OXFORD

Cerebral Cortex, 2019;29: 17–26

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A A : 17 2017
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A A

rr t r t r t t
l rt x l -

1 1 2,3,4,5

1 710062, 2
100871, 3
100871, 4
5 100871, ( ),
100871,

A ,5 100871, .
: @

Abstract

( ) fl 1 2 (1/ 2 3)
1/ 2 3 . fi 3
(90–110) 1/ 2 (120–140),
fi 1/ 2
3 . fi

r , , , 3

Introduction

fi
(. 1993;
. 2003).
1,
fi
(. 1997; . 2002).

A 2017. . A : @

1 (. 1995; . 2006).

fi 1- . 1 . 4, 1 fi . fi . A (A . 2002; 2002; . 2003; . 2006, 2008; . 2007; . 2013; . 2013; . 2014; . 2016). fi (2006; . 2008; 2011).

( ) (A . 2003; . 2003; . 2016). fi 1 . (2014) 1 4 4 1, 1 4. , 4 1. ( ), fi . (1/ 2) (3) . 3 4 (2001; . 2003), (. 2009; 2010; . 2016) (. 2008; . 2009; . 2014). 1, 1/ 2 3 4 (A) fi (. ., A) 90–110 3 120–140 1/ 2, 2, fi 2 fi A 2 2 fi fi 1 3 1/ 2. fi .

Materials and Methods

x r t

Participants

(10 , 10 ; = 21 ; = 18–25) . A .

Stimuli and Aperture

100 . 3 (1997; 1997; . 2007) A A (, A) fi (12.66° × 12.66°) (: 6.62 / , σ: 0.10°, : 100%). A fi . 11 ( ) fi ( ) (. 1 . 1A). fl fi . fi 0.86°. fi .

Procedure

1 3 : 2 fi ( ) (2008; , 2015) 1 3 fi fi 1 3 .

fMRI Session

(1 3) , fi , fi ( ) (. 2005). A , fi fi .

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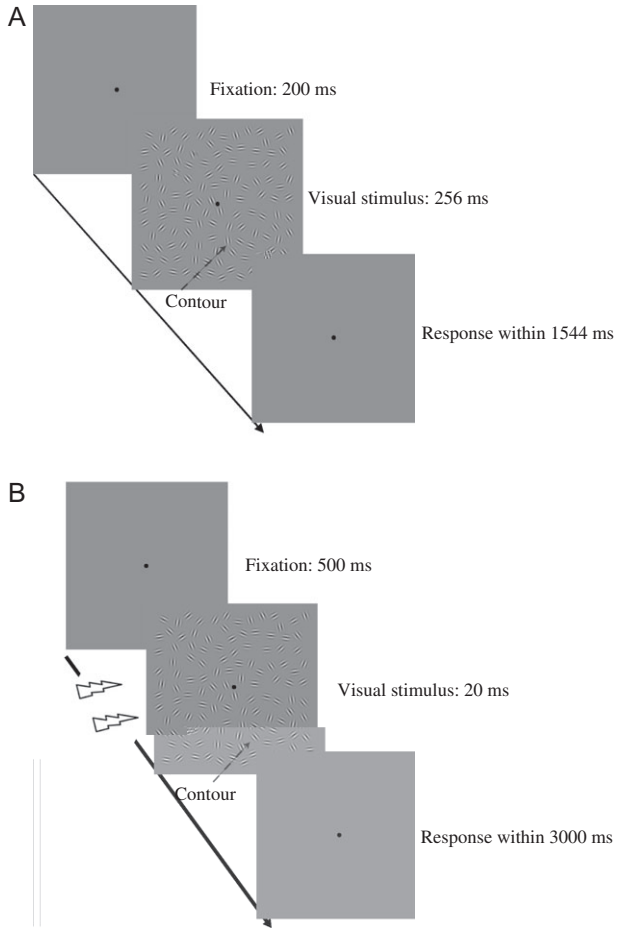

r . (A) A . (B) A fi A fi , 1/ 2 3 4 A (60/80, 90/110, 120/140 150/170) ( ) 1 2 A (90/110 120/140) ( ) 2.

2 : (1) fi (2) fi fi .

Data acquisition: 3 20- (= 2000 , = 30 = 152 × 152 ^{2}, : 76 × 76, fl : 90°, = 0 ; : 28, : 2.5 , :). A - 1- (A , = 2530 , = 2.98 = 256 × 224 ^{2}, fl : 7°, : 0.5 × 0.5 × 1 ^{3}, : 192, : 1 , :).

pRF mapping task: (1, 2, 3, 3) 5 : 1 ( ), 4 fl (100%) (. 1). 8 308 . A fl (10.35°, 100%) 4 , 32 . 8 4 . 36 . A (: 2.14°) (: 10.22°) 18 (: 1.07°) (0°, 45°, 90°, 135°) . A 8- , 12- fi fi .

Contour detection task: , 4 - . 81 (2), (8) (12) . (- , fi) - (2002). A 1A, 200 fi , fi - fi 256 fi . fi .

TMS Sessions

2 3 . 1/ 2 3 . 1/ 2, 1 , - 2 1 (. 2011; , . 2005; - . 2012). , 1 , 1 (. 1995; . 2006; . 2014).

TMS protocol: ^{2} ( ) 70- fi - -8 (. 2A). fi (1/ 2 3) (2; A , ,) . . 2 60% , .

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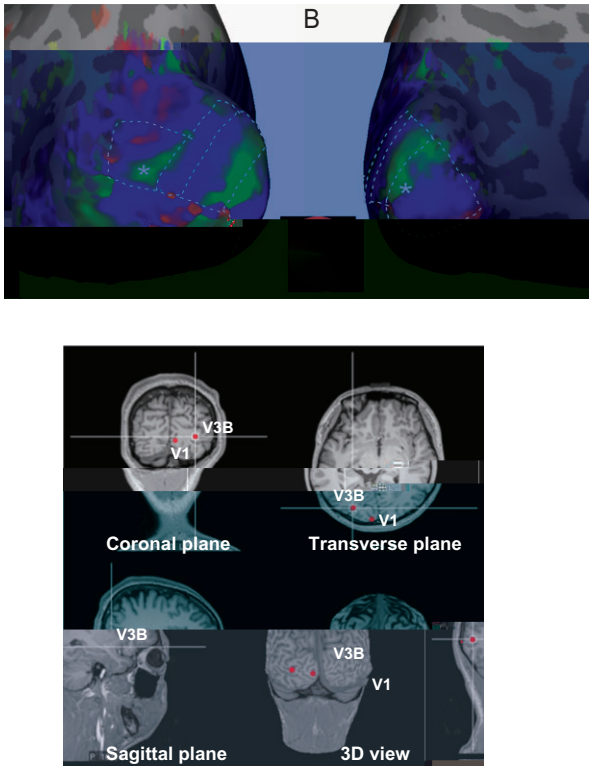

r . (A) 3 (B) 1. (A) ( ), fl fi fi 1, 2, 3, 3 . (C) 1/ 2 3

(, . 2005; . 2012). A (60/80 , 90/110 , 120/140 , 150/170) 1/ 2 3 . A (2003; , . 2005) fi (2003). A , .

Contour detection task with TMS: , fi 1/ 2 3 . A fi 3 1/ 2 , . fi , 16 2 fi (A : 60/80, 90/110, 120/140, 150/170 ; :) , 96 12 . fi , fi , . A 1B, 500 fi , fi 20 . 3 . fi fi .

Data Analysis: A (. ., , , fi) 2- (A A), A 3 fi (. .,) (. 2006, 2009; . 2008; . 2010; . 2012; . 2014). A ( ) A. , fi fi , t- (0) A , A , fi t- , .

x r t

Participants

(11 , 9 ; = 20–26) , 8 1. A , .

Stimuli and Aperture

2 1, fi fi , 2 fi .

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Procedure

2
1,
fi
84%
1,

Psychophysics Session

1- 4
84% 5°
fi
2°.
(. , fi).
7 7
84% fi
40
(fi).
1000 (,)
fi
1° fi
200
15

fMRI Session

2
1.

TMS Sessions

2
1
2 fi
A (90/110 120/140) 96
A
(1/ 2 3).

Data Analysis:

2- A A
(1/ 2 3) A (90/110 120/140)
fi t-
(, 0)
A
t-
fi

fMRI Data Analysis

Data preprocessing:

1- 3 (
. 1999; . 1999). fi 4
8
( ).
fl
(. 2014;
. 2014; A . 2015)

pRF and GLM analyses:

(2008).
A A
(. 2014; A . 2015)
fi
fi fi fi (
. 2014,
fi). fi
fi
(1, 2, 3)
(. 2007). 3 fi
fi
fi 3.
3A 3 fi
fi 1–5°
–80 –10°
fi
fi . A
1 3
fi fi fi
fi fi
2

Results

x r t

1, 1/ 2 3
A (60/80, 90/110, 120/140, 150/170)
( )
85.7 ± 5.8%,
fi
fi-
(. 3). fi

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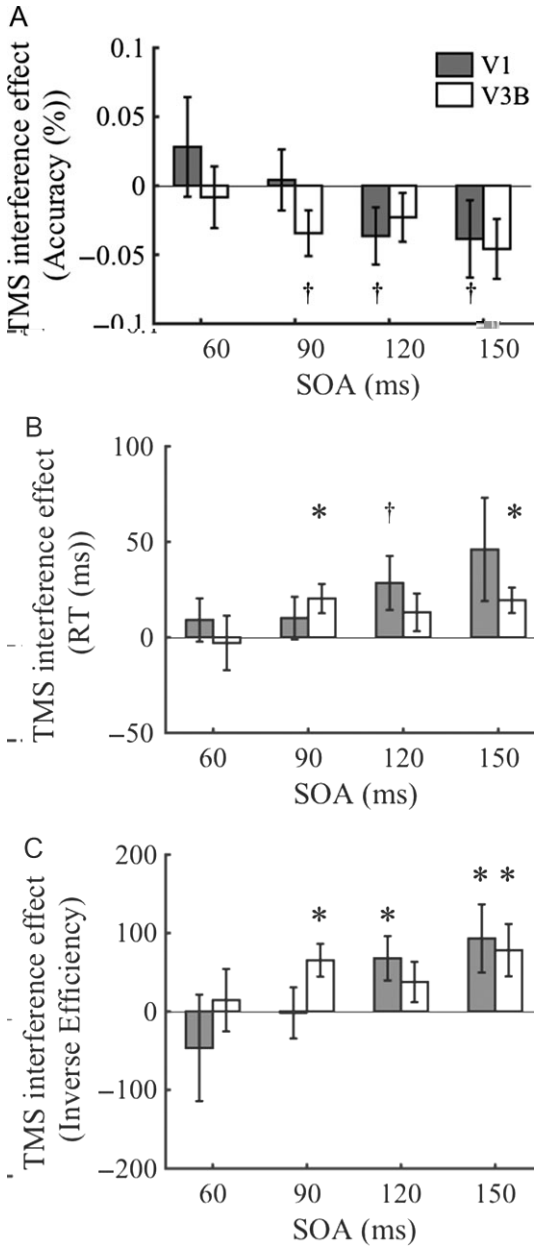

r 3. A 1/ 2 3 1 (A) , (B) , (C) fi - fi - fi - t- (**P <0.01 ; *P <0.05 ; †P <0.05).

fi fi A. fi fi 2- (× A) A A . A A fi A (F(3,57) = 2.93, P < 0.05, η_p^2 = 0.13). fi - 60/80 150/170 A (P = 0.03, - = 0.0083).

(F(1,19) = 0.64, P =0.42, η_p^2 = 0.03) (F(3,57) = 0.83, P = 0.48, η_p^2 = 0.04) fi . A A fi (P >0.1). , A A fi fi A (F(3,57) = 3.22, P <0.05, η_p^2=0.15). (F(1,19) = 0.42, P = 0.52, η_p^2=0.02) (F(3,57) = 1.19, P = 0.31, η_p^2=0.06) fi . fi 60/80 90/110 A (P = 0.05, - - = 0.0083).

1/ 2 3 , - t- (- = 0.00625), (- = 0.01875), fi (- = 0.025) A - fi (. 3). 1/ 2, fi- fi 120/140 A (t(19) = −1.76, P = 0.05, ' d = −0.39), (t(19) = 2.02, P = 0.03, ' d = 0.45), fi (t(19) = 2.40, P = 0.01, ' d = 0.54). 3 , fi fi 90/110 A (t(19) = −2.07, P =0.03, ' d = −0.46), (t(19) = 2.66, P = 0.008, ' d = 0.60), fi (t(19) = 3.18, P =0.002, ' d = 0.71). 120/140 90/110 1/ 2 3 . A , fi 120/140 A 3 fi (t(19) = 1.46, P =0.08, ' d = 0.33). , fi 120/140 3 . fi fi 150/170 A 1/ 2 (- : t(19) = −1.38, P =0.09, ' d = −0.31; : t(19) = 1.70, P = 0.05, ' d = −0.38; fi : t(19) = 2.17, P = 0.02, ' d = 0.49) 3 (: t(19) = −2.12, P = 0.02, ' d = −0.47; : t(19) = 2.91, P = 0.004, ' d = 0.65; fi : t(19) = 2.37, P = 0.01, ' d = 0.53). fi fi . 2, 2 A (90/110 120/140) 1/ 2 3 . fi fi - 2.

x r t

-, 2, 87.3 ± 2.8% (fi : 89.1 ± 4.0%; fi : 85 ± 5.2%) 1. A , fi 4. A 1, fi 2- (- × A) A A . - , - (. .,). A A fi A (F(1,19) = 7.37, P = 0.014, η_p^2=.28).

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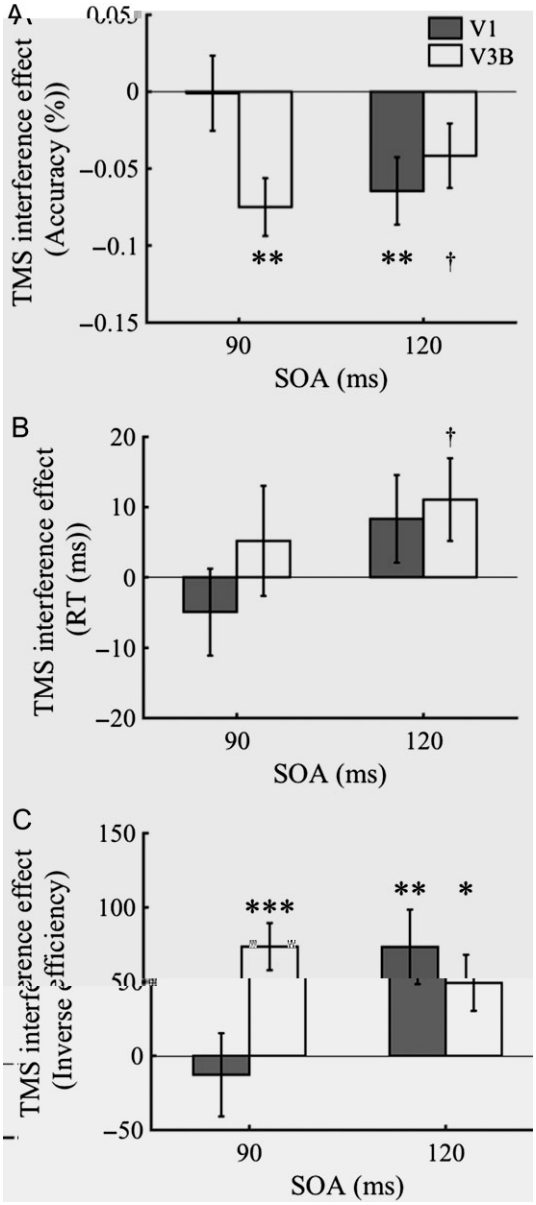

r . - , A 1/ 2 3 2 (A) , ( ). , ( ) fi \ fi - - . - fi fi - t- (***P < 0.001 ; **P < 0.01 ; *P < 0.05 ; †P < 0.05).

2 A. , 120/140 A 90/110 A - 1/ 2 ($F(1,19) = 6.09$, $P = 0.02$, η_p^2=.24). - , fi 2 A - 3 ($F(1,19) = 1.93$, $P = 0.18$, $\eta_p^2 = 0.09$). , A A fi A ($F(1,19) = 3.24$, $P = 0.09$, $\eta_p^2 = 0.15$; $P > 0.3$). , A A fi fi A ($F(1,19) = 7.34$, $P = 0.01$, $\eta_p^2 = 0.28$). - ($F(1,19) = 2.37$, $P = .14$, $\eta_p^2 = 0.11$) A ($F(1,19) = 3.07$, $P = 0.10$, $\eta_p^2 = 0.14$) fi . , - 1/ 2, - 120/140 A 90/110 A ($F(1,19) = 7.67$, $P = 0.01$, $\eta_p^2 = 0.29$). - , fi - A - 3 ($F(1,19) = 1.23$, $P = 0.28$, $\eta_p^2 = 0.06$). \ , - t- (- = 0.0125) fi , 1/ 2 3 , 1/ 2, fi 120/140 A ($t(19) = -2.95$, $P = 0.004$, ' $d = 0.66$) fi ($t(19) = 2.92$, $P = 0.004$, ' $d = 0.65$). 3 , fi 90/110 A ($t(19) = -3.99$, $P < 0.001$, ' $d = -0.89$) fi ($t(19) = 4.64$, $P < .001$, ' $d = 1.04$). - 120/140 1/ 2 90/110 3 , - , A , fi - ($t(19) = -1.99$, $P = 0.03$, ' $d = -0.45$) ($t(19) = -1.88$, $P = 0.04$, ' $d = 0.42$), fi fi ($t(19) = 2.60$, $P = 0.009$, ' $d = 0.58$) 120/140 A 3 . - , 2 fi fi 1 fi 3 1/ 2, .

Discussion

(. 1995; . 2006; . 2013) ' (. 1993) 1 fi fi (A . 2003; . 2009; 2010). \ , (2014) 1 4 4 1. 1 1 4. fi (3) . - , 1/ 2 3 , - 1/ 2 fi 3 . 3 90/110 - , 1/ 2

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A , A . 2013. : . 24:63–71.
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