidence from ERPs

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Abstract

■ We used ERPs to investigate the time course of interactions between lexical semantic and sublexical visual word form processing during word recognition. Participants read sentence-embedded pseudowords that orthographically resembled a

Stringfellow, & Marantz, 2002; Bentin, Mouchetant-Rostaing, Giard, Echallier, & Pernier, 1999; Tarkiainen, Helenius, Hansen, Cornelissen, & Salmelin, 1999; Nobre,

Materials

reflected the component's scalp distribution in our data as well as typical analysis sites for that component in the literature. The P1 was analyzed at three occipital channels (O1, OZ, and O2), the N170 at occipital and occipital–temporal channels (OZ, PO7, and PO8), and the N400 and P600 at three frontal-to-parietal midline channels (FZ, CZ, PZ). Figure 1 highlights channels used in analyses. Analyses were repeated measures ANOVAs with factors Condition (control, supported pseudoword, no-support pseudoword, and nonword) and Channel (three levels, depending on component; see above). Significant main effects of Condition were followed by pairwise comparisons between conditions. The Greenhouse–Geisser (1959) correction was applied to comparisons with more than 1 degree of freedom.

RESULTS

All experimental conditions elicited a positive-going occipital P1 peak at 120

control, nonword, and no-support pseudoword did not differ from each other. The supported pseudoword P130 effect appeared larger over the left than the right hemisphere occipital channels (Figure 2B), but there was no Condition × Channel interaction.

N170 (175–205 msec)

No-support pseudowords and nonwords enhanced the occipital–temporal N170 component (Figure 2C). This was confirmed by a main effect of Condition [$F(3, 57) = 5.01$, $p < .005$], which reflected more negative voltages for no-support pseudowords relative to controls [$F(1, 19) = 4.54$, $p < .05$] and for nonwords relative to controls [$F(1, 19) = 6.76$, $p < .05$]. Supported pseudowords did not differ from controls. There were no interactions between con-

We propose that the findings reflect a rapidly occurring combination of top–down and bottom–up processing, resulting in strong activation of lexical features (CAKE) and word form features (e.g., "ca–," "–ak–"), which highlights the anomaly of the bottom–up input ("ceke" vs. "cake"). More specifically, we suggest that the P130 effect reflects the following recurrent processing events: First, before stimulus onset, context-driven anticipatory priming (Altmann & Mirković, 2009) drives partial activation of lexical features (e.g., CAKE) and constituent word form features ("ca–," "–ak–") for a contextually appropriate word. Second, the physical input "ceke" is partially consistent with and pro-

Speed of Information Flow within Visual Cortex

The current results contribute to recent findings of lexical semantic influences on early brain responses, contradicting a widely held view within the ERP and MEG literature that such influences do not occur until after ~200 msec poststimulus onset. We emphasize here that the newer findings are consistent with what is known about the speed of information flow within the visual system, based on physiological and anatomical findings (Foxe & Simpson, 2002; Lamme & Roelfsema, 2000). The feedforward–

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Notes

1. Dehaene et al. (2005) describe the extraction of such visual features as the "front end" of visual word recognition; the processes that generate orthographic representations are often not addressed explicitly by models of word recognition, which instead assume orthographic representations as bottom-level input.
2. Sixteen of the items (9%) in our actual lists were not included in the cloze test, because of edits to the stimuli that occurred after the cloze test.
3. We assume that cortical systems "settle" into locally stable states through a process of lateral inhibitory competition, which can be accelerated when top–down feedback boosts one representation and enhances its ability to inhibit its competitors (cf. O'Reilly, 1998).

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