

T - a e erce ua , ear , , brea , , ua , cr , d ,

.....
.....
..... (.....)

Z u Z u*

- / ,
..... , ,



.....
.....
..... (.....)

Z e , Fa *

- / ,
..... , ,



Ma e r a a d e d

Sub ec

1, () E () E
E () 3, () E () 2, () E ()
10 () E 5. A () 4,

. N . A 18 26 .
D P H .

S .. u . a . d de . .

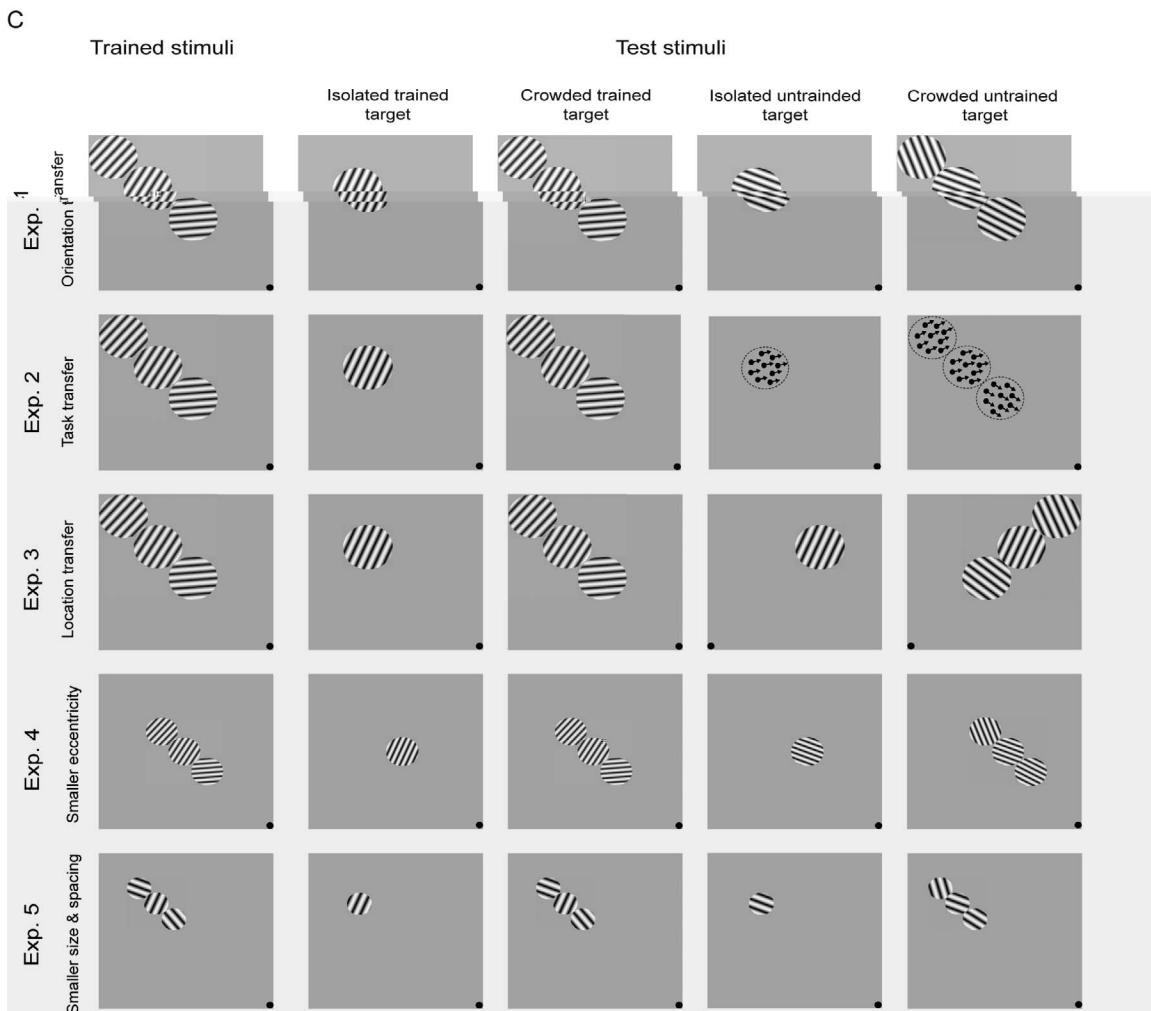
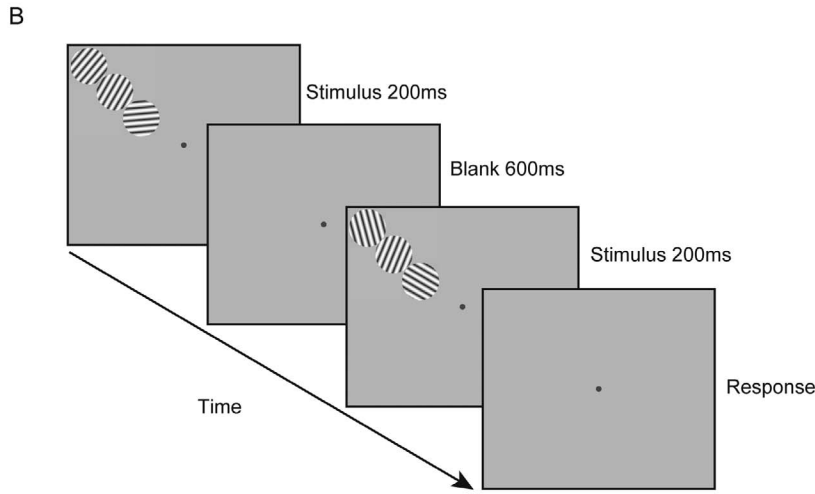
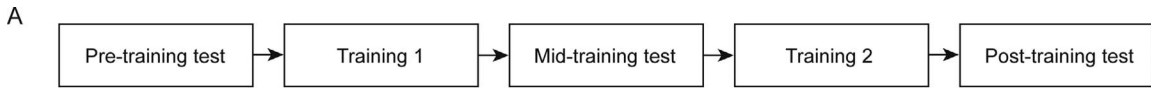
MM906 ; II AMA : 100
H ; : 1024 × 768; : 19 .
(: 47.59 / ²).
57 ,

. E
E 1 :
(P), ()
1), (M),
(2), (P ;
F 1A). D ,
() (: 1.5°;
: 2 /°; M : 1;
: 47.59 / ²; : 10°;
(F 1B). F , θ
(67.5° 157.5°; 0°)

. A
(1) E (40)
() & P , 1983). I $\theta \pm \Delta\theta$
200
600- (F 1B).

3°.

(L , H , & K , 2002; P & 2008)
I , 1996; I & C , 2001;
(H , C , & , 1991). A
(H & M , 2015; L , 2008; & L , 2011).
(, 2011; & , 2015). O
H & N , 2007; H , A , & M G , 2012; , C , & , 2010; & , 2015)
A
H ,
: ()
C ? I
I



1. (), () . () () . () 1, - . () () . () 1, .

I (2014). (G, P, & G, P, 800, 1200). $\Delta\theta$ E 75% D (F 1C,).

E (), F E, M, P. P M M () // $\times 100\%$ ($\times 100\%$), 67.5° 157.5°

E 2 3 E 1. () E 1 2 3. I E 2, E 1 (DK; : 1.5°; : 8/°²; : 10°/; : 0.01 / ²). DK E 1 60°, DK (F 1C, 67.5° 157.5°).

I E 3, E 1 (F 1C, (F 2A).

E 4 E - 4 E 1, 6° 0.98°

E 1 4 (D & B , 1.96° (F 1C,). E 5 1. I : E 1, M . E 1, (F 1C, 10).

Data

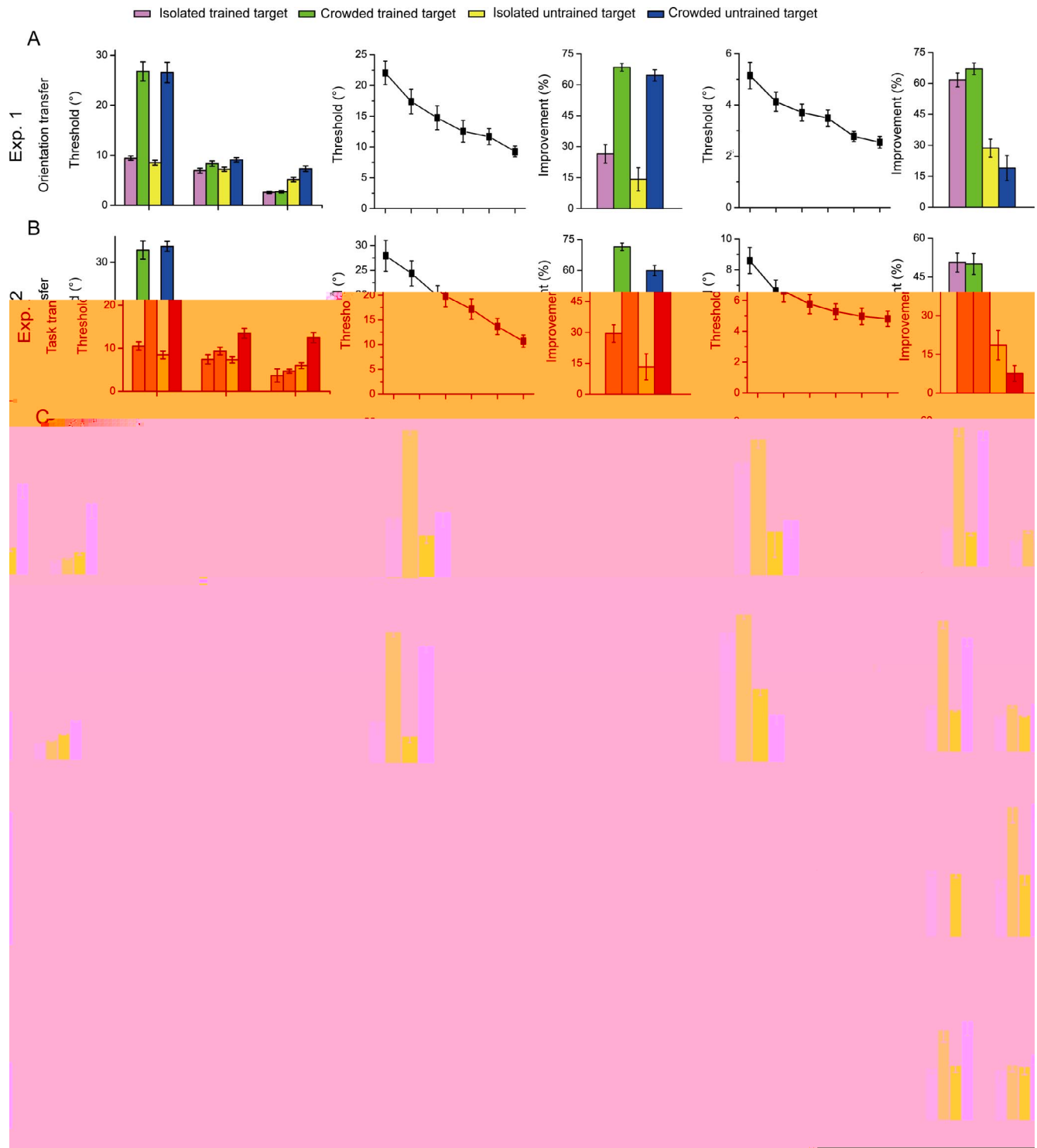
F E, P, M, P. P M M () // $\times 100\%$ ($\times 100\%$), 67.5° 157.5°

Re u

E ep. e 1: Perce ua. ear... cr. ded . re a... a d. ra fer. cr. ded . r... a. re a...

A E 30 E 40 . B , P : (F 2A).

(7) = 10.12, < 0.001; (7) = 10.23, < 0.001,



1, () () 1,

1

learning curve.

(,)

1

D 1, 1,760 ± 302 (1.5 ±), E

M , P . A

0.05, , (7) = 2.37, > 1,

P M (68.47% ± 1.86%), (26.54% ± 4.51%), (64.60% ± 2.77%), (7) > 5.61, < 0.001, (14.22% ± 5.64%), (7) = 2.02, > 0.05.

, (7) = 2.74, < 0.05. A

. H ,

. I ,

1

2011; G , & M , 2002; (A & , M , & O , 2006; , , & O , 2001).

D 2, . A P ,

0.05. , (7) = 0.81, >

M P 67.07% ± 2.79% , 61.68% ± 3.36% , 19.02% ± 6.06% , 28.64% ± 4.36% , (7) > 2.86, < 0.05.

() ,

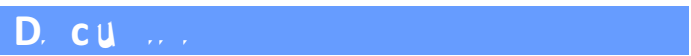
0.05. (8) = 3.801, < 0.01. (53.48% ± 3.48%), (44.87% ± 4.66%), (22.78% ± 7.12%) (7) > 2.92, < 0.05, (12.85% ± 10.16%), (7) = 1.52, > 0.05. A (8) > 2.55, < 0.05.

E exp. e 4: Perce ua. ear... cr. ded
 . re a... a . a. er ecce p.c
 E 4
 E 1 6°
 E 4. A P , (7) > 7.11, < 0.001 (F 2D). 1,720 ± 418
 . F P M , 63.39% ± 2.56%, 19.01% ± 5.76%, 55.43% ± 3.28%, 12.55% ± 3.10%, (7) > 3.04, < 0.05.

E exp. e 3: Perce ua. ear... cr. ded
 . re a... a. d. ra fer . e . . e
 . ua. e .-f.e.d
 E 3
 E 1, 57.20% ± 1.95%, 49.14% ± 3.94%, 18.00% ± 3.71%, 28.02% ± 2.72%, (7) > 4.22, < 0.01.
 E 1.

E exp. e 5: L . ed effec . f erce ua
 . ear... cr. ded . re a...
 I E 5, E 1. E
 1. A P , (7) > 12.97, < 0.001 (F 2C). 1 2,090 ± 407 . I . P
 (. .) . P
 P M 72.77% ± 2.33%, 31.32% ± 4.90%, 34.54% ± 7.03%, 21.18% ± 4.08%, (7) > 4.52, < 0.01. D
 E 1 2, E . F 2E). (90°

D 1, H, E 1.
 10, A
 M, P, (9) < 0.73, > 0.05. A



E, (9) > 4.45, < 0.01.
 1, (9) = 0.33, > 0.05.

P, I ()

E 1, E 5. B 5.
 E 5, I E 5.

(. .,). H, I
 () ;
 N, I

E 1. A P, (3) > 3.77, < 0.05. 1
 2,100 ± 439. F H

I, (, 2011;
 & , 2015). C
 (C , 2007; H & N , 2007;
 , 2012; , 2010; , 2015)

P M, 38.78% ± 2.30%
 , 3.52% ± 2.90%
 , 33.87% ± 7.91%
 , 2.08% ± 4.13%
 A M, (4) = 1.61, > 0.05,
 1,

P 30% 88%,
 H,
 O

I E 1 5, (. .)
 P .
 E 1, 3-
 F 67.5°
 157.5° , 67.5°
 157.5° , 17.29%, & , 2008).
 23.21%, 13.98%, 30.02%,

F, D
 E,
 I,
 E 5.
 C ()
 (L , 2002; P

(Cochran, A., & C. (2014).
 C., A., C. (2007).

. I . M . C .
 . M . (C & ,
 2002),
 . B . (2010)

. H ? O . I . A
 (H ., 1996)
 (., 2005).
 (B ., 1970). I
 . I . P . (2007; P &
 , 2008) .” A
 . O .” A
 . A . I . A
 A . E 5, . A . A
 . C . (J. C ., 2014;
 K ., B ., M ., & , 2014; M ., A .,
 C ., & , 2013)
 . B .
 . F . (A .,
 G ., & C ., 2012; C . & C .,
 2009). . O .

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N FC 31230029, MO 2015CB351800, N FC 31421003, N FC 61527804.

* F C C : F F E : @ A : PK -IDG/M G I B , P , B , P . C

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(N. C , 2015; L & G , 2008; , 2001). I (A & H , 1997, 2004), (H & , 2014; J , D , L , & L , 2010). I . G . I

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M., . . ., A., A. C., C., . . ., L., & . . ., B., . . . (2013). . . . 1. *C C*, . . ., 7, 1–9.

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 11533.
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 B
 & , 33, 113–120.
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 A , 66,
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 C , 15,
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 15(11):16, 1–13, :10.1167/15.11.16. P M
 A