



Journal of the International Neuropsychological Society

Y. L. ^{a,*}, B. W. ^b, C. P. ^c, X. W. ^{d,**}, S. H. ^{e,**}

^a School of Psychology, Northeast Normal University, Changchun, China

^b College of Psychology and Sociology, Shenzhen University, Shenzhen, China

^c School of Psychological and Cognitive Sciences, PKU-IDG/McGovern Institute for Brain Research, Beijing Key Laboratory of Behavior and Mental Health, Peking University, Beijing, China

^d Department of Radiology, Beijing Military General Hospital, Beijing, China

^e Department of Engineering for Innovation, University of Salento, Lecce, Italy

ARTICLE INFO

ABSTRACT

Keywords:

Cerebellum
Saccade
MRI
Saccade
Ipsilateral

Cerebellum is a small but important structure in the brain. It is involved in a wide range of functions, including motor control, cognition, and emotion. In this study, we investigated the role of the cerebellum in saccade adaptation. We used functional MRI (fMRI) to measure brain activity during saccade adaptation. We found that the cerebellum is involved in the adaptation process, and that the activity is localized to the ipsilateral cerebellum. These findings suggest that the cerebellum plays a role in saccade adaptation, and that this role is localized to the ipsilateral cerebellum.

1. Introduction

Cerebellum is a small but important structure in the brain. It is involved in a wide range of functions, including motor control, cognition, and emotion. In this study, we investigated the role of the cerebellum in saccade adaptation. We used functional MRI (fMRI) to measure brain activity during saccade adaptation. We found that the cerebellum is involved in the adaptation process, and that the activity is localized to the ipsilateral cerebellum. These findings suggest that the cerebellum plays a role in saccade adaptation, and that this role is localized to the ipsilateral cerebellum.

Cerebellum is a small but important structure in the brain. It is involved in a wide range of functions, including motor control, cognition, and emotion. In this study, we investigated the role of the cerebellum in saccade adaptation. We used functional MRI (fMRI) to measure brain activity during saccade adaptation. We found that the cerebellum is involved in the adaptation process, and that the activity is localized to the ipsilateral cerebellum. These findings suggest that the cerebellum plays a role in saccade adaptation, and that this role is localized to the ipsilateral cerebellum.

* Corresponding author. Tel.: +86 431 8509 5268; fax: +86 431 8509 130024; e-mail: yls@nenu.edu.cn.

** Corresponding author. Tel.: +39 0732 3932163; fax: +39 0732 3932163; e-mail: xlw@unisalento.it (X.W.), sh@unisalento.it (S.H.).

Functional connectivity was assessed using a general linear model (GLM) for each subject. The model included the task-related regressors (S, F, C, and T) and their interactions. The task-related regressors were created by convolving the task design with a hemodynamic response function (HRF) model. The HRF model was based on the canonical hemodynamic response function (HRF) model (Singer et al., 2006). The HRF model was convolved with the task design to create the task-related regressors. The task-related regressors were entered into the GLM. The GLM was solved for each subject. The resulting parameter estimates were entered into a permutation test. The permutation test was used to assess the significance of the task-related regressors. The permutation test was based on 5000 permutations. The permutation test was used to assess the significance of the task-related regressors. The permutation test was based on 5000 permutations. The permutation test was used to assess the significance of the task-related regressors. The permutation test was based on 5000 permutations.

$$Y = \beta_1 \text{Creativity} + \beta_2 \text{Interdependence} + \beta_3 \text{Creativity} * \text{Interdependence} + \beta_0$$

The results of the permutation test are shown in Table 1. The permutation test was used to assess the significance of the task-related regressors. The permutation test was based on 5000 permutations. The permutation test was used to assess the significance of the task-related regressors. The permutation test was based on 5000 permutations. The permutation test was used to assess the significance of the task-related regressors. The permutation test was based on 5000 permutations. The permutation test was used to assess the significance of the task-related regressors. The permutation test was based on 5000 permutations. The permutation test was used to assess the significance of the task-related regressors. The permutation test was based on 5000 permutations. The permutation test was used to assess the significance of the task-related regressors. The permutation test was based on 5000 permutations.

Was a significant finding. The results of the permutation test are shown in Table 1. The permutation test was used to assess the significance of the task-related regressors. The permutation test was based on 5000 permutations. The permutation test was used to assess the significance of the task-related regressors. The permutation test was based on 5000 permutations. The permutation test was used to assess the significance of the task-related regressors. The permutation test was based on 5000 permutations. The permutation test was used to assess the significance of the task-related regressors. The permutation test was based on 5000 permutations. The permutation test was used to assess the significance of the task-related regressors. The permutation test was based on 5000 permutations. The permutation test was used to assess the significance of the task-related regressors. The permutation test was based on 5000 permutations.

Creativity and Interdependence were assessed using a general linear model (GLM) for each subject. The model included the task-related regressors (S, F, C, and T) and their interactions. The task-related regressors were created by convolving the task design with a hemodynamic response function (HRF) model. The HRF model was based on the canonical hemodynamic response function (HRF) model (Singer et al., 2006). The HRF model was convolved with the task design to create the task-related regressors. The task-related regressors were entered into the GLM. The GLM was solved for each subject. The resulting parameter estimates were entered into a permutation test. The permutation test was used to assess the significance of the task-related regressors. The permutation test was based on 5000 permutations. The permutation test was used to assess the significance of the task-related regressors. The permutation test was based on 5000 permutations.

2.3. Imaging data acquisition and analysis

Behavioral data were collected using a 3.0 T GE Signa MR750 scanner (GE Healthcare; Waukesha, WI) with a standard 12-channel head coil. Functional MRI (fMRI) data were collected using an echo-planar imaging (EPI) sequence with a repetition time (TR) of 2000 ms, an echo time (TE) of 30 ms, a flip angle of 90 degrees, a matrix size of 64 x 64 x 32, a voxel size of 3.75 x 3.75 x 5 mm, and a slice thickness of 5 mm. The data were collected using a T1-weighted sequence with a TR of 2400 ms, a TE of 2.4 ms, a flip angle of 9 degrees, a matrix size of 512 x 512 x 180, a voxel size of 1.0 x 1.0 x 3 mm, and a slice thickness of 3.2 mm. The data were collected using a T2-weighted sequence with a TR of 2400 ms, a TE of 2.4 ms, a flip angle of 9 degrees, a matrix size of 512 x 512 x 180, a voxel size of 1.0 x 1.0 x 3 mm, and a slice thickness of 3.2 mm. The data were collected using a T2-weighted sequence with a TR of 2400 ms, a TE of 2.4 ms, a flip angle of 9 degrees, a matrix size of 512 x 512 x 180, a voxel size of 1.0 x 1.0 x 3 mm, and a slice thickness of 3.2 mm.

3. Results

3.1. Behavioral results

W a a . a . a . a . s' a . . . s (RTs) s -,
 -, - a - - a s a a s s -,
 -, - a - a . s s . A a . a s
 a a s s a a (ANOVA) . a . . s (RTs) w . Ta .
 (s , , ,) as a w . -s a a s w s -
 f i a . a f f . Ta . (F (3, 108) = 111.884, < .001). T
 RTs as s w F , S , F a C
 H w , RTs w a . w . a s' a . a -
 w . s - s a (s > .1). T a
 a a - s was (94.99%). W a s a a .
 a . w s s a . a . a .
 . f i s f i a . s s (37) = .118, = .488).

3.2. fMRI

... w . . s . s - s .
 - s . s w a s s a . w . a . a
 a . s - s a .
 A . f i . a . a . was a a . s f i
 a s s s - a - s s (s . s s)
 a . a . s - s a , w a -
 s . a s (a a . a a -
) w . s - s a . a s' a -
 T 27% s s (10 s s w s s W C A T s s w
 a 113) a . 27% s s (10 s s w s s
 W C A T s s w a 100) w s a s a w
 a . A F s s a . was
 a w . a s s / (s .)
 w . s - s a a s' a . a .
 D s a a a s s was . w . a a . = (s ,
 ,) a s . a . was a s . s a
 . s . a a . s w . a . w s - s a
 a . a . s - s . s a - s .
 s s . s . s . s . friend-²⁵ whole-brn of a
 a w .
 s w . a . w s - s a a a .
 s . s . I . s S -
 C s . a S a . W a s a w s s .
 a . s - s a a a . s - s .
 s a . a . s a . s s w a .
 w . a (s(37) = .495 .703; < .005). T
 , w a a a . a s s s w
 w . s . s . a a a s - s s , w
 s s a s s a a a s s . S a , w s s s -
 a . s - s a a a . - s .
 s a . w s s w a s a
 w . s - s .
 w a s a . w . a . (s(37) = .378-.762;
 s < .021) a w a w . w . s . s w s
 s a s a s a a a s s . S s - s a -
 a . s . a s a . a s - a a . ,
 w s . a . f f . a s
 s I . , , , s , a . A a a .
 s a . was f i a s () = w s s + w + w
 + w 0 . w s a w a . w s . a a . s -
 a - s s , w s . w . a s
 a a w . s - s s
 (a w . s s) a w 0 s . a s . B a s
 a . a s - s a ' s a . w . a a -
 s - s , w ' s , ,
 a a a . s (s , 2 , 2 , 2) a a . s a .
 . T a a . , a . a .
 s s s a . w a a . T
 a w s a s a s a . w a a .
 s . F s s s a . (D a a H a , 1973; Caw
 a T a , 2003). W a - - s - a a . ,
 , as was . a s a s a s s .
 T s a . was s . a s " a -"
 a s . a . w a . R -
 a . s a . a s . a a s . s a .
 a a . a . T a a s a s f i -
 a a s s a a . a s s s - a
 - s s a a s' s - s . a s
 s . a s f i a . a a s s a s
 a . a . a . s . s a . (Caw a
 T a , 2003).

as $s = s$ MPFC (// = -6/
 56/-2) a $s (// = -6/-58/43)$ a
 as s sw s as s
 PPI a a s s. T a w s
 a a sw s w a ss a a s s
 (w a , a a as ss s)
 a was s s a
 a . T a a s s fi a .
 as a w MPFC a a a
 s a s (// = -60/-10/46, = 4.34; = 239;
 : // = 54/-10/55, = 4.35; = 295)
 s (s) w s fi a a w
 a a (F . 3, Ta 1). B
 was s a w a a (s = .668
 a .787 a s s , s <
 .001) s w s s - s a s,
 w as s a sw s w s w
 s - s a s (s = -.0005, -.113, s > .1). T
 ff s a s a s w w s
 s w as fi s fis - a s a (s < .01)
 (F . 3, Ta 2).
 F a , w a s a a a s s . s w -

C, H.-S. (E.S.), C a . . . a I a . . . O a a . a T a s E - a , N w
Y , . 109-136.

F , A., K s . . . , K, B . . . , M, R s . . . , G., I s . . . , A., W s s, E.M., . a .,
2012. S . . . a . . . a . . . s . . . s . . . s a s. H . B a
M a . . . 33 (11), 2603-2610.

G a , J.A., S a w, B.M., 2006. I a s - . . . s a . . . a . . . O a
B a . H . D . P s s 100 (1), 96-109.

G . . . , S., C a a , A., M a . . . , D., C s , R.J., R s . . . f f, S., 2006. S a . . .
a s . . . s . . . a . . . a . . . f f . . . s . . . s . . . s a s. J . P s a . S .
P s . . . 90, 221-242.

H a , S., 2017. T S a C . . a B a : C . . a N s . . . A a . . . H a
N a . . . O U s . . . P s s, O . . . , UK.

H a , S., M a, Y., 2015. A . . . a . . . a . . . a . . . a . . .
T s C . . S . 19 (11), 666-676.

H a , S., M a, Y., W a , G., 2016. S a . . . a . . . s a . . . s s a . . . a a
. . . s . . . s . . . a . . . C . . . B a . . . 1-15.

H a , S., N . . . f f, G., 2008. C . . - s . . . a s . . . s a . . . s . . . a . . . : a
. . . s . . . a . . . a . . . a . . . N a . . . R . . . N s . . . 9, 646-654.

H a , S., N . . . f f, G., V . . . , K., W . . . , B.E., K a a a, S., V a . . . , M.E., 2013. A
. . . a . . . s . . . a . . . a . . . s a a a . . . a . . . A . . .
R . . . P s . . . 64, 335-359.

H a . . . , B.C., 2006. I a s . . . s a . . . s . . . s . . . w . . .
. . . s . . . s a . . . E . . . J . S . . . P s . . . 36, 119-133.

H s s , B.A., A a v , T.M., 2010. C a A . . . R . . . P s . . . 61, 569-598.

K . . . , W.M., M a a , C.N., W a . . . , C.L., C a a , S., I a . . . , S., H a . . . , T.F., 2002.
F . . . s ? A . . . a . . . M R I s . . . J . C . . N s . . . 14 (5), 785-794.

L, W., L, X., H a . . . , L., K . . . , X., Y a . . . , W., W , D., L , J., 2015. B a . . . s . . . s
. . . a . . . a . . . s s S . . . C . . . A f f . . . N s . . . 10 (2),
191-198.

L , C., W a , M., 1999. T C a . . . A s s s . . . P a . . . P s . . . a P . . . s . . . ,
T a . . . , T a w a . . .

L , M.-J., S . . . , W.-L., M a, L.-Y., 2011. A . . . w . . . A s . . . s . . . a . . .
. . . a . . . ? A R s . A . . . S . . . D s . . . 5 (1),
294-298. . . . // . . . /10.1016/ . a s . 2010.04.011.

M a, Y., B a , D., W a , C., A . . . , M., F . . . , C., R s . . . f f, A., H a , S., 2014. S . . . a
. . . a . . . a . . . s . . . f l S . . . C . . . A f f . . . N s . . . 9 (1),
73-80.

M a, Y., H a , S., 2011. N a . . . s a . . . s . . . s . . . s . . . a . . . a
. . . a . . . s . B a . . . 134, 235-246.

M a a , N., O a , G.R., P a . . . , M.G., 2002. T s . . . a . . . ? T . . .
. . . s w a . . . w a . . . s . . . s . . . a . . . a . . .
A a . M a a . . 45 (4), 757-767.

M a s , H.R., K a a a, S., 1991. C . . . a . . . s . . . - a . . . s . . . ,
. . . a . . . a . . . P s . . . R . . . 98 (2), 224-253.

M a s s, N., E a , A., S a a a -T s . . . , S.G., 2015. G a . . . a . . . a s : . . . a

. . . a . . . N . . . a . . . 116, 232-239.

M L a . . . , D.G., R s , M.L., X , G.F., J . . . s . . . , S.C., 2012. A . . . a . . .
. . . s . . . s . . . a . . . a . . . s (P P I): a . . . a s . . . s a a a -
. . . a . . . s . N . . . a . . . 61 (4), 1277-1286.

N . . . f f, G., B . . . , F., 2004. C . . . a . . . s . . . s a . . . s . . . T s C . . .
S . . . 8 (3), 102-107.

O s a , D., C . . . , H.M., K . . . , M., 2002. R a s a . . .
. . . s : a a a a s s . . . s a . . . a - a a s s . P s . . . B . . . 128
(1), 3-72.

O s a , D., N . . . , S., F . . . f l j . . . , N., K a . . . a . . . , L., 2014. I . . . a . . . - a s -
. . . a . . . a . . . s s . C . . . B a . . . 2 (1), 1-26.

S a , R., K a w s . . . , N., 2003. P a . . . a . . . : . . .
. . . a . . . a . . . a . . . " . . . " . N . . . a . . . 19 (4), 1835-1842.

S a , C., E a , K., O . . . , H.J., K a a, E., K s s . . . , C., L . . . , M., 2013. N a . . . a . . . s
. . . a . . . w . . . : a . . . s . . . H . . . B a . . . M a . . . 34 (5), 1088-1101.

S . . . s , T.M., 1994. T a s . . . a . . . s . . . a . . . s . . . s . . .
. . . s a s . P s a . S . . . P s . . . B . . . 20, 580-591.

T a . . . , H., T a . . . , Y., H a s . . . , H., S a s s a, Y., N a a s , T., N . . . , R., . . . a . . . , 2012. T
a s s a . . . w . . . s . . . a . . . a . . . a . . . a . . . C . . . C . . . 22
(12), 2921-2929.

T a , T., Z . . . , H., C . . . , C., L . . . , J., 2015. M w a . . . a . . . a . . . f f . . .
. . . s . . . s . . . C a . . . R s . J . 27 (4), 375-382. . . . // . . . /10.1080/
10400419.2015.1088290.

V . . . s , V.L., O w , E., B . . . , M., S . . . , P.B., E a s . . . , M.J., B w , R., B . . . , M.H.,
2016. B . . . a s - w s . . . : . . . a a a . . . a . . . a . . . s . . . s . . .
. . . J . E . . . P s . . . G . . . 145 (8), 966-1000. . . . // . . . /10.1037/
0000175.

V a a , M.F., C . . . , D., C a s , S., S w a . . . , L.A.V., G s . . . , E.R., F a ,