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RESEARCH ARTICLE

I

Q C . M

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A U a a a a , a b a a (IOR). IOR IOR IOR IOR ff IOR ff ff IOR ff IOR

K A b
S F a
D a- R b
C a a

Q. C X. Z (&)
D a P , P U ,
B 100871, C a
- a : 104@ . .

M. Z a
D a P , N a N a U ,
C a 130024, C a

X. Z
S a K Lab a C N
a L a , B N a U ,
B 100875, C a

X. Z
L a & C Lab a ,
Ca a N a U , B 100037, C a

I

S a a a a b a a a a a a a a SOA b a a 300 (Ma a H 1985; P a C 1984; K 2000 a). T b a a a b (IOR) a b b fl a a , a b . T IOR ff a b a b a b ff a a , a (. . P a C 1984; Ma a H 1985; K a a E 1992), a a (. . Ma 1985; P a a . 1997), a a (. . L ń a . 1997; P a 1995; P a a Ab a 1999; P a a . 1997). I a , , a a . I a IOR ff a a a a a

a b . T b a a b ff a . T b ff a a a b a - (. ., a a a) a . H , b a IOR a a a a a a , Ta - a a l. (2002) a a a a a a a a b a IOR, IOR - a a b a a a a a - , a a a IOR a b b a a , a a - . W a IOR D . S a a a IOR - a a ff a , a a , , a . T a a a a b a - b a a b a , a a - ff a a l. A a a a (S - b 1969; M 1988; Sa 1990), ff - a a a IOR, a a - . I a , a a a b a IOR. A a IOR a b b a a b a , a (La l. 1995), a (R l. 2004), a (F a a M 2003), a a a (F l. 1999). O a a a a (. . R l. 2004). I a a , Ta a a S (1996) a P a a Ca (2001) a a a a a . T a a a a a (a), ( ), a a (a - a). T a ff a . I , b a a - a a a a , a , , a a a . I a , b a a a ba a . L , a a - a ba a , a a - a a ba a a , a a b a . P a a Ca (2001) b a a b a a a b . F , a a-ba IOR b a - a a a b a ff b a b a , a a-ba a a b a - a a a a a . S , a -ba IOR b a a b a a - a . T , a a a IOR ff b a a a a b ff b a b a . I a b a P a a Ca (2001) ff - a a b a -ba IOR a a a a a b a a IOR.

I a a , a a a a a a a a a a a a a a a a ab b a a . M a a a Ma (1990) a a - a a , a , a b , a a a a a a b a a a , a a . M l. (1998b) a a a a a b a a - a a a a a a a - a a a a a . T a a a a a a a a a - a b a a a a . I a , a b a a a a a a a a a a a a a a a - a b a a a a a a a a a a a a a a a a a a a a b a a a . I , a a b a a a a a a a a a a a a a a a a a a a

a a a . I a a , a a a . T a a- a a a a a a b a a a a - IOR. W a a a a- , b a a -ba IOR a b b a a (P a Wa 2002).

M

S b

A a 79 a a , 27 E - 1, 27 E 2 a 25 E 3. T a a a N a N a U C a, a b 21 a 24 a - a . N a a a . A a a a a D a P , N a N a U a a a a .

D a

T a a a , - b a a a b a a . T fi a a a a a a- a a (. ., a a - a) a a a a a a ff a (. ., a). T a bab , . . a a a a - , a a- a ff - , ff a a a - , a ff a a ff - . Ea a 40 a .

T a a a , 555 a 869 H . T a M (1998a). T a a a bab . T a a a a 16,000 H , C E P 2.0. B 100 a , a b a a 5- a / ff a a - a .

A a a , -a a a b (300 × 100 × 200) a ba a 35 B SPL. A P III/933 S ab W XP a a a DMDX (F a F 2003) a - a a . C a a La LA-6000 a a 45 , 45 ' . T a a a a 50 . T a a ab a a 65 B.

P

O a a , a a a , b a a a a ff a a ff . T a b a a a . T a a 750 a . T a , SOA b a a a fi a 750 . T a a 1,000 a a a a a . D - , a a a (E 1) a (E 2) a , a a (E 3). I E 1, a b b fi a a . I E 2, ab a a a a b b fi a a a a a b fi a a a a . Ab a a a - a b - - a a - . I E 3, a b - a . A a , a - b - - a ba a a a .

T a a a a a a a a a b a a ff a a a ba a . Pa a a a a b a a - a . I a a a a a a b a a a a

2,000 a a , a ba a . Tw 20 a a a a . Pa- a a fi a a ab a a a .

I a , a a a a 32 a a a 180 a a . T a a a a b b a a a2- b a .

R

O a a E 1 a a a b a a a a a a a a a a 100 . M a a (RT) a a a a a . Ca a a a a ff . Tw - a a a , a E 1, 2 a 3, a Tab 1.

E 1: a

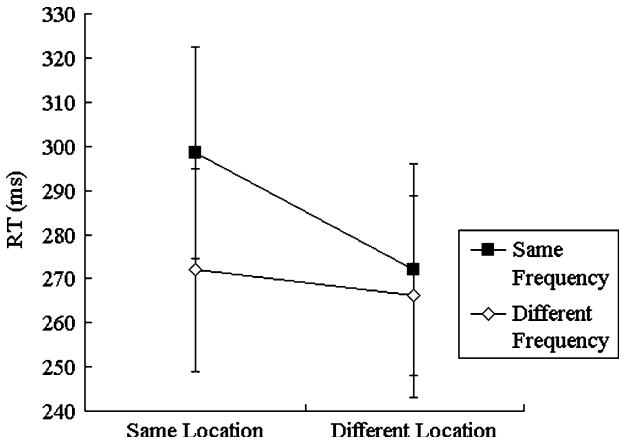
A a a a (ANOVA) RT , a a a - a a - a a . I a , a ff a a fi a , $F(1, 25) = 14.10$, $P < 0.005$, a a a a a a a a (285 , a RT a a a Tab 1 a F . 1) a a a a a a (269 , a RT a ff a Tab 1 a F . 1). Tw ff a a a -ba a - IOR. Tw a ff - a a fi a , $F(1, 25) = 16.94$, $P < 0.001$. RT a - a (285 , a RT a a Tab 1 a F . 1) fi a a RT a ff - - a (269 , a RT a a ff Tab 1 a F . 1), a - a a a -ba a IOR. M a , a b a a fi a , $F(1, 25) = 10.11$, $P < 0.005$ (F . 1). F a a a ff a a a -ba IOR a a a a a a a - , $F(1, 25) = 21.54$, $P < 0.001$. Tw - ba IOR a a a a , $F(1, 25) = 20.10$, $P < 0.001$. Tw a ff a a a ff a a . Tw a a a (. ., a a a a a) fi a fi a .

E 2: a a a

I a a a , a ff a a fi a RT , $F(1, 26) = 12.05$, $P < 0.005$, a RT a a a- a (421) b a RT a

T 1 M a a , a a a a E 1, 2, a 3

		L a	Sa		D ff	
		F	Sa	D ff	Sa	D ff
E 1 ( )	RT ( )		298	272	272	266
	SE		24	23	24	23
	E (%)		3.9	2.9	2.8	1.8
E 2 (a a a)	RT ( )		407	436	404	379
	SE		22	25	22	19
	E (%)		1.5	3.8	2.9	3.2
E 3 (a)	RT ( )		386	381	403	372
	SE		19	18	17	19
	E (%)		1.4	2.9	2.5	2.6



F . 1 M a a (RT ;) a a a a a a a a a / a

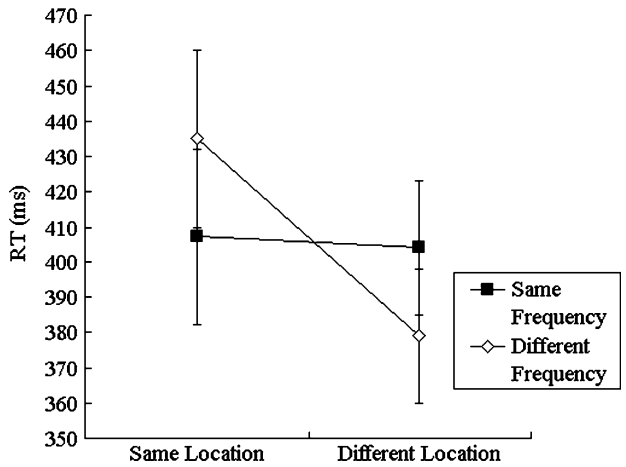
a a (391). U E 1, a ff a fi a , $F(1, 26) < 1$. T a RT a - a (405) a ff RT ff - a (407). T a - b a a - a fi a , $F(1, 26) = 25.37$, $P < 0.001$ (F . 2). A a a ff a a fi a a -ba IOR (56) a a a a ff , $F(1, 26) = 20.34$, $P < 0.001$. R a a a a a a ff a a . T a a -ba IOR a a a a a , $F(1, 26) < 1$. T , a a a - a a a IOR ff a - a a a a a - a a ff a - a a a a IOR ff a - a a . O a , a a fi a -ba a a (28) a a - a , $F(1, 26) = 10.52$, $P < 0.005$ a a fi a -ba IOR (25) a ff a a , $F(1, 26) = 9.88$, $P < 0.005$. T , a a a - a a a b a IOR ff a - - a a , a ff a - a a a a a fl IOR ff a - a a . T a a a (. ., a) fi a fi a .

E 3: a a

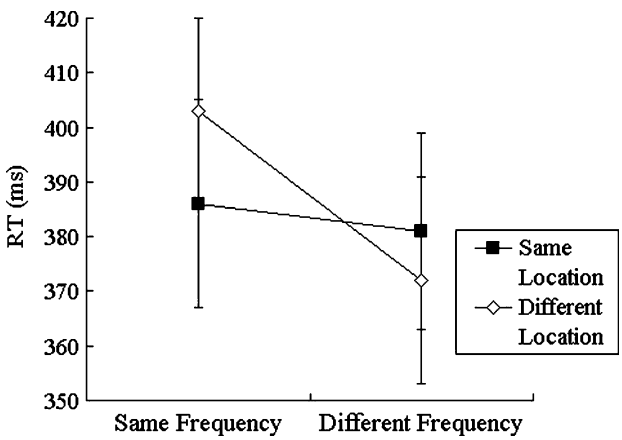
I a a , a ff a a a fi a RT , $F(1, 24) = 1.21$, $P > 0.1$, b a ff a , $F(1, 24) = 11.69$, $P < 0.005$. RT a - a (18) a a ff - a , b a -ba IOR. T a - b a a a fi a , $F(1 20) = 7.54$, $P < 0.05$ (F . 3). F a a ff a a -ba IOR a a a a ff a (31), $F(1, 24) = 21.56$, $P < 0.001$. I a a a a a a a (5), $F(1, 24) < 1$. T a E 2, a a a - a a a IOR ff a - a a a a a IOR ff a - a a . O a , a fi a a -ba a a (17) a a a a a , $F(1, 24) = 9.50$, $P < 0.01$, b a - fi a b (9) a a a a ff , $F(1, 24) = 2.17$, $P > 0.1$. T , a E 2, a a a - a a a b a IOR ff a - - a a , a ff a - a a - a a b a a . T a a a fi a a .

D

T a a . T fi a a - a a b a a



F . 2 M a RT ( ) a a a a a a a a a a a a a (a - a) a / a (a - a)



F . 3 M a RT ( ) a a a a a a a a a a a a a a a (a - a) a / a (a - a)

a a IOR. T
a a ff a a
a a IOR. T -
b a b a a -
a , a a a a
IOR a a
a . H , a a -
a ff a a . E
1 a , a
a a a a , a
a a -ba IOR a a
a a a a -
-ba IOR a a
a a a (F . 1). R a
a a a b
a a a a a . T
a a b a a
a , , a a a
a a a a a -
a a . Ta a a a
a - a a a - a a
E 2 a 3, a ff
(F . 2, 3). W a a a a
, a (E 2) -
(E 3), a a
a , IOR ff a a a
a a ff a -
a . T a ff a -
a a a a a a -
a a . S a , a -
, E 2 a a
E 3, IOR ff a
a a a ff
a - a a , a
a a a a a - a a .
T fi , a a
a a b (C a .
2006) a a a SOA b a
a a (b a a), a
a M a a a Ma (1990) a M a .
(1998b) b a a - a ,
a aff a a ,
a a - a a b a -
a ff a a , a -
a a a . H ,
fi a ff M a a a Ma
(1990) a M a . (1998b) a fl
a - a a a a ,
a a a a a
b a a a b a a
a - a a a . O
a , a ff a a a -
b a IOR (P a a Ca
2001), a a a
a a . A a a a F . 2 P a a
Ca (2001) a a a a a a -
a a (a a -
a , a a , a
/ a a a a) a
a , IOR a - a a a b
b a a (a
a a a) ff a - a
a ( ), b IOR a - a a a
b a a a
a a a - a a . S a , IOR
a - a a a b b a
a ff a - a
a , a a b a a
a a a - a
a . R a fi -
a a a a a
MRI (Q. C a X.
Z , b a a).
I a a a , -
a a a b a a
a a IOR. T a -
a a fi a IOR,
b a fl b a a fi -
. R b a a b a
ff b , a
b ba a a a -
(Ha 1980; S a D 1998b),
a a a fi a-
(Ta a a . 1987, 2002), b a
a b a
a a a (F a . 1999; K 2000;
T a . 1994; V a a F 2001). A a
b a a a
fi a , a ffi
a a b a - a a
a - a a a a -

a a a a - a a , a a - a (L ń a . 1997, 2001a, b; M a . 2000). I a fi a IOR a SOA a - a a a a a fi a ffi a a , SOA a IOR , L ń a . (1997, 2001a, b) a a a a - a a IOR a a . Ka a a . (1992) a a a a - a a a , b fi . Ta a a a . I a a a a , b fi a a - a ; a a a b fi , a b fi a a - . B a , M a . (2000) a L ń a . (2001a, b) a a b fi a a b fi a a a , b a b a a a a a a a a . I a a a , a a a a a a a a a a ; a a a a , a a , a a ff a a . Pa a a b fi a a a a a (. . a fi a b) a a a . A a a , a a a ab a b . S a a a a a (. . a a) - a a b a a a a a a a a a ff a a - a . A ff b a a a a a a . Ta a E 1 a a a a ff a b a a a a a a a a a a

a a b . P P - 62:1280 1296
M TA (1999) P ab a a - a b . P P 61:1501 1509
M TA, B a LM (1999) Fa a a b ff a a : a a a . P P 61:438 444
M TA, B a LM, M B (1998a) I b a a : a -ba a -ba b . P P - 60:296 302
M TA, La TE (2001) Fa a a b ff a , , a b . P P 63:726 736
M TA, Za RJ, T NA (1998b) C a a a . J E P H P P 24:66 79
P MI, C Y (1984) C a . I : B a H, B DG ( ) A a a , X. E ba , H a , 531 556
P a J (1995) I b a a a . P B R 2:117 120
P a J, Ab a RA (1999) I b a a . J E P H P P 24:229 242
P a J, Ca AD (2001) R a a : a - a a b a a a . V R 41:3903 3908
P a J, K A, K W (1997) I b a- - a -ba a . P P 59:964 971
P DJ, Wa LM (2002) A -ba b ff a a IOR. P P 64:771 784
Ra a RD, H A (1994) T b . I a - a a a . I : Da ba D, Ca T ( ) I b P a , a a . A a , Sa D , 1 50
Ra a RD, Ca ab PA, B CW, S TK (1989) Sa a a b a a- . J E P H P P 15:673 685
R -L PA, J a A, R JN (1996) W a b- b b ? J E P H P P 22:367 378
R -L PA, R JN (1996) A a b : a a- . E B a R 112:119 126
R L, Pa I, U a C (2004) L a a a b - . P R 68:41 54
Sa AF (1990) I a ba . a . A a P 74:123 167
S WC (1996) I b a . N a 34:943 952
S CJ, D J (1997) A a a . P P 59:1 22
S CJ, D J (1998a) A a a a b . P P 60:125 139
S CJ, D J (1998b) C - a a b , a , a . P P 60:544 557
S CJ, L D, M G F, N MER, D J (2000) I b a a: a a b a , a a . E B a R 134:42 48
S b S (1969) T a : D ' . A a P 30:276 315
Ta a a Y, S S (1996) L a . a : a a a b a . V R 36:2125 2140
Ta a G, A S, C a L, Ma CA, B C (1987) D b a fi a a a - a b a - ff . N a 25:55 71
Ta a G, Ca a a D, B C, B C (2002) T b a a fi b - a a b . E B a R 146:523 530
Ta TL, K RM (1998) O a a ff b - . P B R 5:625 643
Ta TL, K RM (2000) V a a ff b . J E P H P P 26:1639 1656
T SP, W a B, J a LM, B a AL (1994) Ob - ba a -ba b a a . J E P H P P 20:478 499
V a AB, F LJ (2001) S aff b . P B R 8:315 323