

DOMAIN GENERAL COGNITIVE CONTROL BRAIN NETWORKS ARE ASSOCIATED WITH THE DEVELOPMENT OF CHILDREN'S LANGUAGE ABILITIES

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The processing of language is a crucial aspect of complex cognitive functioning in humans. In research on adults, it has been found that this process is mainly supported by a left-lateralized language specific network, distributed across frontal and temporal lobes, with less dependence on brain networks related to domain-general cognitive control (Diachek, Blank, Siegelman, Affourtit, & Fedorenko, 2020). However, could this finding be applicable to children and adolescents? As they may have inferior language skills compared to adults, could they be more reliant on domain-general brain networks? To address this question, in this study, we investigated the developmental patterns and associations between cortical morphology and language abilities in childhood and adolescence.

We used data from 236 subjects (age= 6-18) in the Chinese Color Nest Project (Liu et al., 2021) . To assess language ability, we used the verbal processing scores derived from two subtests, namely vocabulary and comprehension, extracted from the Chinese version of the Wechsler Intelligence Scale for Children, Full Scale, Fourth Edition. Gray matter volumes of the language network and the domain-general cognitive control network (defined as the combination of the fronto-parietal network and dorsal attention network) were used as indicators of brain morphology. The language network was further divided into left and right hemispheric to investigate hemispheric differences.

Results have emerged as follows: (1) In childhood and adolescence, the development of language skills shows significant association with the left hemisphere of the language network. However, for the right hemisphere of the language network, significant correlation with language ability was only observed during adolescence. Additionally, domain-general cognitive control network demonstrated a relationship with language abilities in both childhood and adolescence. These results suggest a switch of reliance on the left portion of the language network to both the left and right portion of the language network from childhood to adolescence. Additionally, our results also indicate that both the language network and the domain-general cognitive control network work in conjunction to facilitate the development of language ability.

References

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