

# Investigating Language Lateralisation and Motor Control in Development

## INTRODUCTION

- Previous research has demonstrated a neurological link between language and motor functions (Tremblay & Gracco, 2009).
- There is much debate about at what age motor proficiency and handedness is established in childhood development, with some research suggesting it is established in infancy and some suggesting hand preference is still developing at 6 years old (Hodgson, Hirst and Hudson, 2016).
- Similarly, there is debate around the hemispheric profile of language processing during development with data showing this may be linked to motor development.
- Differences in measurement of hand preference and language lateralisation have contributed to the different findings in the literature. It is thought that performance measures are more indicative of language profiles.
- By investigating the developmental trajectory of language and motor functions in young children more information can be uncovered about these same functions in individuals with impairments to these functions, for example, Developmental Coordination Disorder (Hodgson and Hudson, 2017).



## DESIGN & METHODS



124 children, aged 3 to 10 yrs (M= 6.30, SD= 2.19. 55 Male, 57 Female), were recruited during the University of Lincoln's Summer Scientist 2019. Participants completed a series of handedness tasks, looking into the consistency of hand preference, manual dexterity, and the difference in performance between preferred and non preferred hands, and how this interacted with language lateralisation.

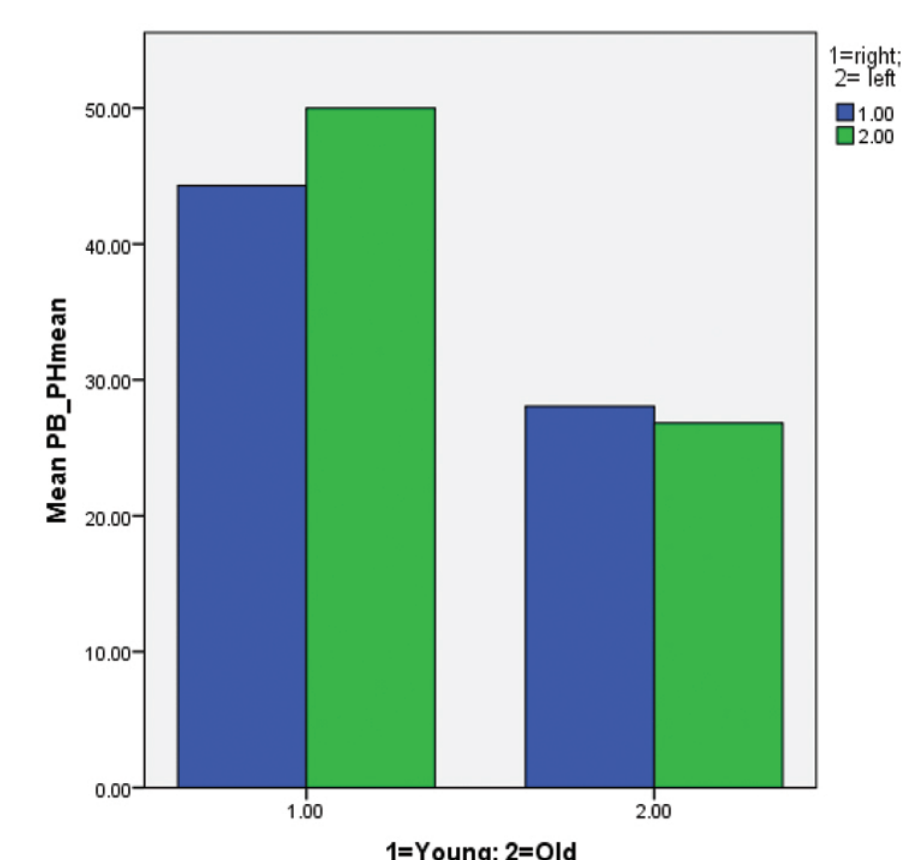
Using a repeated measures, within subjects design, a combination of tasks were used; Pegboard and Coin Turning measured hand performance, whereas Card Reaching and Line Drawing measured preference. Participants also completed a Dichotic Listening task to uncover ear preference, which is a determinant of language lateralisation.



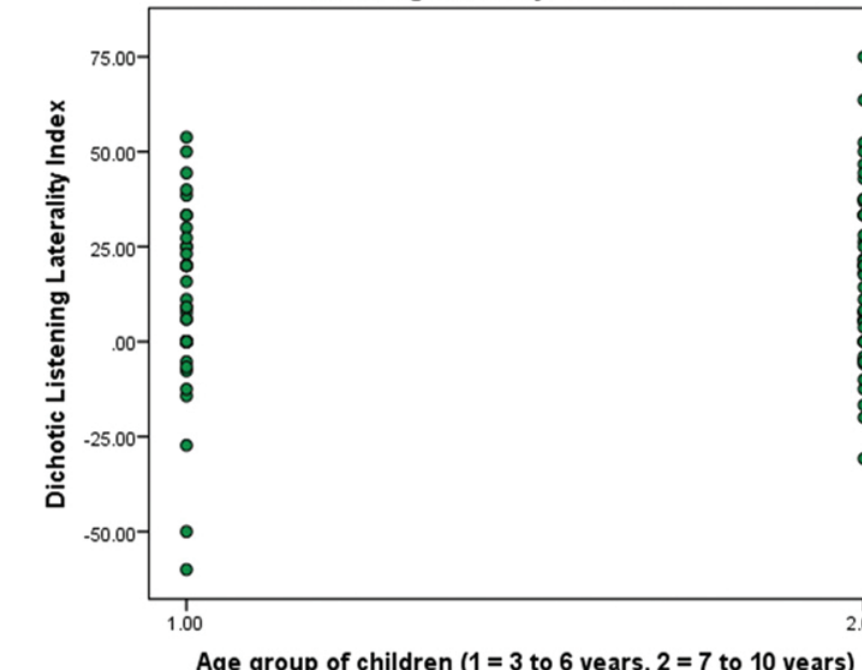
Lateralisation indices were calculated for handedness and language tasks to produce a hemispheric lateralisation profile for each age group.

## RESULTS

- **Hand Performance:** Older children showed significantly faster hand skill times than younger children across both preferred and non-preferred hands (**Preferred hand:**  $t(100) = 8.9, p < 0.001$ ; older children mean time = 27.8 secs, SD = 3.8; younger children mean time = 46.2 secs, SD = 13.6. **Non-preferred hand:**  $t(100) = 9.1, p < 0.001$ ; older children mean time = 32.3 secs, SD = 5.4; younger children mean time = 50.01 secs, SD = 12.5). The Laterality Index calculated from the pegboard data showed that older children performed more strongly with their preferred hand than younger children ( $t(100) = -2.1, p < 0.05$ ; older children LI = 7.1, SD = 6.1; younger children LI = 4.5, SD = 6.8). This means that older children have a greater performance advantage with their preferred hand than younger children, even taking into account the increased proficiencies in overall performance time between their hands.
- **Language Lateralisation:** Older children (7-10 years) displayed fewer errors than younger children (3-6 years) in the Dichotic Listening task ( $t(83) = 6.5, p < 0.001$ ; older children mean errors = 10.9, SD = 4.2, younger children mean errors = 16.9, SD = 4.4), as well as demonstrating a larger ear advantage (regardless of which ear was dominant) than participants under the age of 7 ( $t(83) = -2.1, p < 0.05$ ; older children mean difference = 3.34, SD = 4.7, younger children mean difference = 1.4, SD = 3.6). The Dichotic Listening Laterality Index was not significantly different across age groups.



A scatterplot to demonstrate the influence of age on Dichotic Listening Laterality Index



There was no significant interaction between language lateralisation and hand performance across age groups.

## DISCUSSION

The results of this study show that there is no age affect in the establishment of hand preference; however hand skill proficiency develops with age, with older children showing more adult-like patterns of skill. Similarly, most children showed an 'ear advantage' affect, indicating language lateralisation in the brain, but younger children showed higher errors on the task and had a more variable pattern of language distribution.

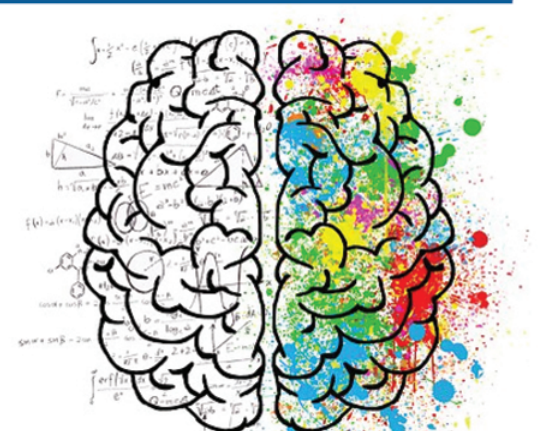
The implications of this for children with developmental disorders are that delayed motor and language performance may reflect the abilities of younger children. Understanding the developmental trajectories of typically developing children will help us understand the performance of children with impairments to these functions

## ACKNOWLEDGEMENTS

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### References

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Student: Amber Scotting

Supervisor: Dr John Hudson & Dr Jessica Hodgson