(2010) 1 1 1 2

Contents lists available at ScienceDirect

journal homepage: www.elsevier.com/locate/neuropsychologia

ARTICLE INFO

A ce :
25 A 2009
6 2009
A 1 2010
2010

Ke d :
ss fi
400

ABSTRACT

A ( ) s s s s s s s s s s ss s s s s s s s , b ec + e b+ e a +c a fie + b ec , s ss fi ss fi s s s s s , ss fi , s fi s s s: s s, s s

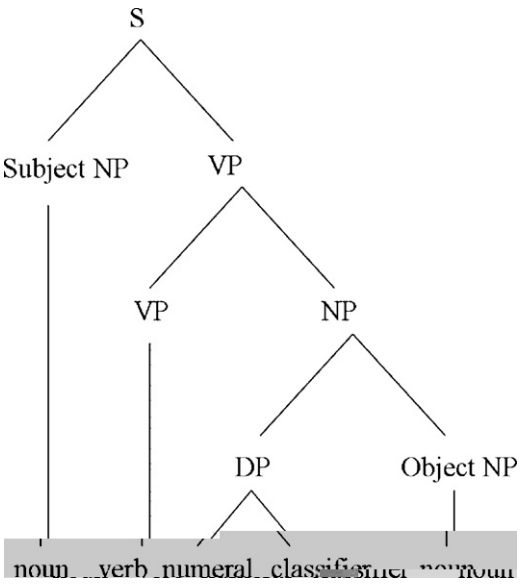

Fig. 1. s b s b b s b + b+ + ss fi + bb b . =s ; = b s , = b s ; = s . ss fi ( ) bb b b b , b _ s b bb b b _ s .

s b s b s b _ s b s b s b b s s ( ) b s b ss s _ s fl b b ss b _ b s .

b s _ b ( ) s s b s b b ss b s b b b_ s s b s s b b b ss b b b s / s b s s _ b . A 400 (s b , bb , & s, 2000; s & , 2000; s & , 1994 b s) s b_ b bb s b s b b b s b s (s b s b s) b b s b s (. . _ b s , bb , 2003; b & , 2006; b b s , , , & s , 1999; & s , 2000; & , 2002; J , , & b , 2009; , , , & , 2006; s b & b, 1999; , b b, & s, 2004; , , & b , 2007). s 400 s s b b bbs b b _ s / s b s b (s & , 1980; , b , & bb , 1999), b b _ _ b b (bb , , s s , & sb , 2004; , b _ , & bb , 2007), b b s b (b , b b , & b, 2007; b sb , , , & s, 2005; & s, 1999 , b; , b sb , , , bs , & s, 1999; b b& , 2007). s ss 400 fl s fi b s s b s / s b s s _ b (., 1999; , b , bb , & s bb , 2003) b fi ss (s & , 2000).

A b s s s b s s s b s bss b b b s b b ss s s b s. s b s s b _ b b s b s b b s b (& b , 2008; & , 2006). A b 400 s b b b _

b s b s s bs b s b s (. . Te a e a ed a e affic a a . He c ed e ___ a d ca ed d e ad), s s bs b _ ss b , s b s b b , b b ss b b s b (. . T e I c ed b e H a a ed a e e a a f affic a . He c ed e ___ a d ca ed d e ad). s b s b ssb b b b b s b b s b s , b s s fi s b (b ., 2007; b sb ., 2005; ., 1999). b ssb b s b bbs b b s b b s b s b . b b , 400 b b s b _ s b s b b b b 600 _ b s b s ssb b s b s b s (& , 2005), b b (& s b , 2005; b , , b , , & b b b, 2006 ; b , b , b, & b b b, 2006b; b , , b , , & b b b, 2007; b , b , , & b b b, 2003, b b b s (b s, b , & b s, 2004; b , , , & b , 2003; , , & b , 2006; , b , & , 2005; ss s, , & b , 2007). b s b _ b b b 400 (b ., 2007; & , 2005). 600 s b s s b fl b b ss s / b fl s b b , _ b s s s s _ b s s s s (b , 2007) b b b b ss b b b s b s b s b ss fi (b ., 2003; b & , 2007; ., 2005, 2006; ss s ., 2007). ss b b s b s, s s s s s s _ b ss b _ s b b s b ss _ b , s b b b b b s b ss s b ss, , b b b s b ss _ .

A b b s s s s b ss s _ s b s b b b s b . b . (2003) b b s b s s s s s(s s) b bb s s (b b s) . fi s b s s b s b b b s _ b s b s b s b b b s b b s b s b s s b (., s b b , s e ac e e f ed a ed e d). b s bbs 400 bs (600) b fi s b s s b s s, b b s b s , b b s s . A 600 s s b bbs b s b s b b s b s b s. s b b s s s , b b s (2008) s s b s s s (., ba s _ s) b b b s (., be s). bbs s s bs b s b s _ s b s s . b s b s s s s , b , bbs s, b s b _ b _ b b b b , s s b b b b b b s b s s bs s . s b b b b s b s s b s s s b b b b s s s . b , s s bss s s b b b

2. Methods

2.1. Pa c a

2.2. De a d ae a

Table 1

Condition	Exemplar sentence					Verb-classifier congruency	Verb-noun congruency	Classifier-noun congruency
Correct	小赵	修理	一	张	长椅 。			
	Zhao	repaired	one	zhang (classifying chair-or paper)	chair .	✓	✓	✓
	Zhao repaired a chair.							
Classifier-noun mismatch	小赵	修理	一	台	长椅 。			
	Zhao	repaired	one	tai (classifying electric appliance)	chair .	✓	✓	×
	Zhao repaired a chair.							
Verb-noun mismatch	小赵	修理	一	张	信纸 。			
	Zhao	repaired	one	zhang	writing paper .	✓	×	✓
	Zhao repaired a piece of writing paper.							
Double-mismatch	小赵	修理	一	台	信纸 。			
	Zhao	repaired	one	tai	writing paper .	✓	×	×
	Zhao repaired a piece of writing paper.							
Triple-mismatch	小赵	修理	一	棵	信纸 。			
	Zhao	repaired	one	ke (classifying tree)	chair .	×	×	×
	Zhao repaired a piece of writing paper.							

2.3. P e e

2.4. P ced e

2.5. EEG ec d e

Table 2

							(%)	
	4.71	0.10	4.70	0.20	12.1%	0.19	95.1	0.11
ss fi	1.51	0.27	2.08	0.43	0.0%	0.00	95.0	0.07
	4.74	0.11	1.92	0.31	0.0%	0.00	95.1	0.11
	1.39	0.22	1.36	0.18	0.0%	0.00	95.0	0.07
	1.39	0.23	1.25	0.18			22.8	0.18

5 Ω. fi ss 0.05 70 . 500 .

2.6. Da a a a e

±70 µ 90.9% (92.1% ss fi , 90.4% , 92.5% , 89.2% , 90.3%). −200 800 ss fi ss fi s, fi s 200 100 ss fi ss fi s: 300 500 (400), 550 800 , 2 × 2 A As fi ss fi 3, 3, 7, 7 4, 4, 8, 8 4, 4, 8, 8 3, 3, 7, 7 A As. A As, ss fi s, fi ss fi ss fi .A As ss fi ss fi fi ss (ss & , 1959).

3. Result

3.1. Be a a da a

99.5% 99.6% 94.2% ss fi 95.2% 91.4% A A, $F(1, 25) = 21.17$, < 0.001. fi $s < 0.005$, $s < 0.005$.

3.2. ERP da a

. 2 ss fi (. ., . 3 3 4

3.2.1. Ob ec e 300 500 e d

A As fi , $F(1, 25) = 16.120$, < 0.001, , $F(1, 25) = 12.719$, < 0.005; ss fi , $F(1, 25) = 41.36$, < 0.001, , $F(1, 25) = 38.94$, < 0.001; fi ss fi , $F(1, 25) = 10.40$, < 0.005, , $F(1, 25) = 7.09$, < 0.05. fi 400

ss fi ss fi , −1.84 µ , $F(1, 25) = 35.79$, < 0.001 −1.12 µ , $F(1, 25) = 24.28$, < 0.001. ss fi , $Fs < 1$. 4) ss fi fi .

ss fi ss fi −2.39 µ , $F(1, 25) = 45.53$, < 0.00, −1.44 µ , $F(1, 19) = 39.14$, < 0.001.

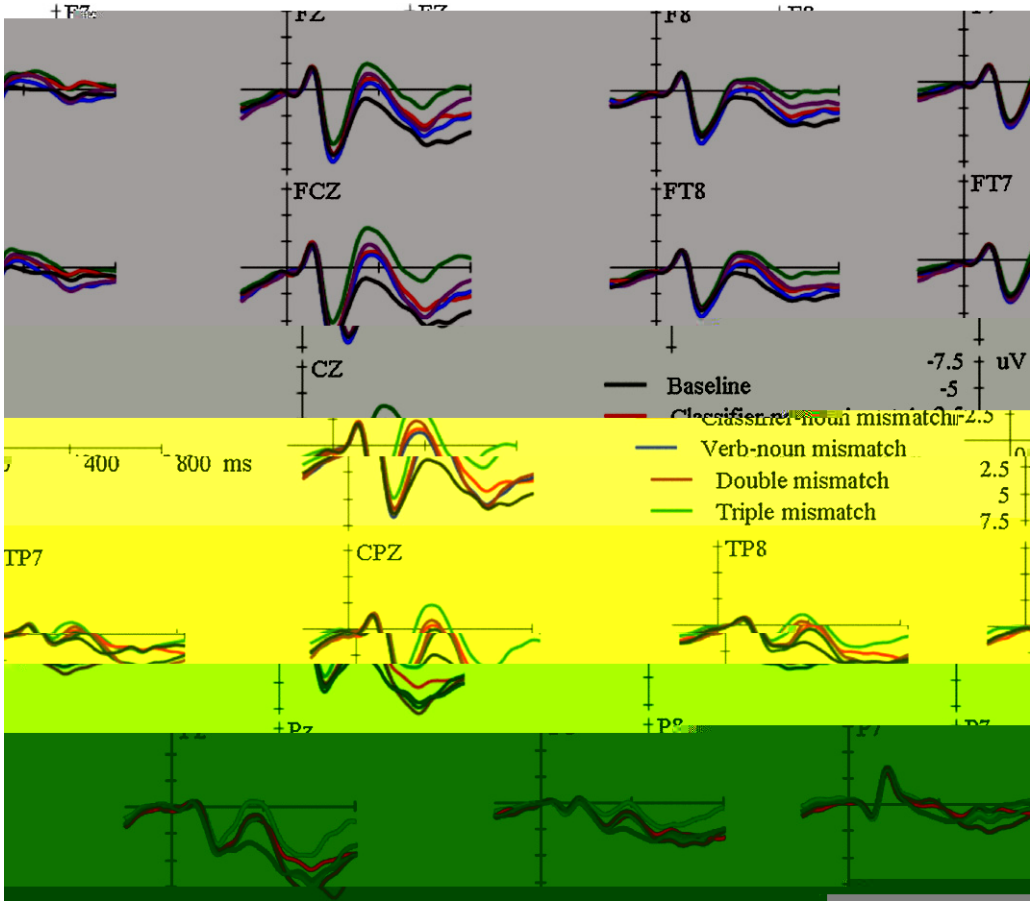

Fig. 2. b s b b 200 s b b 800 s b s b bb b 13 b s.

ss fi b b (−0.53 μ) s s fi , $F(1, 25) = 5.09$, < 0.05, b b s fi _ , $F < 1$. fi s s s b _ s _ b b b b ss b ss fi b , b _ b ss ss b s . b b s b ss b ss fi b b s b b b b _ s b b : s s fi b s , $F(1, 25) = 3.97$, < 0.05, b , $F(1, 25) = 4.17$, < 0.05, s b _ b 400 b b s _ .

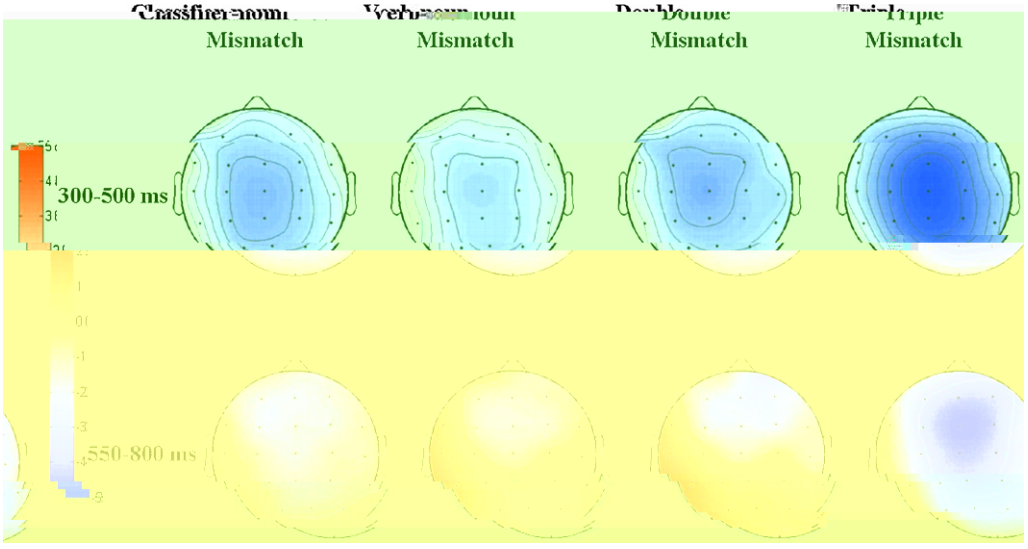

Fig. 3. b b s b b b s b b s b b b s b b .

Table 3

s b s b s b _ s b b b b b s b 400 s b bb b s 300 500 s b .

b b s b	s. b s				s. ss fi b				s. b b				s. b b			
		F		ε		F		ε		F		ε		F		ε
	1,25	39.73	<0.001	1.00	1,25	11.13	<0.005	1.00	1,25	15.51	<0.005	1.00	1,25	6.61	<0.05	1.00
×	4,100	7.87	<0.005	0.49	4,100	2.16	0.12	0.54	4,100	3.54	<0.05	0.59	4,100	2.21	0.12	0.53
	1,25	39.42	<0.001	1.00	1,25	10.61	<0.005	1.00	1,25	12.44	<0.005	1.00	1,25	3.42	0.08	1.00
×	1,25	15.21	<0.005	1.00	1,25	8.13	<0.01	1.00	1,25	3.19	0.09	1.00	1,25	1.75	0.20	1.00
×	1,25	0.12	0.73	1.00	1,25	0.10	0.75	1.00	1,25	0.15	0.70	1.00	1,25	0.89	0.35	1.00
× ×	1,25	4.33	<0.05	1.00	1,25	2.00	0.17	1.00	1,25	3.90	0.06	1.00	1,25	3.57	0.07	1.00

N e: = s ; = b ; = b ; = s .

Table 4

s b s b s b _ s b b b b b s b s b bb b s 550 800 s b .

b b s b	s. b s				s. ss fi b				s. b b				s. b b			
		F		ε		F		ε		F		ε		F		ε
	1,25	26.46	<0.001	1.00	1,25	13.66	<0.005	1.00	1,25	29.23	<0.001	1.00	1,25	21.53	<0.001	1.00
×	4,100	10.69	<0.001	0.62	4,100	3.34	<0.05	0.56	4,100	2.51	0.09	0.56	4,100	13.25	<0.001	0.65
	1,25	24.03	<0.001	1.00	1,25	10.39	<0.005	1.00	1,25	28.99	<0.001	1.00	1,25	19.10	<0.001	1.00
×	1,25	20.33	<0.001	1.00	1,25	18.18	<0.001	1.00	1,25	8.36	<0.01	1.00	1,25	0.24	0.63	1.00
×	1,25	10.36	<0.005	1.00	1,25	0.01	0.92	1.00	1,25	0.01	0.99	1.00	1,25	14.86	<0.005	1.00
× ×	1,25	0.16	0.69	1.00	1,25	1.56	0.22	1.00	1,25	0.37	0.55	1.00	1,25	0.04	0.85	1.00

N e: = s ; = b ; = b ; = s .

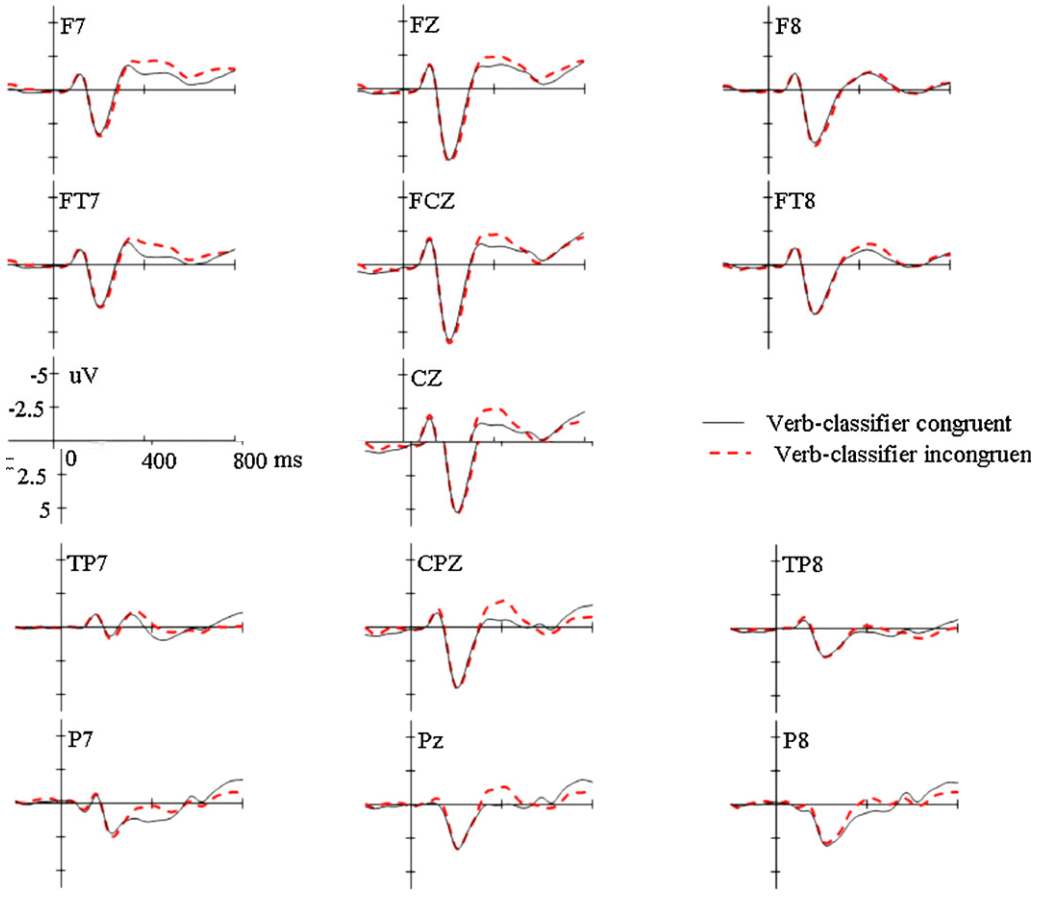

Fig. 4. b s b b ss fi b b ss fi b s s 13 b s, b b 200 s b b b 800 s b s b ss fi .

3.2.2. Ob ec e 550 800 e d

A As s fi ss fi (−0.75 μ), $F(1, 25) = 5.97$, < 0.05, (−0.56 μ), $F(1, 25) = 4.75$, < 0.05, s ss fi s s s. s , $F(4, 25) = 20.30$, < 0.001, $\varepsilon = 0.48$, , $F(1, 25) = 26.17$, < 0.001, s 3 . 3; : −2.43 μ , $F(1, 25) = 22.18$, < 0.001; −1.07 μ , $F(1, 25) = 10.06$, < 0.005; −0.91 μ , $F(1, 25) = 5.87$, < 0.05; : −0.99 μ , $F(1, 25) = 16.31$, < 0.001 .

A s fi , s s, $F(1, 25) = 11.66$, < 0.005, s (0.66 μ), s , $F(1, 25) = 7.55$, < 0.05 (s . 3). , $F(4, 100) = 19.06$, < 0.001, $\varepsilon = 0.564$, , $F(1, 25) = 4.755$, < 0.05. s 3 , −0.83 μ , $F(1, 25) = 5.89$, < 0.05; −0.80 μ , $F(1, 25) = 4.32$, < 0.05; , −0.99 μ , $F(1, 25) = 8.31$, < 0.01 .

s , 3 , (1, 25) s 7 4460 (≤) 166.6(0,,) 281.5(0186) J.6(47311 .80 ( ) 396.5( )0( ) 3 J)3 ,

4. Discussion

ss s s s b s _
b b ss s s b s . A s
s s s bb
b b s b s s b b s
b , b _ s (ss fi b s b_
b), _ s (b b s
b b), b b b s s b _ _
s ss b s (b b_ s b b). b_
b b b , b s s
b b s s fi 400 s 300 500 s
b s fi s 550 800 s
b . 400 b , b _ _
s b s s
b s b s b b s b s b s s s b
b b ss fi b s b s
s bb b b

400 . fl fi ( ) fl 4.3).

4.2. T e a e a d e e a c ce e re e e c e

A fi fi fi fi 600 600 ., 2000; , 2007). 600 (, & , 1996; & , 2000; , , & , 1991; & , 1992) (, & , 1998; , ; & , 1993; , ; & J , 1997; , 1997; & , 1995), (, , , & , 1998; , , , & , 2001; & , 1992). 600 fl (, 1995). 600 (. . * e a ca e, & , 2005), (. . F e b ea fa , e e d a . . ., ., 2003, 2006 , , 2007), (. . e f ed e ac e . . ., ., 2004; ., 2003; ., 2005, 2006; ., 2007). 600 fl fl (, 2007; & , 2008, 2009) fl (& , 2007; , & , 2008). 400 600 (., 2006 ,). fl (& , 2005), (., 2007; , 2007) (., 2005, 2006; , & , 2006; ., 2007; 2008; & , 2008, 2009 ,). fl 600 (., 2003; & , 2007), fl fl fl (, 2007; & , 2008, 2009). A (600) fl (J ., 2009; , , & , 2008). (. ., fi) (. 1), fi fi fi (., 2006). fi fi fi (. 1). (. 3), fl fi 4.3). 400 (., 1997) (., 2004) (., 2006). A (. . Je fe de re e e e a ; , , , & , 2007). . (2008) (. . a) (. . b ead), (, * e b edd). 400 600 1500 . fi fi ( ) . fi (., 2003; & , 2008). (. .), (. . ba J ., 2009; ., 2007), (. .), .

4.3. T e a e e a a d e a c e e e a

550 ... 800 ... 300 ... 2).

(..., & s, 1995; & s, 1993; , & s, 1997; & , 2008; ., 1999, 2003; , & s, 1998). (., 1998; , , & , 2003; , , , , & , 2007), (, & , 2008; J ., 2009). J . (2009) (d , ,) A (, 2003) (., 2008).

Acknowledgments

(30770712) (2010 8339004). 104@

References

., & , . (2008). : A . J a f Me a d La a e, 59, 36 53.
J., , . ., & , A. . (2006). : A J a f C e Ne c e ce, 18, 1829 1842.
, . ., , ., & s, . (2000). : (.), T e c e e c e ce (2 ., . 881 895).
, . ., , ., & , . (2007). . J a f Me a d La a e, 56, 103 128.
, . (1965). A ec f e e f a. , A: ss.
, ., , . ., , ., & s, . (2005). . J a f E e e a P c : Lea Me , a d C , 31, 129 147.
, ., , J. ., & s, . (1998). : . La a e a d C e P ce e, 13, 21 58.
, . ., & s, . (1999). A : . J a f Me a d La a e, 41, 469 495.
, . ., & s, . (1999). s: . C e B a Re ea c , 8, 373 392.
, ., & , . (2008). 400. P c , 45, 554 558.
, A. . (1995). : A, . B a a d La a e, 50, 259 281.
, A. . (2004). . T e d C e Sc e ce, 8, 245 247.
, A. ., , J., , ., , . ., & A , A. (2006). : . P ceed f e Na a Acade f Sc e ce USA, 103, 2458 2463.
, A. ., & s, . (2000). : . J a f Me a d La a e, 43, 476 507.
, A. ., , . ., , A., & , . (2004). . Ne e , 15, 165 169.
, A. ., , A., & , A. (1996). . J a f E e e a P c : Lea Me a d C , 22, 1219 1248.
, A. ., , A., , . ., , ., & , . (2001). : A s . C e B a Re ea c , 11, 305 323.
, A. ., , ., & s, . (1999). . Me a d C , 27, 438 453.
, A. ., , ., , A., & , . (1998). . B ca P c , 47, 193 221.
ss, ., & , . (1959). . P c e a, 24, 95 112.
, . ., , . A., & , . (1997). . P c , 34, 660 676.
, . ., , ., & , A. . (2003). : A . J a f C e Ne c e ce, 15, 643 657.

(2002). D c a f ca fie a e c e a C e e X a da a a c fa c d a. : ss.
(2003). s s s s . fC e Ne c e ce, 15, 883 899.
(2000). : 600/ s s s . Ne c a, 38, 1531 1549.
., J. (1993). s s s . La a e a d C e P ce e, 8, 439 483.
A., s s ., & s , . (2004). . Sc e ce, 5669, 438 441.
, A., & , A. (2002). s s s s . C e B a Re ea c, 13, 339 356.
, A., & J s , J. (2001). s J s ? A s s ss s. s s . C e B a Re ea c, 11, 199 212.
, A., ., & , . (2007). s s s : 400. B a Re ea c, 1146, 210 218.
, J. (2000). Re ea c de C e e ea e d. X a da a a c a. : ss.
s, J. J., , A., & s, . (2004). s : . C e B a Re ea c, 19, 59 73.
J , ., , ., & , . (2009). ss s fi s . Ne c d, 47, 1799 1851.
J , ., & , . (2009). ss s s : A s . s. Ne c a, 47, 1282 1293.
, . (2000). s s. J a fNe c, 13, 57 82.
, ., , ., & , . (2007). ? A s s s s . B a a d La a e, 100, 238 256.
, ., , ., & , . (2009). s s s . J a fNe c, 22, 91 108.
, A., & s , . (2005). ss : s. J a fMe a d La a e, 52, 205 225.
, J. ., & s, . (1995). ? s s s s . J a f C e Ne c e ce, 7, 376 395.
, ., & s, . (1993). : s s ss s. J a f C e Ne c e ce, 5, 196 214.
, J., & , J. (2007). s s s s s. B a a d La a e, 100, 257 261.
, J., , J., , ., & , J. (2003). : A s s. B a d d La a e, 85, 1 36.
, . (2007). s s s s : s s. B a Re ea c, 1146, 23 49.
, ., , ., , ., & , J. (2006). s ss s s s s. La a e a d C e P ce e, 21, 489 530.
, ., , A., , ., & , J. (2007). s s ss s s s: s. B a a d La a e, 100, 223 238.
, ., , ., & , J. (2003). s s ss s s s s s. C e B a Re ea c, 17, 117 129.
, ., , ., ., & , J. (2006). s s s s s : s s s ss . J a f Ab a P c , 115, 251 265.
s, ., & , . (2000). s s ss s . T e d C e Sc e ce, 4, 463 470.
s, ., & , A. (1980). s s ss s s: fl s . Sc e ce, 207, 203 205.
s, ., & , . (1994). s s s fi : s s. A. s (.), Ha db f c c (. 83 143). A: A ss.
, ., , ., & , . (2006). s s . J a f C e Ne c e ce, 10, 1774 1787.
, ., s , ., & J , . (2008). A s s s fi : A s s. B d Re ea c, 1228, 161 176.
, J. ., & , s, . (1997). s s s. C e B a Re ea c, 5, 193 203.
, ., , ., & s, . (1998). s s . Na e, 395, 71 73.
, ., , ., & J , s, . (1997). ss s s s s s s. J a f C e Ne c e ce, 9, 318 329.
, J., , J. ., ss, A., s , ., & , . (1991). s s ss ss s: s. J a f C e Ne c e ce, 3, 151 165.
, ., & , J. J. A. (2005). s s s s ss s s s. C e B a Re ed c, 24, 691 701.
, ., & , J. J. A. (2006). s : 400 s s. J a f C e Ne c e ce, 18, 1098 1111.
, ., & , J. J. A. (2008). s s s s : s. B a a d La a e, 106, 119 131.
s, ., , J., , ., , ., , ., & ss , . (2007). s s s s: . Ne a e, 37, 361 378.
, ., & , A. (2007). s s s ss s . H a B a Ma , 28, 585 592.
s , . (1997). s s s s: s s ss s. B a a d La a e, 59, 494 522.
s , ., & , J. (1992). s s s . J a f Me a d La a e, 31, 785 806.
s , ., & , A. (1995). s . J a f Me a d La a e, 34, 739 773.
s , ., & , J. (1999). s ss, s s s s s. La a e a d C e P ce e, 14, 283 317.
, A., & , . (2006). s s s. P c , 43, 440 449.
, ., & , . (2007). s fl : s ss fi s s? J a f E e e a P c : Ge e a, 136, 485 501.
, ., , ., , ., & , . (2008). s s s s s. J a f C e Ne c e ce, 20, 2037 2057.
, J. J. A., , ., & , . (1999). s s ss : s. J a f Me a d La a e, 41, 147 182.
, J. J. A., , ., , ., & s , . (2003). s fl s s s. P c , 40, 235 248.
, ., , J., & , J. (2006). s s s s s: fl s . J a f C e Ne c e ce, 18, 1181 1197.
, ., , J., & , . J. (2005). A s 600 s s. C e B a Re ea c, 22, 241 255.
, ., s , ., , J., s , ., s , J., & s, . (1999). ss s : A s. J a f C e Ne c e ce S e e , 46.
ss s, ., , J., & , J. (2006). s : ss s s s s. B a Re ea c, 1106, 150 163.
ss s, ., , J., & , J. (2007). s s s s s s : s. B ca P c , 75, 8 18.
ss s, ., , J., , ., & , J. (2008). s : s s. Ne c a, 46, 967 982.
, ., , ., & s, . (2004). A s s : A s s s s. J a f C e Ne c e ce, 16, 1272 1288.
, ., & , . (2007). : s s s s s s. Ne c a, 45, 3001 3014.
, ., , A., & , . (2006). s ss s s : s. B a Re ea c, 1071, 186 196.
, ., & , . (2007). s ss s s s : A s. B a Re ea c, 1142, 135 145.
, ., & , . (2008). s : s. B a Re ea c, 1203, 103 115.
, ., & , . (2009). ss . Ne c e ce & B be a a Re e , 33, 1168 1177.
, ., & , . (2009). fl s s : . Ne a e, 48, 280 290.
, J., & , . (2008). s s s s s . Ne e , 19, 745 749.