Mutualistic coupling of vocabulary and non-verbal reasoning in children with and without language disorder
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**Background**

- Mutualism is a developmental theory that posits positive reciprocal relationships between distinct cognitive abilities during development.
- Positive reciprocal relationships have been found between language and non-verbal reasoning abilities in typically developing children.
- Mutualism may explain why children with Language Disorders also tend to have lower than average non-verbal cognitive abilities, as poor language would limit the rate of growth of other cognitive skills.
- We tested whether language and non-verbal reasoning show mutualistic coupling in children with and without language disorder.

**Method**

- We used data from the Surrey Communication and Language in Education Study (SCALES)⁴.
- SCALES is a population derived longitudinal cohort study that oversampled children identified as having low language at school entry.
- Children were classified as having language disorder based on six word picture vocabulary tasks in Year 1.
- This analysis uses data from tests of receptive vocabulary (One Word Picture Vocabulary Test⁵) and non-verbal reasoning (Matrix Reasoning⁴) taken when children were in Year 3 (N = 501), Year 6 (N = 384) and Year 8 (N = 196).

**Analysis**

- Bivariate latent change score models⁶ were used to examine dynamic developmental relationships between receptive vocabulary and non-verbal reasoning.
- Coupling parameters (red arrows in Fig 1) from baseline scores on each measure to latent change in the other measure capture the strength of mutualistic relationships between the two domains.
- We first compared the fit of a model with coupling parameters to a model without coupling parameters in the whole cohort to replicate previous evidence for mutualistic coupling between language and cognition.
- We then compared the strength of the coupling parameters between children with and without language difficulties in a grouped model to test whether children with language disorder had intact coupling.

**Results**

- The model with coupling parameters showed superior fit to a model without these parameters indicating that there is mutualistic coupling between receptive vocabulary and non-verbal reasoning.
- Children with higher initial language abilities showed greater growth in non-verbal ability and vice versa.
- We found no evidence for a difference in the strength of coupling between children with language disorder and those the typical language.

**Conclusions**

- Our results replicate previous evidence for mutualistic relationships between language and non-verbal reasoning⁰ and suggest that these relationships also exist in children with language disorders.
- This challenges the existence of selective language impairments as language impairments will impact on development of other abilities during development.
- Future intervention studies should test whether improving language skills in children with language disorder has positive impacts on other cognitive abilities (and vice versa).

**References**

1. van der Maas et al., 2006 Psychol Rev, 113(3), 400-461.

![Fig 1. Multi-group bivariate Latent Change Score model with mutualistic coupling parameters between block design and receptive vocabulary. Standardised estimates are in roman font and unstandardized estimates (and standard errors) are in italics. Panel a) shows estimates for children that met the criteria for LD and panel b) shows estimates for children with typical language.](image-url)

![Fig 2. Growth in scores for a) block design and b) receptive vocabulary for children with typical language and those with language disorder. The thick line shows the model predicted score for each group for each measurement occasion.](image-url)