

Lateralization of Color Discrimination and Lexical Effects in Patients With Schizophrenia.



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Introduction

Schizophrenia (SZ) is characterized by cognitive impairments, including visual processing. Limited information exists regarding color perception in patients with SZ. Previous research indicates that 1) patients with SZ have impaired color perception (Shuwairi et al., 2002) and 2) they exhibit lateralized impairment in naming colors in the left visual field (David, 1987).

In this study, we investigated the atypical hemispheric laterality of color recognition in patients with SZ using a color search task developed by Gilbert et al. (2006).

Methods

Experiment

We used a color search task to investigate the effect of laterality and the influence of color lexicon on the performance of patients with SZ. The task manipulated two factors: the target position (LVF or RVF; left or right visual field) and the color category (same or different color names). Three stimulus pairs, G2B1, G1G2, and B1B2, were analyzed. These pairs were categorized as different-category (G2B1; green and blue) or same-category (G1G2; two greens or B1B2; two blues) based on their color lexicon (figure 1A).

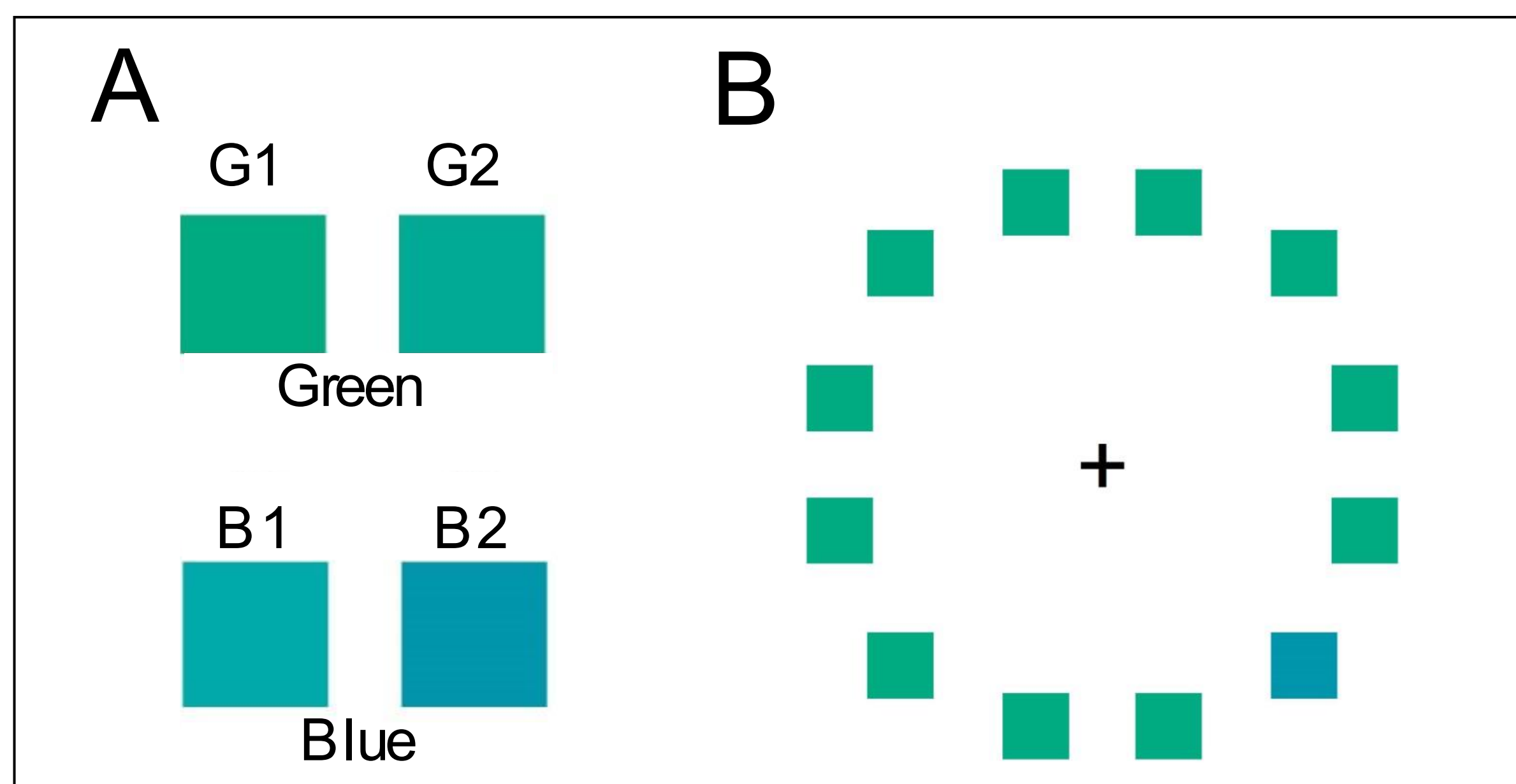
Color Search Task

In the color search task, participants had to judge whether the odd target color appeared in the LVF or RVF from distractors (figure 1B). We compared the reaction time (RT) of the trial on each condition. Each trial began after the fixation stimulus, followed by the color search task. When the participants finished performing a search trial, the fixation stimulus was shown again until the next search trial began. The sequence of trial blocks was randomized to counterbalance all conditions.

Before the color search task, a color naming task was administered to ensure that participants in both the groups had similar lexical color boundaries for the stimuli.

Figure 1

- A) Color stimuli (Two greens and two blues).
- B) The sample of color search task (An odd target emerges in the right visual field).



Participants (See also table)

This study was approved by the ethics committee. Written informed consent was obtained from all participants.

	SZ (n = 16)	HC (n = 15)
Sex (M/F)	10/6	10/5
Age in years	50.6 (5.6)	46.8 (8.4)
Education in years*	13.0 (1.8)	16.1 (1.8)

SZ, schizophrenia; HC, healthy control; *p < 0.05, N/A, not available.

Statistical analysis

First, to compare the effect of target position in each group, we computed the laterality index and performed a Mann–Whitney U test. Second, to compare the interaction between color category and target position, we also computed the categorical perception (CP) index in the LVF/RVF in each group and performed a Wilcoxon signed-rank test.

Both index was calculated by using the following formulas:

$$\text{Laterality index} = \frac{RT(LVF-RVF) \times 100}{RT(LVF+RVF)}$$

$$\text{CP index} = \frac{RT(\text{same_category} - \text{different_category}) \times 100}{RT(\text{same_category} + \text{different_category})}$$

Results (See also figure 2)

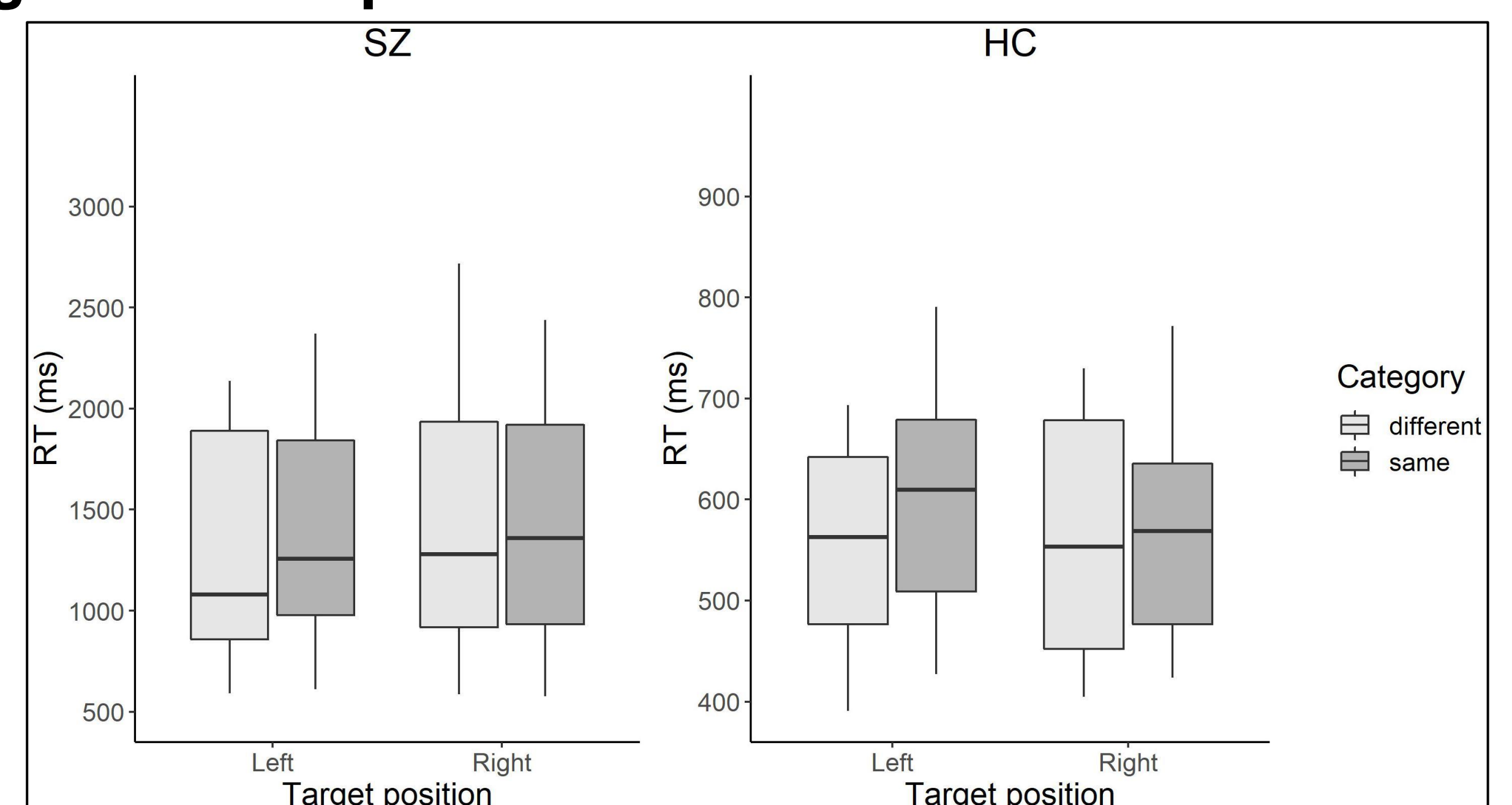
Finding 1: Patients with SZ showed slower response in RVF.

The mean laterality index was -1.3 ± 2.6 for the SZ group and 1.4 ± 3.8 for the HC group. There was a significant difference between the laterality index of the SZ and HC groups ($p = 0.03$, $r = 0.4$).

Finding 2: Patients with SZ showed a lateral advantage of faster discrimination in the LVF than RVF for different category condition.

In patients with SZ, the mean CP indexes were 5.8 ± 4.6 for the LVF and 0.7 ± 5.5 for the RVF. In HCs, the mean CP indexes was 2.9 ± 4.9 for the LVF and 1.1 ± 3.2 for the RVF. Patients with SZ showed a significantly greater CP effect in the LVF than in the RVF ($p = 0.004$, $r = 0.3$), whereas HCs did not show significance ($p = 0.3$).

Figure 2. Box plots of RT in each condition in both groups.



Discussion

Patients with SZ detected targets slower in the RVF compared to the LVF, replicating previous findings (Posner et al., 1988). Conversely, the significant visual field difference in CP effect was observed only in the SZ group, indicating a lateralized effect of semantic properties in the color search task in SZ. This lateralized performance could imply the failure of the left hemisphere language processing dominance in SZ (Crow, 1997).

Acknowledgments

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