

Neural Substrates Differentiating Global/Local Processing of Bilateral Visual Inputs

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Abstract:

Global/local processing of bilateral visual inputs was investigated using functional magnetic resonance imaging (fMRI). The results showed that the left and right hemispheres of the visual cortex were differentially activated by global and local processing of bilateral visual inputs. The left hemisphere was more sensitive to global processing, while the right hemisphere was more sensitive to local processing. These results suggest that the left and right hemispheres of the visual cortex have different functional roles in processing bilateral visual inputs.

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Key words: global/local processing; bilateral visual inputs; fMRI; visual cortex

INTRODUCTION

Global/local processing of bilateral visual inputs has been a topic of interest in the field of cognitive psychology and neuroscience. The left and right hemispheres of the visual cortex have been shown to be differentially activated by global and local processing of bilateral visual inputs (Han et al., 1989, 1990; Jiang et al., 1988). The left hemisphere is more sensitive to global processing, while the right hemisphere is more sensitive to local processing (Han et al., 1997). These results suggest that the left and right hemispheres of the visual cortex have different functional roles in processing bilateral visual inputs (Han et al., 1997). The present study was designed to investigate the neural substrates of global/local processing of bilateral visual inputs using functional magnetic resonance imaging (fMRI). The results showed that the left and right hemispheres of the visual cortex were differentially activated by global and local processing of bilateral visual inputs. The left hemisphere was more sensitive to global processing, while the right hemisphere was more sensitive to local processing. These results suggest that the left and right hemispheres of the visual cortex have different functional roles in processing bilateral visual inputs (Han et al., 1997). The present study was designed to investigate the neural substrates of global/local processing of bilateral visual inputs using functional magnetic resonance imaging (fMRI). The results showed that the left and right hemispheres of the visual cortex were differentially activated by global and local processing of bilateral visual inputs. The left hemisphere was more sensitive to global processing, while the right hemisphere was more sensitive to local processing. These results suggest that the left and right hemispheres of the visual cortex have different functional roles in processing bilateral visual inputs (Han et al., 1997).

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1998 . E , 1997 ; (F) / E

2001 . F 80 120 (1)

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1993 . C E E

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SUBJECTS AND METHODS

Participants

21.2 ; 20 24 (2 , 8)

A D

Stimuli and Procedure

7 × 7 F 1 . (A , E) A / , E / A , E / , / A , / E) . A (. / : A / E , F F E , F A A / E A / (F) F F

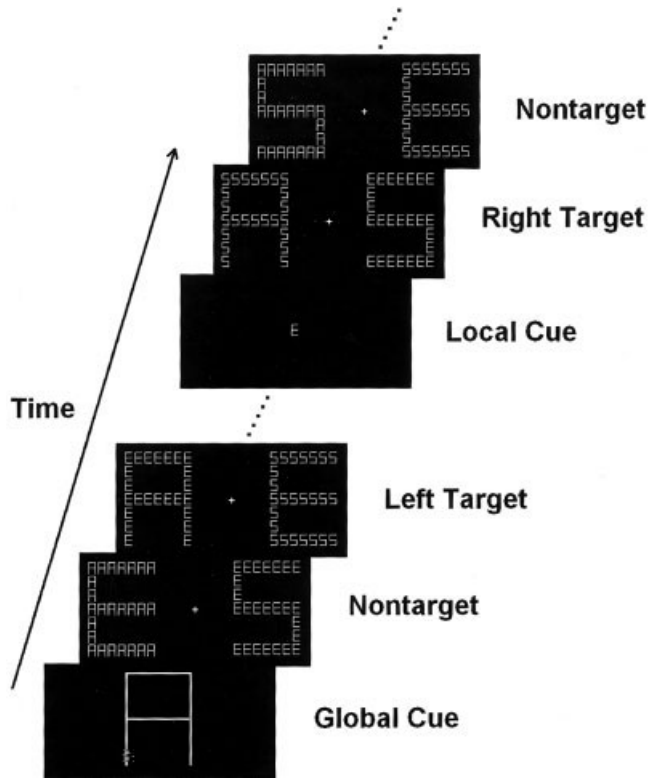


Figure 1.

Illustrations of the stimuli and procedure used in the current study.

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 43 (30),
 14%

fMRI Image Acquisition and Analysis

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RESULTS

A (F
 F)
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 (96.1 62.2%, = 8.99, P < 0.001)

TABLE I. Brain areas activated by global/local processing of bilateral visual inputs*

C	BA	x	y	z	T
G	21	-44	-2	-18	4.71
	41	-40	-18	2	3.94
	41	-52	-16	12	3.87
	36	32	-24	-14	3.99
	36	24	-40	-8	3.34
	36	28	-36	-18	3.29
	7	-14	-74	32	3.83
	7	-30	-62	48	3.55
	7	8	-72	50	4.03
	7	22	-78	38	3.96
	7	24	-64	58	4.04

*A $P < 0.01$. BA, B

(762 .867 / = 3.02, $P < 0.014$). F (1.9 .3.0%, = 1.34, $P > 0.2$). B

B 21 41 (F .2). A F B 36 (F .2). 1996; , 2002 ; , 2001 B 7 (F .3).

DISCUSSION

E , 2000; , 1999 ; , 1998 . , 2002 B E

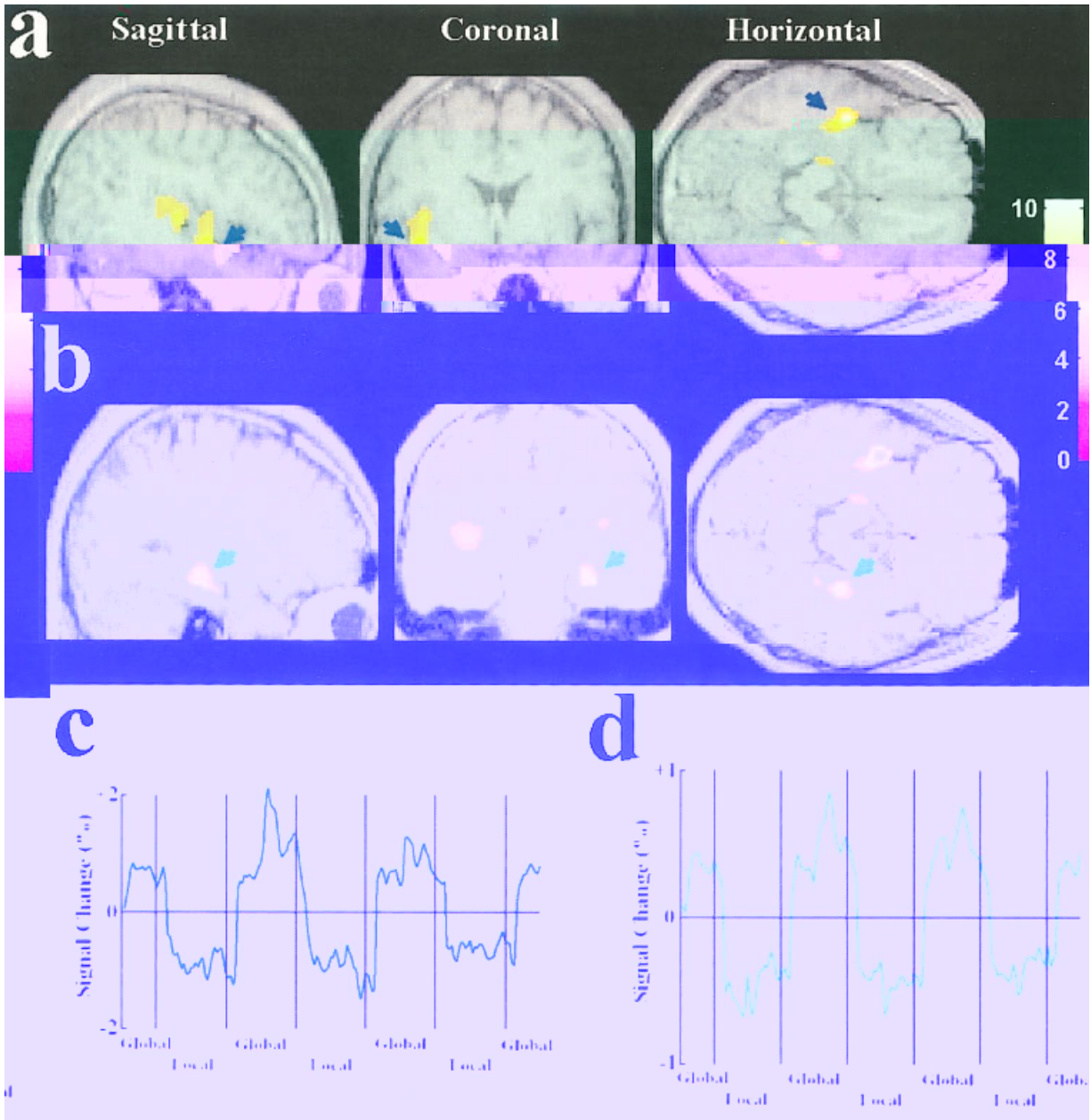


Figure 2.

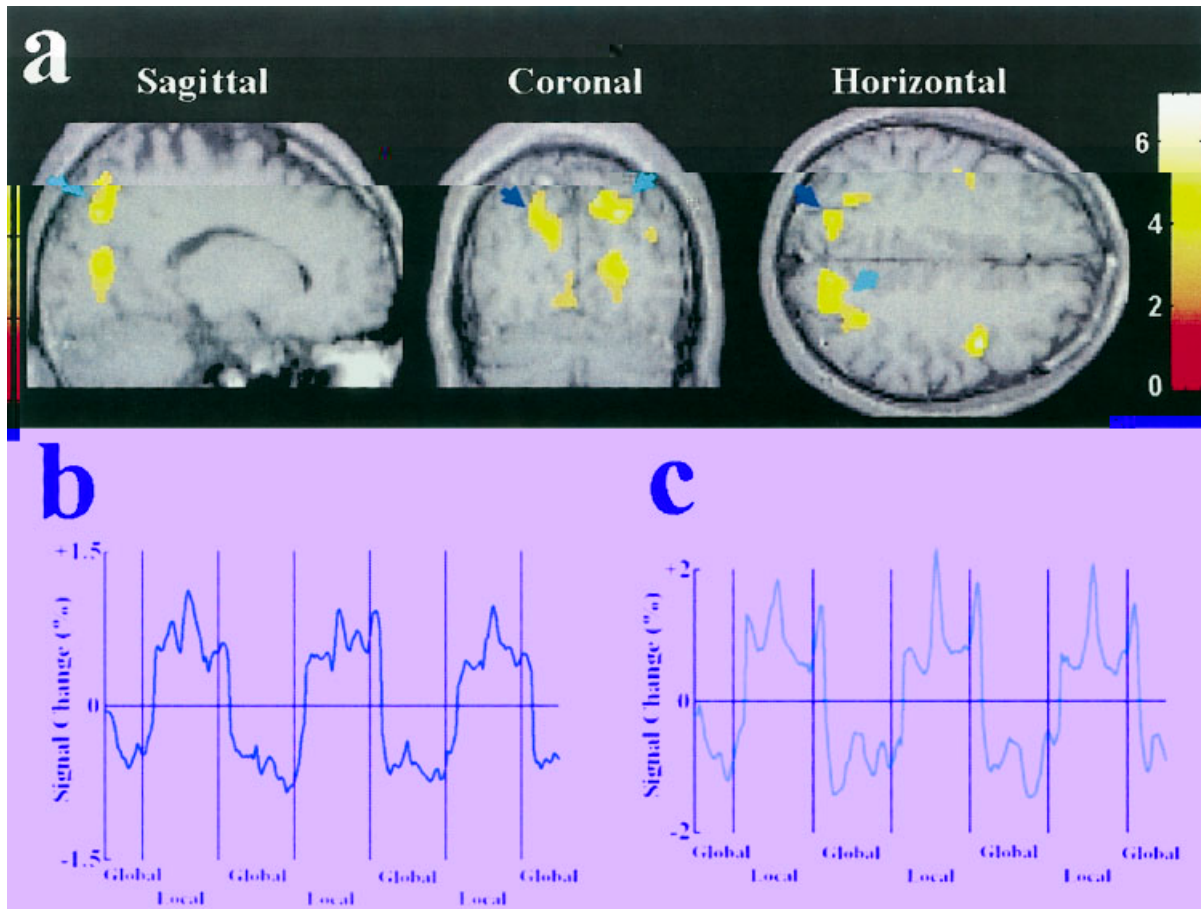


Figure 3.

Brain areas activated by attention to the local level of bilateral compound stimuli. The results of the group analysis from 10 subjects were plotted on MR images of a representative subject. Threshold for activation of all clusters was $P < 0.01$ (corrected). The activations were observed in bilateral superior parietal cortex. The color bar indicates the scale of z values. **a:** Activations in the left superior parietal cortex (indicated by blue arrows) and the right superior parietal cortex (indicated by green arrows). **b:** The time

courses of the signal change in the left superior parietal cortex as a function of global/local attention, averaged across the 10 subjects. The mean image values obtained from the average of the six scans were used as baseline. **c:** The time courses of the signal change in the right superior parietal cortex as a function of global/local attention, averaged across the 10 subjects. The time courses were averaged from raw fMRI signals.

... F ... / ... (F) ... 1986; ... 1987, ... F ... 1998; ... , 1982 F , ... E ... F ... , 2001 . E

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291.GB

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 C, (1989): A
 27:471 483.
 A, F, B E, (1997):
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 8:1685 1689.
 A, D F, A A (2001): E
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 D (1977): F
 C 9:353 383.

A, A, A (1998): E
 C B 6:321 334.
 C, (1988): E
 8:757 3769.
 C, E (1993):
 E 19:471 487.
 B (2001): F B, A, D A,
 A A
 98:2077 2082.
 (1982):
 ? E 8:253 272.
 G, (1987): 16:89 101.
 G, A, G (1986):
 15:259 279.
 (1998): C
 (2003): C
 C C 13:90 99.