Word priming in schizophrenia: Associational and semantic influences

Published in final edited form as:
Schizophr Res. 2006 February 28; 82(2-3): 139–142. doi:10.1016/j.schres.2005.10.010.

Word priming in schizophrenia: Associational and semantic influences

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Abstract

We examined semantic vs. associational influences on word priming in schizophrenia. Tested on three occasions, subjects made speeded lexical decisions to three kinds of prime-word relationships: semantic-only (e.g., Deer-Pony), associated-only (e.g., Bee-Honey), or semantic-and-associated (e.g., Doctor-Nurse). Controls showed greater priming of words related via two relationships (semantic-and-associated) than for words related only semantically.. However, patients showed greater priming for associated-only words than for words related only semantically. Schizophrenic patients may show an associational bias, restricting semantic integration and contributing to their disturbed thinking.

Keywords

Schizophrenia; Priming; Associational bias; Thought disorder

1. Introduction

Disturbed word associations in schizophrenia are often investigated by priming tasks that require speeded lexical decisions (word/non-word) to target letter strings that are preceded by word primes. Priming reflects faster lexical decisions for word targets preceded by related words than for unrelated words. Schizophrenic patients have shown reduced priming for related word pairs separated by relatively long intervals (see Minzenberg et al., 2002). Unclear, however, is the influence of different kinds of word-pair relationships on schizophrenic priming. For controls, priming is additive, greatest for word pairs related both semantically and associatively (e.g., Doctor-Nurse) than for words related only semantically (e.g., Deer-Pony) or associatively (e.g., Bee-Honey) (Chiarello et al., 1992). We now examine priming in schizophrenia in relation to these 3 kinds of prime-word relationships.

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2. Methods

2.1. Subjects

All subjects were males between the ages of 17 and 55 years, right-handed, native speakers of English, without histories of ECT, neurological illness, and without alcohol or drug abuse in the past 5 years, as assessed by the Addiction Severity Index (McClellan et al., 1992). All subjects provided written informed consent. The Structured Clinical Interview for DSM-IV Axis I Disorders—Clinician Version (SCIDI: CV) (First et al., 1997a,b), along with chart review, ascertained the diagnosis of schizophrenia. Fourteen patients, all part of an ongoing comprehensive study of schizophrenia, participated. All patients were diagnosed with chronic schizophrenia, with a mean duration of illness of 18.6 years (SD=10.58), and were medicated, with a mean chlorpromazine (CPZ) daily dose of 613.70 mg (SD=370.62). Fourteen control subjects, recruited from newspaper advertisement, underwent the SCID-I: CV (First et al., 1997a,b) and the Structured Clinical Interview for DSM-IV Axis II Personality Disorders (SCIDII) (First et al., 1997a,b), and were matched to the patients on the basis of age, sex, handedness, and parental SES. Mean age did not differ significantly (t =0.777, df = 81, p = 0.439) between patient (42.8 years, SD=10.96) and control (46.6 years, SD=6.54) groups.

2.2. Stimuli and task

Following Chiarello et al. (1990), stimuli consisted of three sets of 48 related prime-target noun pairs, corresponded to three types of relationships: semantic-only (e.g., Deer-Pony), associated-only (e.g., Bee-Honey) and semantic-and-associated (e.g., Doctor-Nurse). Each of the three conditions (semantic-only, associated only, semantic-and-associated) included equal percentage of three types of trials: related, unrelated, and neutral. Unrelated fillers were included to maintain a low probability of prime-target relatedness (approximately 11% related trials). Orthographically legal non-word targets (four or five letters) were created by substituting one letter of a real word. Fifty percent of all trials had a non-word target. All stimuli were horizontally presented in uppercase using Times New Roman font, size 80. Stimuli appeared in black against white background.

2.3. Apparatus and procedure

The SuperLab Pro software package (2001) controlled stimulus presentation, timing of events, and recorded subjects' responses. Subjects sat 100 cm in front of a View Sonic Monitor. A Gateway Computer, GP6-400 (Gateway Computer, Inc., Cupertino, CA), and registered their lexical decisions by pressing one of two buttons of a response pad (mouse). Half the subjects pressed their left thumbs for a word and their right thumbs for a non-word. For the other half of the subjects this response mapping was reversed. Subjects participated in three sessions, separated by a week, and each corresponded to one of the three conditions (semantic, associated, and semantic-and-associated), counterbalanced across all participants. Each session consisted of approximately 450 trials broken into 6 blocks of approximately 5-7 min long. Each block had 8 related, 8 unrelated, 8 neutral, and 16 filler trials, along with 40 non-word targets. Each of these trials began with a fixation marker (+) in the middle of the screen for duration of 1000 ms, followed by a prime word for 75 ms duration. After a fixed 500 ms interval, a target (word or non-word) was displayed for 100 ms. The next trial was initiated 1200 ms after the subject's response, or after 3000 ms, if no response had occurred. Stimuli order was randomized. The subjects were told to focus on the fixation marker and to register their word/non-word decisions as accurately and quickly as possible. They were told that the first (prime) stimulus was a warning signal that the target item was about to appear. For each session, subjects completed block of 30 practice trials prior to the experiment.

3. Results

For RT data comparing related and unrelated trials, a mixed-model analysis of variance (ANOVA) revealed significant effects for group, $F(1, 26)=8.060$, $p=0.009$, trial type, $F(1, 26)=50.257$, $p<0.001$ and the interaction of trial type by condition, $F(2, 52)=9.489$, $p<0.001$. Patients had slower overall slow RT, yet both groups had fastest RT for related trials in the associated-only condition. Analyses of accuracy data revealed no significant group difference (see Table 1).

Fig. 1 presents priming rates, calculated by subtracting RT of related from unrelated trials. Schizophrenic subjects had mean priming of 98 ms (SD=85.067), 49.54 ms (SD=51.06), and 71.50 ms (SD=74.36) for association-only, semantic-only, and semantic-and-association conditions, respectively. Corresponding values for control subjects were 59.43 ms (SD=24.01), 22.29 ms (SD=26.86), and 70.18 ms (SD=47.45) for association-only, semantic-only, and semantic-and-association conditions, respectively.

Fig. 2 presents mean percentage priming rates, calculated to control for overall slowness [UNRELATED-RE-RELATED/UNRELATED*100]: patients showed mean percentage priming rates of 10.84%, 5.51% and 8.7% compared to control values of 9.95%, 3.38%, and 11.75% for association-only, semantic-only, and semantic-and-association conditions, respectively. Paired *t*-tests revealed that the patient group showed greatest priming for associated-only related word pairs, which differed significantly from priming of word pairs related only by semantic category, $t(13)=2.801$, $p=0.015$. By contrast, controls showed greatest priming for word pairs related via both semantic category and association, which differed significantly from priming of word pairs related only by semantic category, $t(13)=3.279$, $p=0.006$. Controls also showed greater priming for associated-only word pairs in comparison to semantic-only word pairs, $t(13)=4.638$, $p<0.001$.

4. Discussion

Patients and controls showed evidence of different within-group patterns of priming for words pairs related associatively, semantically, or by both these dimensions. Consistent with previous studies (see Lucas, 2000), both groups showed their lowest levels of priming for semantic-only word pairs. Likewise, for both groups, priming did not differ significantly for associated-only versus semantic-and-associated words. However, the controls showed significantly greater priming for semantic-and-associated word-pair relationships in comparison to words related only semantically. By contrast, the patients showed greater priming for associated-only word pairs in comparison to semantic-only word pairs. That the controls showed greater priming for semantic-and-associated words than for words related only semantically may reflect an additive priming effect. This effect in patients may be weakened, perhaps due to an associational bias that leads to restricted semantic integration and contributes to disturbed thinking. (e.g., Chapman and Chapman, 1973; Nestor et al., 1998; Han et al., 2003). However, the current findings are limited, demonstrated as statistically significant on the basis of within- but not between-group analyses. Future studies will require greater statistical power to establish the hypothesized reduced semantic additivity by between-group analyses, specifically the interaction of group by word-pair relationship.

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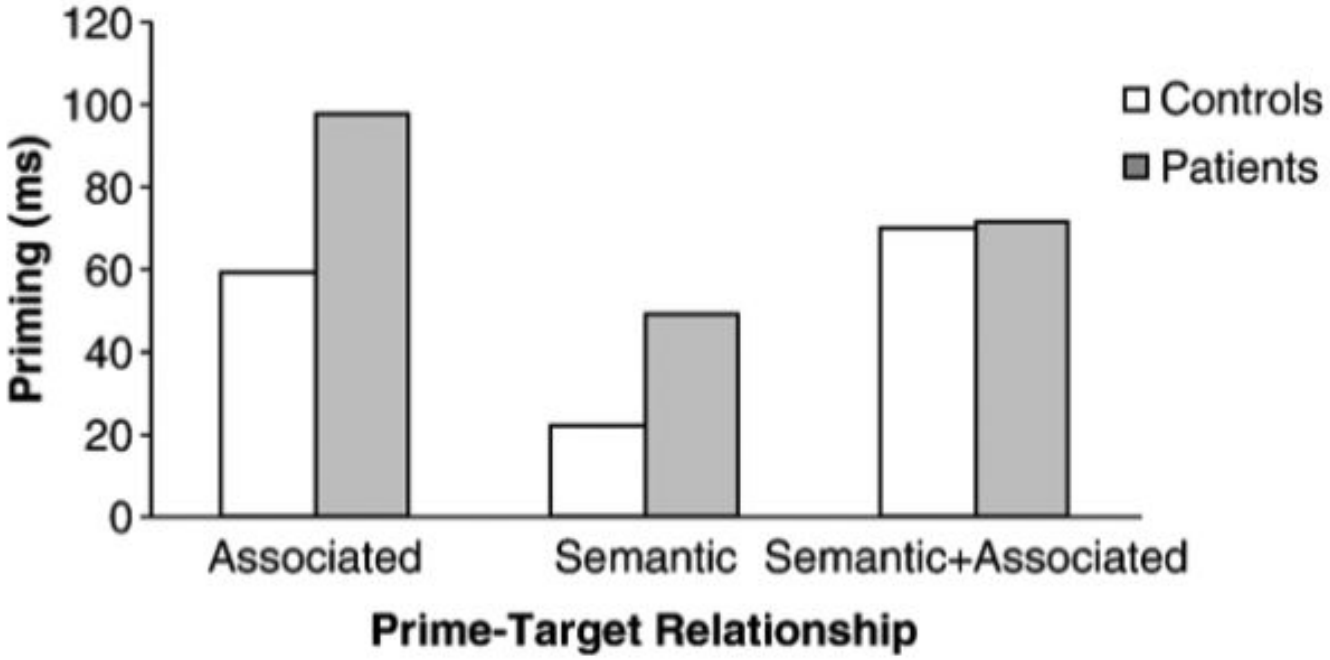

Fig. 1.
Priming effect (RT unrelated RT - related) for patient and control groups.

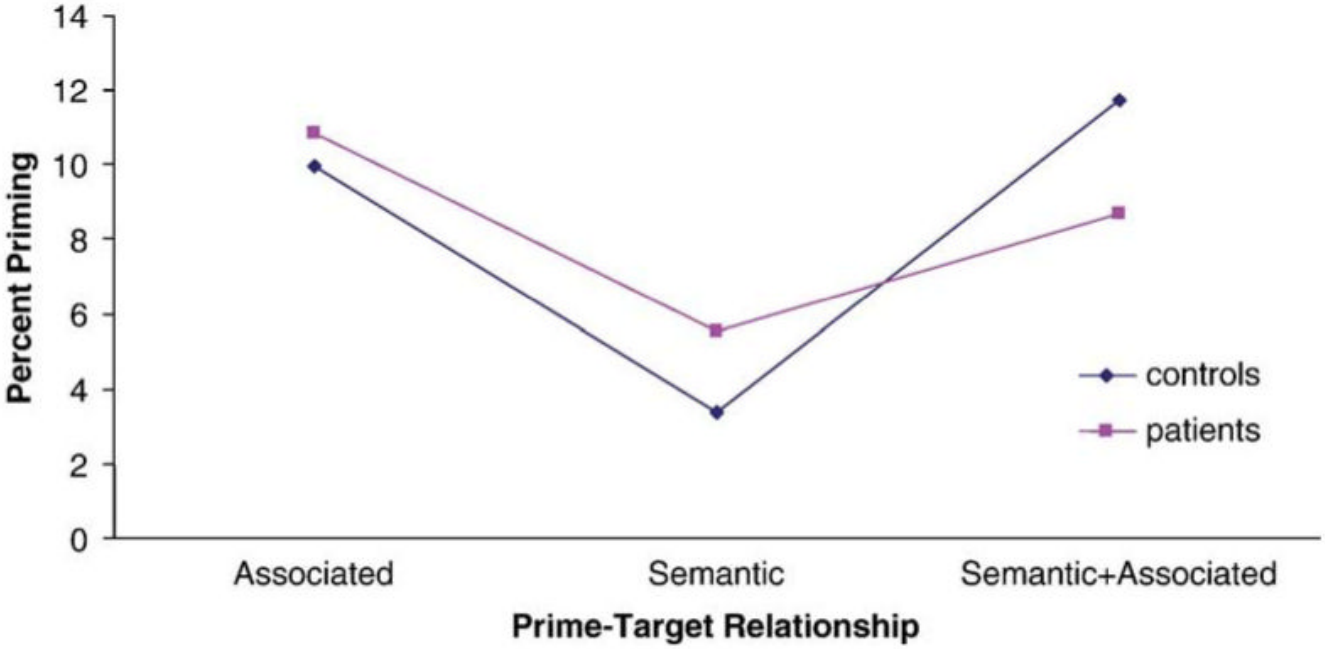

Fig. 2.
Mean percent priming for patient and control groups.

Table 1

Mean reaction times and accuracy for patient and control subjects

		Patients		Controls	
		RT	% correct	RT	% correct
Associate	Non-word	783.75	0.94	614.21	0.96
	Related	693.43	0.97	540.04	0.99
	Unrelated	791.43	0.92	599.46	0.98
Semantic	Non-word	821.46	0.92	615.94	0.96
	Related	717.96	0.95	560.00	0.97
	Unrelated	767.50	0.91	582.29	0.97
Semantic+ associate	Non-word	792.69	0.94	584.55	0.97
	Related	666.21	0.99	519.39	0.99
	Unrelated	738.00	0.95	589.57	0.97