

BACKGROUND

- There is a robust literature on the positive benefits of executive functions (EFs) on academic and socio-emotional outcomes in neurotypical young children from Western countries (Blair & Razza, 2007; Bull et al., 2008; Clark et al., 2010; Carlson & Wang, 2007)
- Recent studies conducted over the last decade offer emerging support for higher EF ability in neurotypical East Asian children compared to same-aged peers in the United States (Imada et al., 2013; Lan et al., 2011) and United Kingdom (Ellefson et al., 2017; Oh & Lewis, 2008).
- Given the social and academic challenges experienced by autistic individuals, it is important to better understand EF ability in this population.
- There is mixed evidence regarding EF difficulties in autism (Faja & Dawson, 2014; Griffith et al., 1999; Pellicano et al., 2014).
- Very few studies have investigated EF skills in East Asian autistic children (Shu et al., 2011; Yang et al., 2009). No studies to date have focused on EF in autism during the preschool years.

OBJECTIVES

To compare Chinese autistic and neurotypical preschoolers on iPad-delivered EF performance tasks (inhibitory control, visuospatial working memory, and cognitive flexibility).

METHOD

Sample (N=48):

- Age: 36-83 months
- Autistic (n=21) and age- and sex-matched neurotypical (n=28) preschoolers. All autistic children had a confirmed clinical diagnosis of autism spectrum disorder and no other comorbid developmental disability.
- Locations: three early developmental centers, an outpatient clinic, and a kindergarten in Beijing, China

Measures:

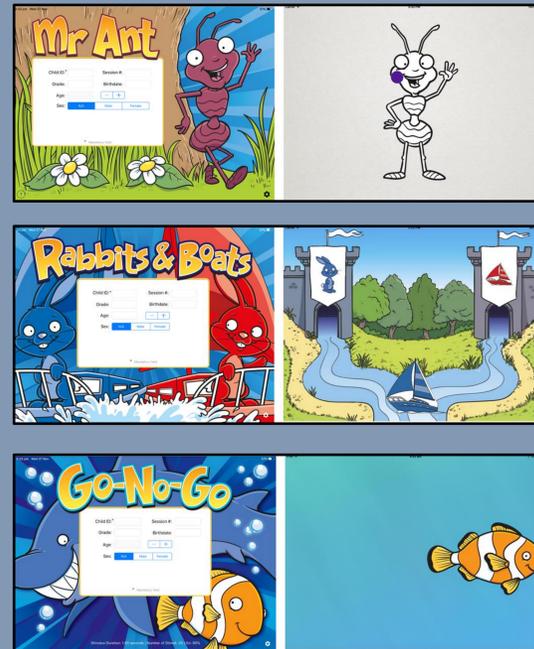
- *Verbal ability:* Verbal Comprehension Index (VCI) standard score on the Wechsler Preschool and Primary Scales of Intelligence – Fourth Edition (WPPSI-IV; Wechsler, 2012). All children had VCI scores > 70.
- *Executive functioning:* iPad-based assessment battery from the Early Years Toolbox (EYT; Howard & Melhuish, 2017)
 - Inhibitory control: Go/No-Go task
 - Working memory: Mr. Ant task
 - Cognitive flexibility: Card Sort task

Analyses:

Linear regression analyses were conducted to evaluate the unique associations between autism and inhibitory control, working memory, and cognitive flexibility.

METHOD (continued)

Early Years Toolbox iPad tasks



Peking University Sixth Hospital



Beijing Haidian
Modern Art Kindergarten

RESULTS

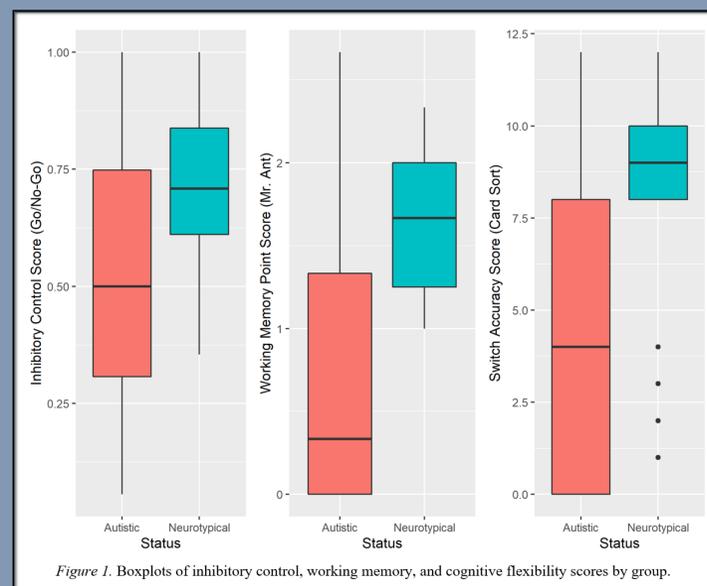


Figure 1. Boxplots of inhibitory control, working memory, and cognitive flexibility scores by group.

- Diagnostic status was significantly associated with inhibitory control ($B = -0.19$, $t(47) = -2.96$, $p < .001$), working memory ($B = -0.88$, $t(47) = -4.27$, $p < .001$), and cognitive flexibility ($B = -3.50$, $t(47) = -3.52$, $p < .001$).
- Neurotypical children outperformed autistic children on all EF tasks.

DISCUSSION

- This study provides preliminary evidence for EF difficulties in Chinese autistic preschoolers compared to neurotypical peers.
- It is also the first study to utilize iPad-administered tasks to assess for EF in autistic young children.
- Currently, early intervention for autistic children focuses largely on core autistic symptoms.
- However, it is evident that autistic preschoolers may benefit from accommodations and interventions that support their EF challenges.
- Further research on the efficacy of EF interventions for autistic preschoolers is needed.
- Cross-cultural studies are also needed to determine the generalizability of these findings to other preschool populations.

REFERENCES

- Blair, C., & Razza, R. P. (2007). Relating effortful control, executive function, and false belief understanding to emerging math and literacy ability in kindergarten. *Child Development*, 78, 647-663. <https://doi.org/10.1111/j.1467-8624.2007.01019.x>
- Bull, R., Espy, K. A., & Wiebe, S. (2008). Short term memory, working memory, and executive functioning in preschoolers: Longitudinal predictors of mathematical achievement at 7 years. *Developmental Neuropsychology*, 33, 205-228. <https://doi.org/10.1080/87565640801982312>
- Carlson, S. M., & Wang, T. S. (2007). Inhibitory control and emotion regulation in preschool children. *Cognitive Development*, 22, 489-510. <https://doi.org/10.1016/j.cogdev.2007.08.002>
- Clark, C. A. C., Pritchard, V. E., & Woodward, L. J. (2010). Preschool executive functioning abilities predict early mathematics achievement. *Developmental Psychology*, 46, 1176-1191. <https://doi.org/10.1037/a0019672>
- Ellefson, M.R., Ng, F.F., Wang, Q., & Hughes, C. (2017). Efficiency of executive function: A two-generation cross-cultural comparison of samples from Hong Kong and the United Kingdom. *Psychological Science*, 8, 1-12. <https://doi.org/10.1177/0956797616687812>
- Faja, S., Dawson, F., Sullivan, K., Meltzoff, A., Estes, A., & Bernier, R. (2016). Executive function predicts the development of play skills for verbal preschoolers with autism spectrum disorders. *Autism Research*, 9, 1274-1284. <https://doi.org/10.1002/aur.1608>
- Griffith, E. M., Pennington, B. F., Wehner, E. A., & Rogers, S. J. (1999). Executive functions in young children with autism. *Child Development*, 70, 817-832. <https://doi.org/10.1111/1467-8624.00059>
- Howard, S.J., & Melhuish, E. (2017). An early years toolbox for assessing early executive function, language, self-regulation, and social development: Validity, reliability, and preliminary norms. *Journal of Psychoeducational Assessment*, 25, 255-275. <https://doi.org/10.1177/0734282916633009>
- Imada, T., Carlson, S. M., & Itakura, S. (2013). East-West cultural differences in context-sensitivity are evident in early childhood. *Developmental Science*, 16, 198-208. <https://doi.org/10.1111/desc.12016>
- Lan, X., Legare, C.H., Ponitz, C.C., Li, S., & Morrison, F.J. (2011). Investigating the links between the subcomponents of executive function and academic achievement: A cross-cultural analysis of Chinese and American preschoolers. *Journal of Experimental Child Psychology*, 108, 677-692. <https://doi.org/10.1016/j.jecp.2010.11.001>
- Oh, S., & Lewis, C. (2008). Korean preschoolers' advanced inhibitory control and its relation to other executive skills and mental state understanding. *Child Development*, 79, 80-99. <https://doi.org/10.1111/j.1467-8624.2007.01112.x>
- Pellicano, E. (2012). The development of executive function in autism. *Autism Research and Treatment*, 1-8. <https://doi.org/10.1155/2012/146132>
- Shu, B.C., Lung, F.W., Tien, A. Y., & Chen, B.C. (2001). Executive function deficits in don-retarded autistic children. *Autism*, 5, 165-174.
- Wechsler, D. (2012). *Wechsler Preschool and Primary Scale of Intelligence –Fourth Edition (WPPSI-IV)*. San Antonio, Pearson Education.
- Yang, J., Zhou, S., Yao, S., Su, L., McWhinnie, C. (2009). The relationship between theory of mind and executive function in a sample of children from Mainland China. *Child Psychiatry and Human Development*, 40, 169-182.

ACKNOWLEDGEMENTS



Funding: Organization for Autism Research Graduate Research Grant

We are deeply grateful to the families who participated in the study and to the teachers, psychiatrists, and psychiatry residents who assisted with this project.