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: 2016-08-23; : 2016-08-26; : 2016-09-30

12),
Super Hirn((1A).
Super Brain) . 2014~2016 , ,
2014 27 ?
, 2016 ,
22 () . [1].
“ ”. ,
“ ” ?
(1) , “ ”
1 “ ” ,
“ ” ; (2) “ ”

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(autism spectrum disorder, ASD)

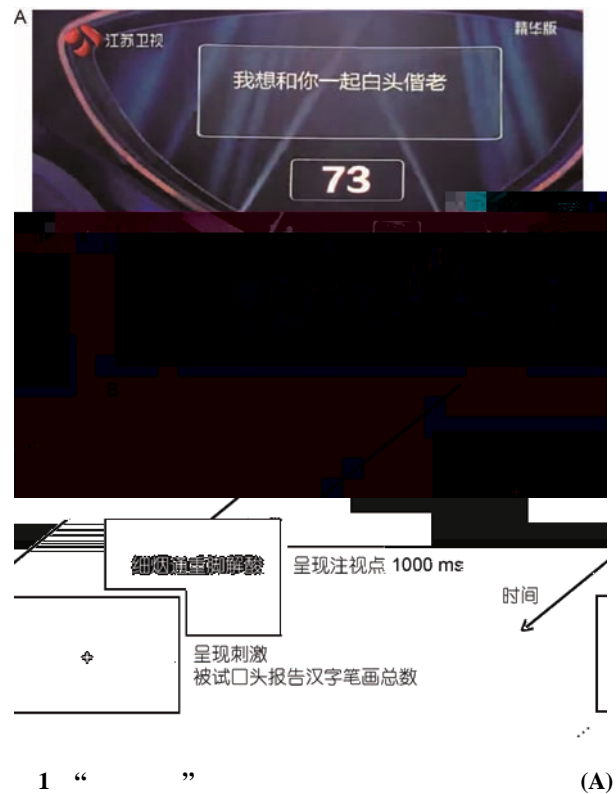
(numerosity estimation)^[2-4].

(1B).

(functional Magnetic Resonance Imaging,

fMRI)

(left hippocampus)



1 “ ” (A) (B)()

(autism spectrum disorder, ASD) (obsessive compulsive disorder, OCD)

(autism-spectrum quotient, AQ) (obsessive-compulsive inventory-revised, OCI-R)

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[4]

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(savant

syndrome)

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[5,6]

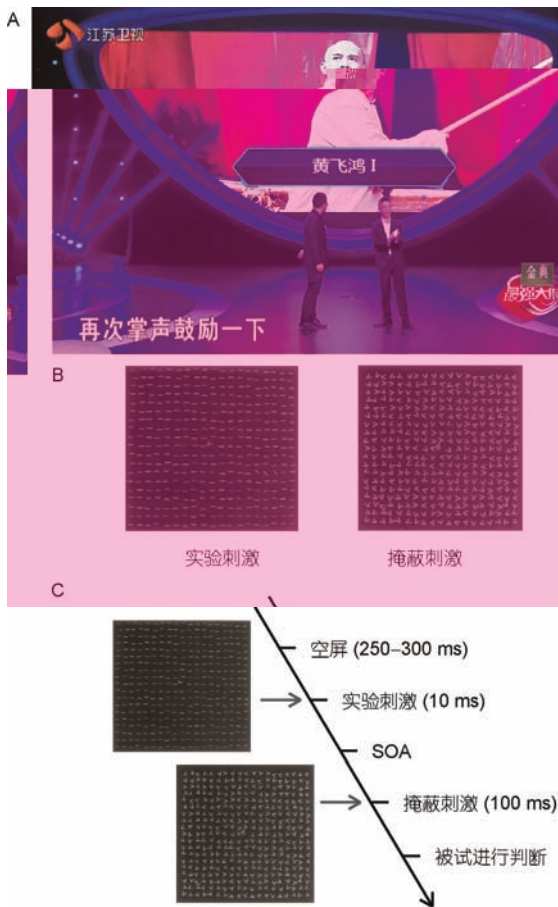
(

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,

(calendar calculating,

!N+EE565426SAF%HEH0LPWç2 94/C20 1 f 0.018 Tc 0.778 .479 T 94/CBTj 3TT0 1A2C60.0135 Tc 17.3



2 “ ” (A) (B) TDT (C) ()

1000) , 50%~ 70%, 40~50 ms [8], 40~50 ms,

, TDT 10

, [13] [14] [9-12]

(V1)^[15] ,

[9], [8,16], [17,18], (V1), [19], [20,21], (amblyopia), 12, [22,23], 3, “ ”, 50, 15 min, 50 (3A). (multiple-object tracking, MOT) , 30, 1998 , Pylyshyn Storm [24], (target item),



3
”(A) [25](B)()

(distractor item).
7~15 s.
(3B).
capacity).
(tracking

15 min 50 [25]

50

(visual attention)

(multifocal attention), [24] [25]

(visual index)
(switch model) (preattentive indexes theory).

, Green Bavelier

2 [26]

“ ”

[27]

(superior parietal lobule, SPL)

(frontal eye fields, FEF) (intraparietal sulcus, IPS)
(middle temporal complex, MT+)^[28-31], SPL FEF
MT+ , IPS

4

“ ”

(4A).

(biological motion)

Johansson(1973)

(4B)^[32].

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- ” : “ , ” , ”
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- 1 Zhou X, Marslen-Wilson W. Phonology, orthography, and semantic activation in reading Chinese. *J Mem Lang*, 1999, 41: 579–606
 - 2 Soulières I, Hubert B, Rouleau N, et al. Superior estimation abilities in two autistic spectrum children. *Cogn Neuropsychol*, 2010, 27: 261–276
 - 3 Falter C M, Braeutigam S, Nathan R, et al. Enhanced access to early visual processing of perceptual simultaneity in autism spectrum disorders. *J Autism Dev Disord*, 2013, 43: 1857–1866
 - 4 Snyder A. Explaining and inducing savant skills: privileged access to lower level, less-processed information. *Philos Trans R Soc Lond B Biol Sci*, 2009, 364: 1399–1405
 - 5 Miller L K. The savant syndrome: intellectual impairment and exceptional skill. *Psychol Bull*, 1999, 125: 31
 - 6 Treffert D A. The savant syndrome: an extraordinary condition. A synopsis: past, present, future. *Philos Trans R Soc Lond B Biol Sci*, 2009, 364: 1351–1357
 - 7 Heaton P, Wallace G L. Annotation: The savant syndrome. *J Child Psychol Psychiatry*, 2004, 45: 899–911
 - 8 Karni A, Sagi D. Where practice makes perfect in texture discrimination: evidence for primary visual cortex plasticity. *Proc Natl Acad Sci USA*, 1991, 88: 4966–4970
 - 9 Poggio T, Fahle M, Edelman S. Fast perceptual learning in visual hyperacuity. *Science*, 1991, 256: 1018–1021
 - 10 Doshier B A, Lu Z L. Mechanisms of perceptual learning. *Vision Res*, 1999, 39: 3197–3221
 - 11 Adini Y, Sagi D, Tsodyks M. Context-enabled learning in the human visual system. *Nature*, 2002, 415: 790–793
 - 12 Ball K, Sekuler R. A specific and enduring improvement in visual motion discrimination. *Science*, 1982, 218: 697–698
 - 13 Harris J A, Harris I M, Diamond M E. The topography of tactile learning in humans. *J Neurosci*, 2001, 21: 1056–1061
 - 14 Wright B A, Buonomano D V, Mahncke H W, et al. Learning and generalization of auditory temporal–interval discrimination in humans. *J Neurosci*, 1997, 17: 3956–3963
 - 15 Schwartz S, Maquet P, Frith C. Neural correlates of perceptual learning: a functional MRI study of visual texture discrimination. *Proc Natl Acad Sci USA*, 2002, 99: 17137–17142
 - 16 Schoups A A, Vogels R, Orban G A. Human perceptual learning in identifying the oblique orientation: retinotopy, orientation specificity and monocularly. *J Physiol*, 1995, 483: 797
 - 17 Ahissar M, Hochstein S. The reverse hierarchy theory of visual perceptual learning. *Trends Cogn Sci*, 2004, 8: 457–464
 - 18 Li W, Piëch V, Gilbert C D. Perceptual learning and top-down influences in primary visual cortex. *Nat Neurosci*, 2004, 7: 651–657
 - 19 Schoups A, Vogels R, Qian N, et al. Practising orientation identification improves orientation coding in V1 neurons. *Nature*, 2001, 412: 549–553
 - 20 Zohary E, Celebrini S, Britten K H, et al. Neuronal plasticity that underlies improvement in perceptual performance. *Science*, 1994, 263: 1289–1291
 - 21 Chen N, Bi T, Zhou T, et al. Sharpened cortical tuning and enhanced cortico-cortical communication contribute to the long-term neural mechanisms of visual motion perceptual learning. *Neuroimage*, 2015, 115: 17–29
 - 22 Levi D M, Polat U. Neural plasticity in adults with amblyopia. *Proc Natl Acad Sci USA*, 1996, 93: 6830–6834
 - 23 Huang C B, Zhou Y, Lu Z L. Broad bandwidth of perceptual learning in the visual system of adults with anisometric amblyopia. *Proc Natl Acad Sci USA*, 2008, 105: 4068–4073
 - 24 Pylyshyn Z W, Storm R W. Tracking multiple independent targets: Evidence for a parallel tracking mechanism. *Spat Vis*, 1988, 3: 179–197
 - 25 Cavanagh P, Alvarez G A. Tracking multiple targets with multifocal attention. *Trends Cogn Sci*, 2005, 9: 349–354
 - 26 Green C S, Bavelier D. Action video game modifies visual selective attention. *Nature*, 2003, 423: 534–537
 - 27 Makovski T, Vázquez G A, Jiang Y V. Visual learning in multiple-object tracking. *PLoS One*, 2008, 3: e2228
 - 28 Culham J C, Brandt S A, Cavanagh P, et al. Cortical fMRI activation produced by attentive tracking of moving targets. *J Neurophysiol*, 1998, 80: 2657–2670

- 29 Culham J C, Cavanagh P, Kanwisher N G. Attention response functions: characterizing brain areas using fMRI activation during parametric variations of attentional load. *Neuron*, 2001, 32: 737–745
- 30 Howe P D, Horowitz T S, Morocz I A, et al. Using fMRI to distinguish components of the multiple object tracking task. *J Vis*, 2009, 9: 1–11
- 31 Jovicich J, Peters R J, Koch C, et al. Brain areas specific for attentional load in a motion-tracking task. *J Cogn Neurosci*, 2001, 13: 1048–1058
- 32 Johansson G. Visual perception of biological motion and a model for its analysis. *Percept Psychophys*, 1973, 14: 201–211
- 33 Kozlowski L T, Cutting J E. Recognizing the sex of a walker from a dynamic point-light display. *Percept Psychophys*, 1977, 21: 575–580
- 34 Cutting J E, Kozlowski L T. Recognizing friends by their walk: Gait perception without familiarity cues. *Bull Psychon Soc*, 1977, 9: 353–356
- 35 Walk R D, Homan C P. Emotion and dance in dynamic light displays. *Bull Psychon Soc*, 1984, 22: 437–440
- 36 Cutting J E, Moore C, Morrison R. Masking the motions of human gait. *Percept Psychophys*, 1988, 44: 339–347
- 37 , . : . , 2011, 19: 301–311
- 38 Dittrich W H, Lea S E G, Barrett J, et al. Categorization of natural movements by pigeons: Visual concept discrimination and biological motion. *J Exp Anal Behav*, 1998, 70: 281–299
- 39 Regolin L, Tommasi L, Vallortigara G. Visual perception of biological motion in newly hatched chicks as revealed by an imprinting procedure. *Anim Cogn*, 2000, 3: 53–60
- 40 Simion F, Regolin L, Bulf H. A predisposition for biological motion in the newborn baby. *Proc Natl Acad Sci USA*, 2008, 105: 809–813
- 41 Pavlova M, Krägeloh-Mann I, Sokolov A, et al. Recognition of point-light biological motion displays by young children. *Perception*, 2001, 30: 925–933
- 42 Bonda E, Petrides M, Ostry D, et al. Specific involvement of human parietal systems and the amygdala in the perception of biological motion. *J Neurosci*, 1996, 16: 3737–3744
- 43 Saygin A P. Superior temporal and premotor brain areas necessary for biological motion perception. *Brain*, 2007, 130: 2452–2461