Seeing the Wood for the Trees:
ERPs reveal opposite patterns of perceptual and semantic priming during object recognition in schizophrenia

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INTRODUCTION

There is debate about the contribution of early perceptual deficits to cognitive abnormalities in schizophrenia. At least some aspects of higher-order processing in schizophrenia can arise from lower-level perceptual abnormalities (Butler and Javitt 2005; Revheim, Butler et al. 2006; Leitman, Laukka et al. 2008; Dale, Findlay et al. 2009). However, several electrophysiological studies using semantic priming paradigms have reported N400 abnormalities in the absence of perceptual N1/P2 abnormalities (Kuperberg, Kreher et al. 2006; Kreher, Holcomb et al. 2008). However, because the activation of perceptual and pre-semantic representations decay very rapidly, and because an identity priming manipulation has not usually been included, these studies may have been relatively insensitive to detecting pre-semantic abnormalities in schizophrenia (Grainger and Holcomb 2009).

We combined event-related potentials (ERPs) with a masked priming paradigm to examine the relationships between pre-semantic and semantic processing during object recognition in schizophrenia.

We used a paradigm developed in previous studies in healthy adults which demonstrated a pattern of early perceptual priming effects (N190/P190) followed by a later semantic effect (N400) (Eddy, Schmid et al. 2006; Eddy and Holcomb 2009). In addition, a longer prime exposure led to a larger N400 effect (Eddy & Holcomb (in press).
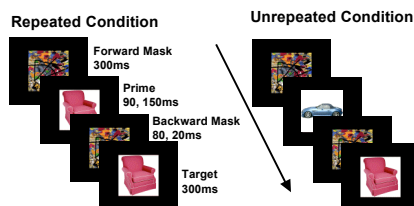
METHODS

Masked picture priming paradigm with two prime durations (90 and 150 ms), SOA of 170 ms.
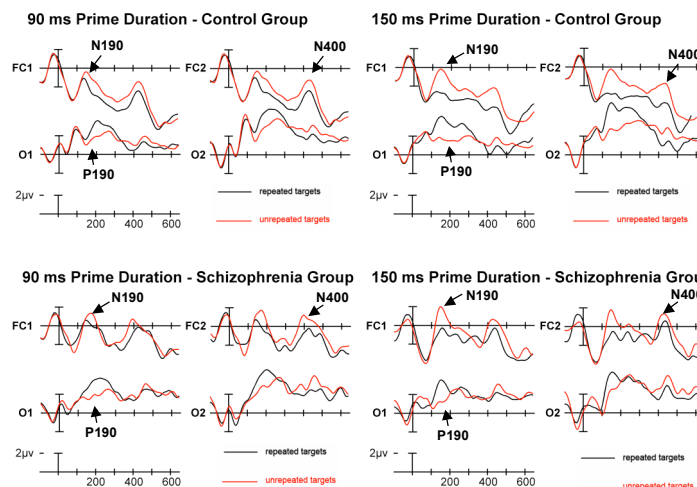
60 trials per condition

22 patients with schizophrenia, 23 matched adult controls

Go-no go semantic categorization task: press only food pictures

ERPs: 29 channel recording (200 Hz, bandpass 0.01-40 Hz)

RESULTS

90 ms Prime Duration - Control Group

150 ms Prime Duration - Control Group

90 ms Prime Duration - Schizophrenia Group

150 ms Prime Duration - Schizophrenia Group

repeated targets
unrepeated targets

Voltage Maps: Unrepeated – Repeated Targets

N190 Controls

N190 Patients with Schizophrenia

N400 Controls

N400 Patients with Schizophrenia
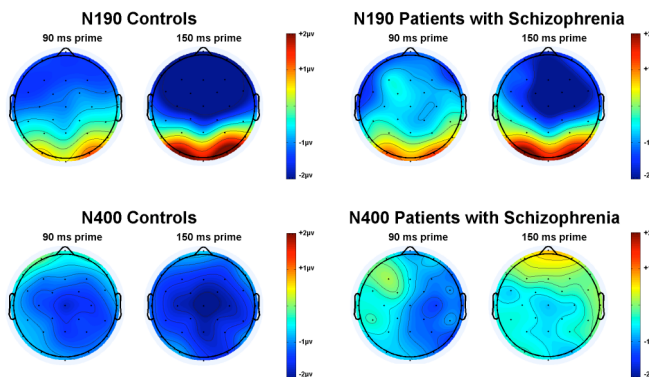
DISCUSSION

On the N/P190, repetition priming effects were smaller overall in patients than controls, consistent with previous findings indicating impaired perceptual visual processing in schizophrenia.

However, like controls, patients were able to take advantage of the longer prime duration to produce larger N/P190 priming effects.

The opposite pattern of findings across the two prime durations was seen on the N400:

At the short prime duration, schizophrenia patients showed a normal priming effect, suggesting that, under these highly automatic conditions, feed-forward activation effectively facilitated semantic processing of the target picture.

At the longer prime duration, however, controls showed a larger N400 effect than at the shorter duration, but patients showed a smaller N400 effect.

We suggest that, in controls, efficient mapping of perceptual information to the semantic representation further facilitated semantic processing of the target, but that, in patients, inefficient early perceptual processing of the prime impeded activation of its semantic representation.

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