Exploring the development of the forward model system for motor control in children

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Introduction

- The forward model system is important for daily life as it allows us to differentiate between self-produced actions and externally-generated actions.
- It achieves this by predicting the most probable sensory consequences of an intended action. It then compares the expected sensory feedback with the actual sensory information observed. If a match occurs, the action is percieved as self-produced (Haggard, 2017).
- Previous research has demonstrated that children show immature forward model functioning compared to adults (Wilson & Hyde, 2013).
- However, limited research has investigated how the forward model develops as children age (Debrabant, Gheysen, Vingerhoets & van Waelvelde, 2012).

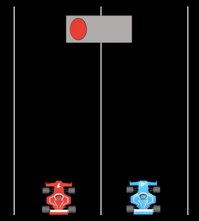
Hypothesis

It was hypothesised that successful use of the forward model system would be predicted by age.

Method

- 43 children (*M* age=9.11, *SD*=2.48, range=4.25-12.95) played an online game where they were presented with two race-cars and a set of traffic lights that changed from green to amber to red.
- Participants clicked the screen as soon as the green traffic light was visible.
- The faster they clicked, the better their chance of winning a trial.
- Participants' reaction time was recorded relative to the onset of the green light.
- Reaction times were classified either anticipatory or reactive using a two-horse race-to-threshold model developed by Burnett Heyes et al. (2012).

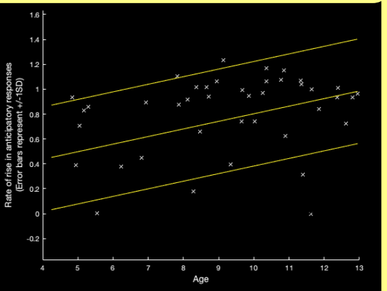
See a demo here!



- An anticipatory response demonstrates effective use of the forward model as it shows that the participant has predicted when best to respond to maximise their chance of winning the trial.
- A stepwise multiple linear regression was performed to investigate whether age, parent-reported impulsivity or sex could predict the mean rate of rise in participants' anticipatory responding.

Results

- The mean rate of rise in participants' anticipatory responding was significantly predicted by age (*Beta*=.36, *SE*=.03, CI 95% [.008 .12], *p*=.03).



- This was not predicted by sex or parent-reported impulsivity (all *p*>.05).
- The overall model fit (*R2*) was .13 *(SE*=.4).
- This suggests that as age increases, participants anticipatory responding increases.

Conclusion

- Successful use of the forward model system improves as children age.
- These findings advance our understanding of how the motor system develops in childhood.

References

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