◆ Human Brain Mapping 30:1338–1351 (2009) ◆

Parsing Neural Mechanisms of Social and Physical Risk Identifications

Jungang Qin[1] and Shihui Han[1,2]*

[1]*Department of Psychology and Functional Imaging Center, Academy for Advanced Interdisciplinary Studies, Peking University, Beijing, 100871, Peoples Republic of China*
[2]*State Key Laboratory of Cognitive Neuroscience and Learning, Beijing Normal Univresity, Beijing, Peoples Republic of China*

Abstract:
. ,
.
(C, /10)/
(CC) (CC) -
. , C
CC . , C -
CC -
. ,
/ CC . -
, , /
.
-
. *Hum Brain Mapp 30:1338–1351, 2009.* © **2008 Wiley-Liss, Inc.**

Key words: , , / , ,

INTRODUCTION

- -

C
C , C 30 3002 .
*C , . ., -
, U , , 100 1, ,
C . - . .
22 200 ,
200 - -
10.1002/ .20 04
20 200 (. ., 2002 . ,
. .).

-
, C (/32)
, 2003 . ,
-
, 200 ,
., 2002, ., 2001 ,
-
.

MATERIALS AND METHODS

Participants

(
, , 20 31 , 23.4 ± 2. ,
±)
. -
, - - ,
. -
-
. .

Stimuli, Tasks, and Experimental Design

C
- -
, . -
- .
C (10 C
, 1. 1°
× 0. 1° 6. ° × 0. 1° (×) -
0),
.
4 4
. -
(. ., -
) -
, , ." "
, "
" (
). 4
4
.
(. .,
)
- ,
" ."
,
" ."

TABLE I. Examples of the situations employed in this study

. 2002 .
, 22
- (0 = , 1 =
, 2 = , 3 = , 4 =
). t
(-
2.0 ± 0.62 . 2. 0 ± 0. 1, t (21) = . 4, $P < 0.001$,
0.21 ± 0.1 . 0.33 ± 0.2 , t (21) = 4.12, $P <$
0.001).
. 0. 0. 1,
, 0. 4
0. , .
1.
,
-
(?")
(?") . -
/
/
.
, .
2,000 , (. .,
).
,
. -
. , -
.
2, 00

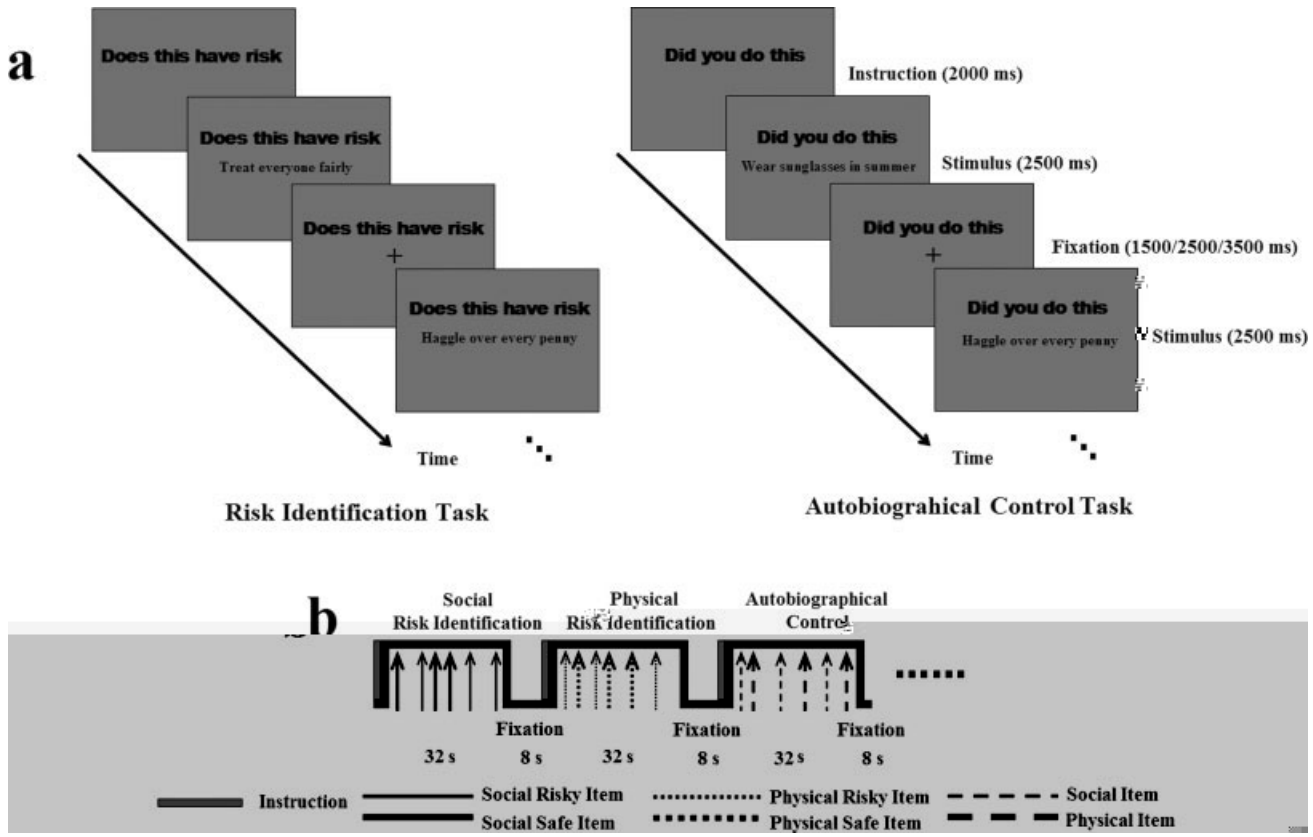

Figure 1.

Illustration of the experimental design. (**a**) Illustration of the risk identification task and the autobiographical control task; (**b**) Illustration of three sessions in one scan. Each session started with the presentation of instructions to define the task (i.e., risk identification or autobiographical control). Each session consisted of six trials. Risk and safe items were presented in a random order in each session.

1, 00, , = 30 , = 220 , = 0°). -
2, 00, 3, 00 . 32 . - 3 1-
,000 . (2 × 2 × 1 0. 3 ×
- 0. 3 × 1.3 3 , = 1,00 , =
- . 3. 3). ,
, .
-
(0 = , =)
-

Data Analysis

- ( ) (. -
- .) (.
) . - *t*

fMRI Data Acquisition

3-
C .
. - 2 (C ,
- , U)
- - (4 × 4 × 32 . -
3.4 × 3.4 × 4.4 3 , = 2,000

, [illegible]

(// . - . . . / -
/ .).

-

$2 \times 2 \times 2$ [3] ,

( ) -

, [illegible] ( )

.

- ,

( ) . (

(, $y = \beta x + \varepsilon$, .) (

y .) .

(βx) (ε)) -

. ,

(βx) ,

- ,

(ε) (-). - ( )

(βx)

- - .

(ε) (-

). - (10-

- (- 3- C/ CC -

(CC),).

).

- 0.3 (// . .).

.

-

( ). **RESULTS**

. **Behavioral Data**

- 12 . -

, [illegible]

- [illegible] 3.4% ± 4. 6% 4 , [illegible] 0.2%

. U ± 6.10% 4 , [illegible] 2.46% ± . 4%

- , - 4 , [illegible] 4.31% ± 3. 1%

- 4 .

( )

. , ($F(1,13) = 11.34$, $P < 0.00$),

, (1 4.23 ± 6 .21

- , 1 22. 2 ± [illegible]. 3)

(1 0.42 ± 3. 6 , 1 . 4 ±

- , - 6 .).

, ($P > 0.0$).

-

-

. (16 14 ± 233 . 1 ± 31 , $t(13) = 1.23$, $P > 0.0$).

. -

-

( ) - (3. 1 ± 0. 6 . 4. 0 ± 0.66, $t(13) =$ [illegible] .3 , $P < 0.001$)

( ). (0. 4 ± 0.32 . 0.4 ± 0.3 , $t(13) = 0.$, $P > 0.0$).

.

Neural Activities Related to Identification of Social and Physical Risks

.

P- 0.0 (- -

). , -

-

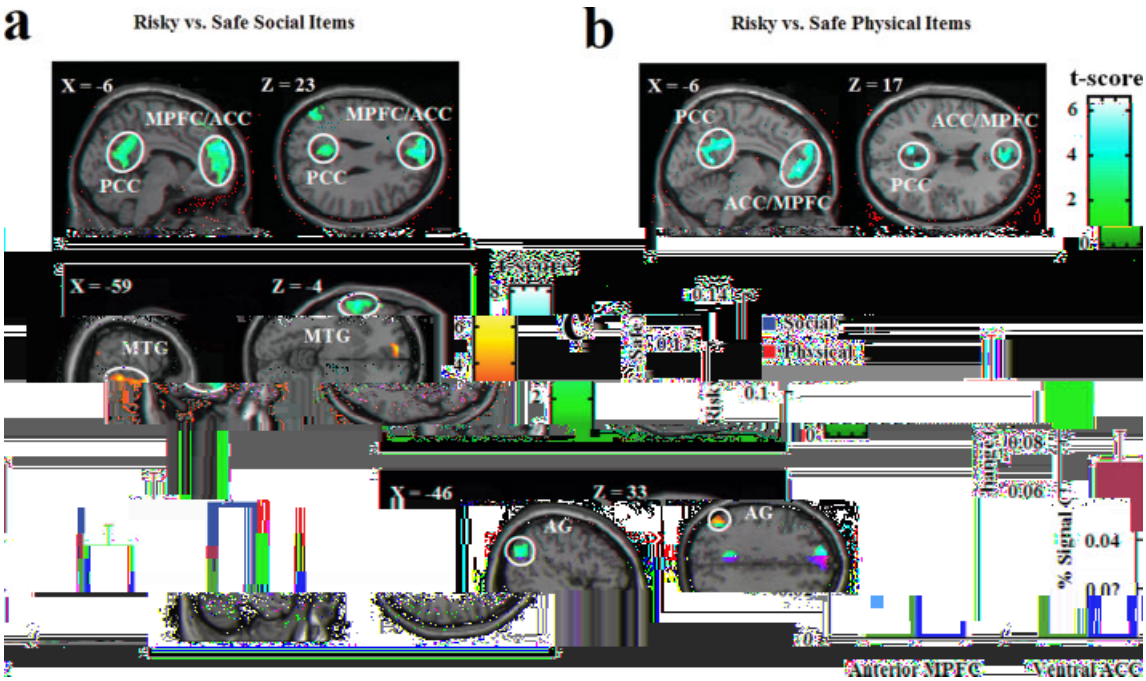

Figure 2.

(**a**) Increased activation associated with identification of social risky relative to safe items; (**b**) Increased activation associated with identification of physical risky relative to safe items; (**c**) Percent signal changes in the ROIs (anterior MPFC and ventral ACC) differentiating identification of risky social (or physical) items relative to safe social (or physical) items. Bars indicate standard error of the mean. MTG = Middle Temporal Gyrus; AG = Angular Gyrus. [Color figure can be viewed in the online issue, which is available at www.interscience.wiley.com.]

, . ., C
, . CC. -
C/ CC, CC, ,
, (. 2 , . -
). - -
CC CC/ C - C
(. 2).
, - (*F*(1,13) = 4 . , *P* <
C/ CC 0.001). ,

TABLE II. Brain activities associated with identification of risky items

		X	*Y*	*Z*	*Z*-	
>						
C ( )/ C ( )	/10 ( )	−14	4	2	4.41	1 14
		−		23	4.	
C ( )/C ( )	31/23( )	−4	−		3. 3	3
		−	−	30	3.	
( )	21 ( )	−		−12	4. 0	4
( )	3 ( )	−4	−1	33	3. 0	3
>						
C ( )/ C	31( )	−14	−33	33	3. 2	
		−	− 4	1	3.	
C ( )/ C ( )	32/10 ( )	−	43	3	3. 2	14
		−		2	3. 0	

, , , , 0.00 , > 30, < 0.0 .

,
×
, -
($F(1,13) = .3$, $P < 0.0$, . 2). -
.
, CC
,
($F(1,13) =$ /
, .20, $P < 0.001$) ( )/ CC,
CC . / ,
×
, ,
($F(1,13) = 4.4$, $P < 0.0$), , , (. 4 ,).
CC ,
/ (. 4). -
.
,
.
Correlation Between Subjective Reports and Neural Activities
C
(. 4).
, ,
C/ CC CC .
,
-
(. -
).
C
(. 4 ,). ,
($r = -0.4$, $P = 0.042$, . 3). ,
-
CC ($r = 0.41$, $P = 0.046$, . 3). / (.
, 4).
.
. -
CC
($r = 0.$, $P = 0.05$, . 3).
CC -
($r = 0.32$, $P = 0.0 0$,
. 3). CC
-
($r = 0.24$, $P = 0.0 4$, . 3).
-
10. ± 4.4 . ± 2.
(2),
.
, , ,
(. ., C -
. , $r =$
0.4 , $P = 0.0 4$, CC
. , $r = -0.43$, $P = 0.120$).

Neural Activities Related to Ongoing Task Demands and Trial-Specific Processes

-
, -

.
-

DISCUSSION

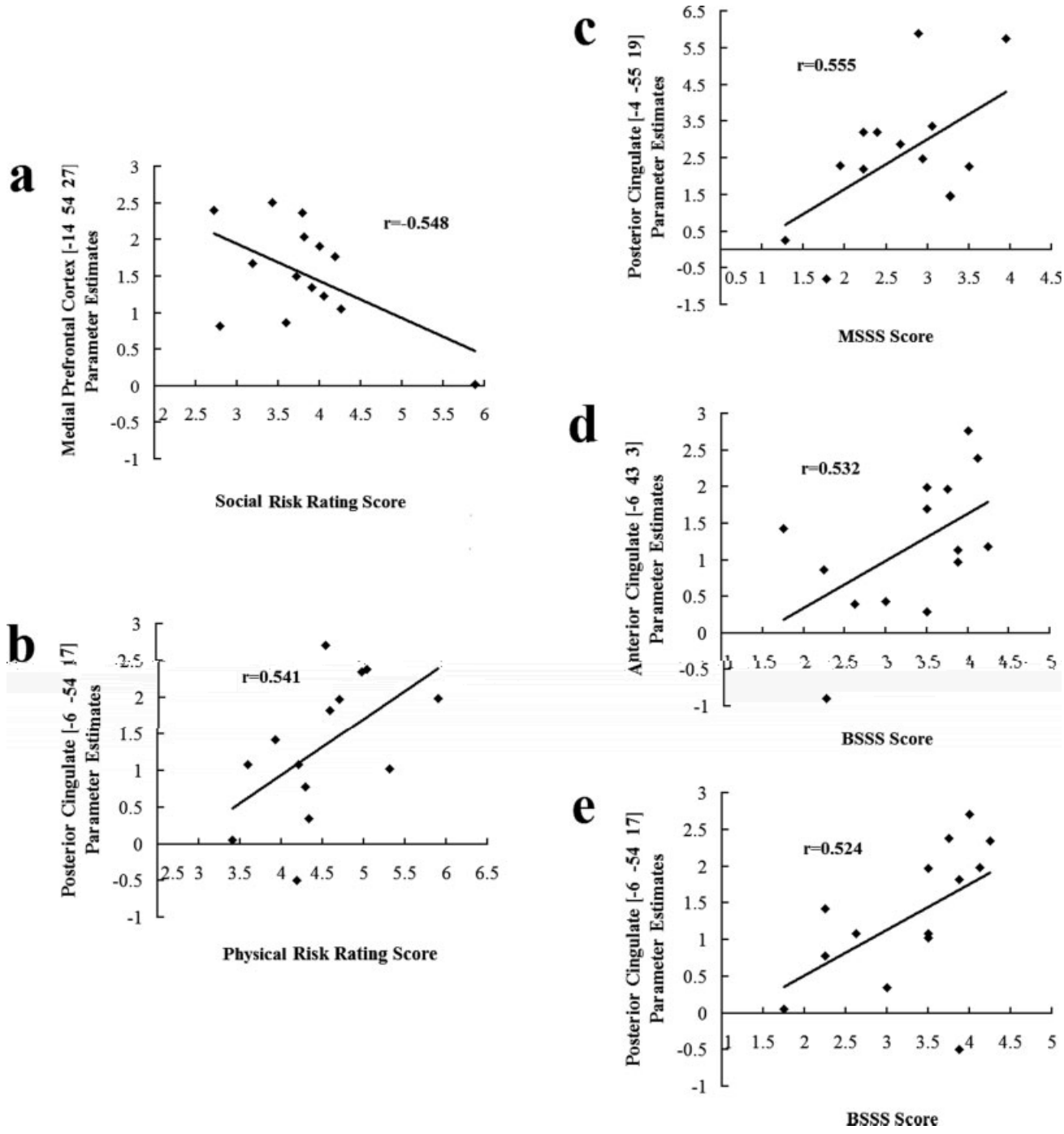

Figure 3.

(**a**) Correlation between activation level (parameter estimates) observed within anterior MPFC related to risky social items and

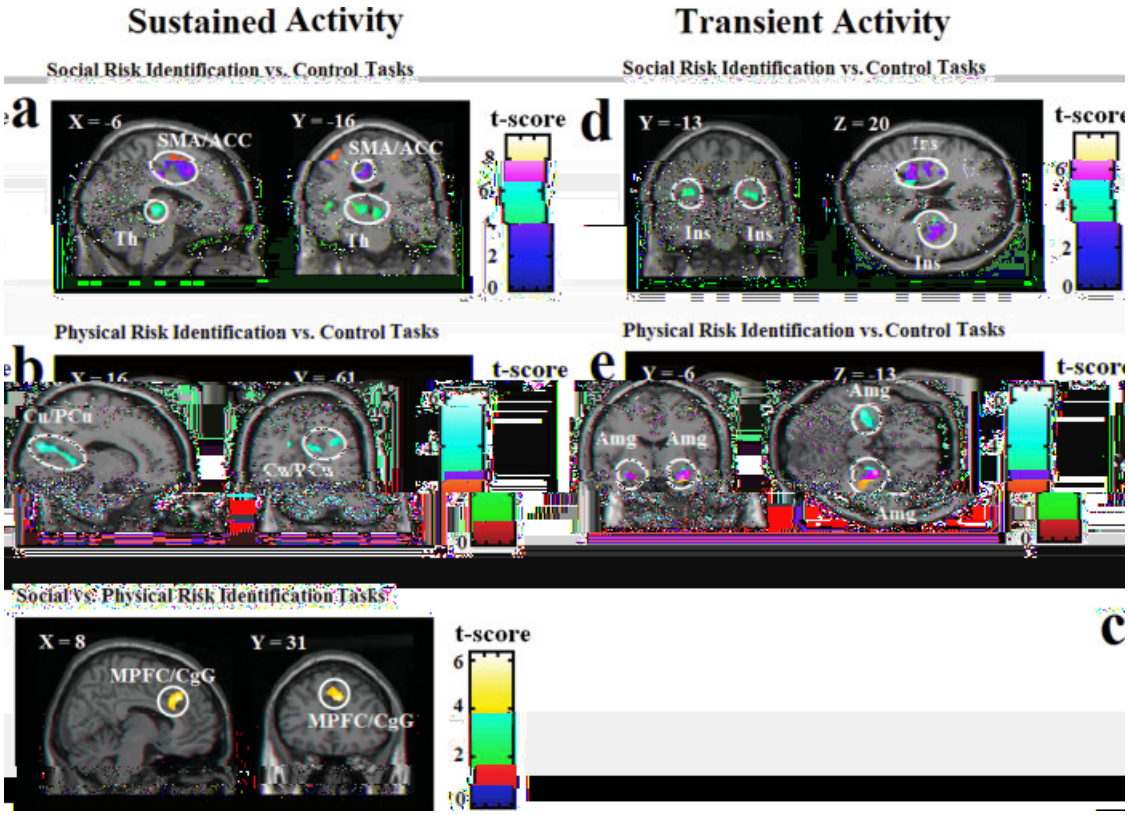

Figure 4.

Sustained and transient neural activities associated with social and physical risk identification tasks. (**a**) Sustained activities linked to social risk identification vs. autobiographical control tasks; (**b**) Sustained activities associated with physical risk identification vs. autobiographical control tasks; (**c**) Sustained activities linked to social vs. physical risk identification tasks; (**d**) Transient activities associated with social risk identification vs. autobiographical control tasks; (**e**) Transient activities linked to physical risk identification vs. autobiographical control tasks. SMA = Supplementary Motor Area; Th = Thalamus; Cu = Cuneus; Pcu = Precuneus; CgG = Cingulate Gyrus; Ins = Insula; Amg = Amgydala. [Color figure can be viewed in the online issue, which is available at www.interscience.wiley.com.]

TABLE III. Sustained activities associated with risk identification

			X	*Y*	*Z*	*Z*-	
>							
( )/	( )	13/4 ( )	−4	−13	4	3. 3	1021
( )/	C ( )	¿/32/24( )	−¿	−1¿	3	3.	2
			−10	1	43	3. ¿	
( )		1 ( )	−3¿	−	1	3. 3	1
			−	−21	1	.0	4
				−1	−1	4.12	
( )/	( )	¿/3( )	−40	−1	¿	3. ¿	4 0
C ( )			2¿	− 2	−21	4.12	404
( )/	( )	1 /1 ( )	24	− 2	2	3.3	33¿
>							
C ( )/	( )	1 /1 /31( )	14	− ¿	2¿	4.0¿	
>							
C		/32		31	32	4.20	4
			−10	1	41	3.¿	
( )		21/22( )	−	−33	−2	3. 3	3 4

, , , , , , 0.00 , > 30, < 0.0 .

TABLE IV. Transient activities associated with risk identification

			X	*Y*	*Z*	*Z*-	
>							
( )		13( )	−34	−24	2	4.6	613
( )		13( )	46	−13	1	3.34	2
>							
( )/	( )		46	−20	−	4.20	63
( )/	( )		−34	−16	−	4.2	4 4

, , , , , , *P* 0.00 , > 30, *P* < 0.0 (46 13 1 , *P* < 0.06).

, CC .
CC -
., 2001 , - C ., 2003, , 2001, .,
2004 , ., 2006 , 2001, ., 1
C , 1 ,
., 2003 . CC
. , - .,
C 2003, ., 2002, ., 2002 . -
. , -
C
- . ,
. -
, CC CC
,
- ., 2002
C. .
C
. CC
,
- .
, , 1 3, ' ., 2004, -
- , 2003 ,
/ CC
., 2002, ., 2000, ., 2003 . -
, -
. -
CC -
CC -
. CC CC
- .
., 2000 CC

- -
, 2004 . CC , . -
,
CC
- C
. , 200 . , -
CC CC -
, -
. , CC -
-
. .

Neural Substrates Associated With Risk Identification Tasks

., 2002 ., 200 . . CC
CC .
(CC, - . C
)
., 2000, ., 200, -
., 2003, ., 200 . , . , -
,

., 1 , ., .
2004 . C

.
- -
., 200 . .
C/ -
CC CC - . ,
', 20 31 ,

. -
.
., 2003, ., 2001 .

., 200 , , 31 , 3 3
-
., 2002, ., 200 .
- .
,
-
.
. ,
.
,

. -
, -
( )
- , , , C ,
., 2002 . , - (2004) C
- . 23 14 0 14 1.
- , (200)
C , . 2 33
2000 . - 3 2.
, , , (2002)
. - . 12 1 1 .
, C (2000)
". 123 1122 1141.
. , , U (2001) - -
. 4 .
, U (200) - -
. 1 33 4 .
. - , , (2004)
., 200 , . 3 0 3 .
., 200 , , , , (2003) -
-

CONCLUSION

REFERENCES

- .
1 2 41.
, , (2000) C -
. C 4 21 222.
C , (200)
. 12 4 3.
C , , (200)
. C 4 133 1 3.
C , , C, C,
(2003) . -
3 4 .
C , C , (2004)
, -
, . C
1 1 1 2 .
(2004) . 2
.
, , , , ( )
- -
. 2 4 0 4.
(2004)
1 -
2 442 444.
(2) C .
.
, , C , C , , ,
, , , , , C -
, (2004) C -
. 42 1 1 .
, , , C, , C
(2003)
.
1 0 1 3 1 4 .
U, C (2003)
. 3 4 4 3.
U, C (200) .
0 31 34.
, (200)
-
. 33 2 3 2 4.
, , C , ,
(2004)
. C
C 14 1214 122 .
, , , , C
(2001)
. 2 3 210 210 .
, , (200) -
-
- . 1 300 304.
, (3) , ,
. 14 41 2.
, , , ,
(2002)
. 32 401 414.
C, (2004)
, -
.
13 0 1 .
, , , , C (200)
.
2 2 2 .
C, C, , , , -
(2002) - .
12 1 0 1 14.
, , , - , (2000)
.
11 23 .
, C , C , C , ,
(2002) -
C 14 4.
, C , , C , ,
C C (2004)
. 303 1023 102 .
, , , C ,
(200)
- - . 32 4 4 4.
, , , ,
, ( )
. 3 143 1444.
C , , , (2002)
-
. 1 24 3 .
, C , , (200) -
.
C C 1 42 4 .
, U, C , (2001)
. 12 2 2 .
, U ( )
. 30 1 20 .
C , (0) C -
. 3 422 43 .
( )
.
22 310 31 .
, (2001)
. 104
, , (2003) -
. 1 30 41.
, C , C (2000) -
-
. 10 4 4 2.
, - , (2001)
. 124 11 11 0.
(200) C
. , U , ,
. U . U
. 22 2 .
, , , , ,
C (200)
- . 31 3 3 .
C , (200) -
. 1220 122 .
, , - ,
(2003) -
. C -
1 3 4 40 .
, - , , , ,
C - , (200)
. C 1
.

, (200) C -
, ,
C C 14 0 42 .
, , C, (2004)
. 10 221 234.
( )
.
(200) -
. 30 3 .
, , - , , (2004) -
-
. 11 10 112.
, C, , , , -
, , (2003)
.
C, , , (2003)
-
.
1 143 144 .
, , (200)
- -
2 0 1 .
, , , (2002)
-
. 1 331 34 .
, , , , ,
(2001)
U 2.
, C (2004) - .
2 1 1 2.
2003)
.
, , C , C 200) -
.
, C , (2004) U
. 124.
, , , , ,
, , (2000)
- -
. 4 43 0.
( ) . 1 3.
(2)
. , ,
. .

, ( )
. C ,
, .
.
, , (2002)
. , , , . -
.
.
(200)
.
- 3 1 1 1 1.
, ( ) C
.
, C , (200)
. 44 21 21 0.
, (200)
- .
3 1 2 .
, C, , , ,
(200)
( ) . -
4 3242 32 0.
U, , (2002) - -
.
1 2 3 2 0.
, , -C , (2003)
.
41 13 14 .
C , , ( )
.
3 103 11 .
, , , ,
, (200) -
.
2 1 2 .
, , (2002)
-
. 2 2 3.
, , , (200) -
,
.
43 24 2 .
(2003) -
. 41 123.
, , , (200)
- . 34 1310 131 .