Young Children are Sensitive to their Learning Curve

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Introduction

Persistence is positively associated with academic achievement.[1] Yet little is known about how young children make decisions about when and how to persist.

What evidence informs when children decide to persist with a challenge and when to give up?

Adults successfully monitor their past performance over time, also known as a learning curve, and use this information to determine where to put their effort.[2-4]

Children may also learn from past performance and integrate their prior beliefs with new evidence.[5-8]

However, some studies indicate children fail to learn from their prior performance and remain optimistic about their ability after encountering failure.[9-12]

Do 4-6-year-olds track their past performance over time and use this information to determine when to stick with a challenge?

Experiments 1-2: Learning Curves & Rewards

Experiment 1: 66 4-6-year-olds (38F) 33/condition → Unequal rewards

Experiment 2: 132 4-6-year-olds (79 F) 44/condition → Equal rewards

Tall: two stickers | Small: one sticker

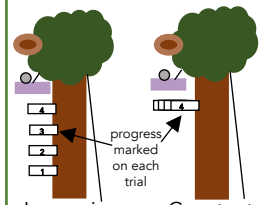
Tall: one sticker | Small: one sticker

Preregistered OSF

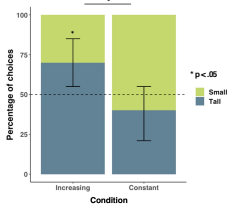
Goal: get egg back to nest with pulley device (we control performance surreptitiously)

added no-treatment Baseline condition for Exp 2

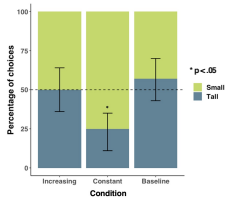
Two Conditions



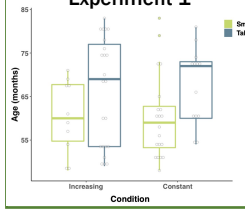
Experiment 1



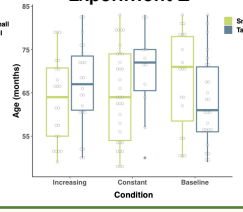
Experiment 2



Experiment 1



Experiment 2



Children are more likely to stick with the Tall tree in the Increasing condition than Constant

Older children are more likely to stick with a challenge across both Increasing and Constant conditions

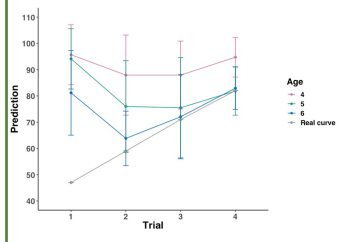
Rewards shift preferences

Experiment 3: Predictions

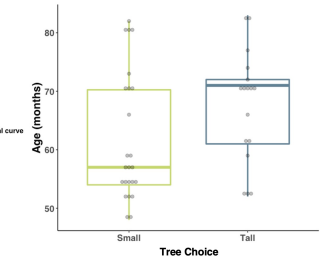
41 4-6-year-olds (12F)
All Increasing Condition from Exp 2 (equal rewards)

Preregistered OSF

Predictions made before each trial:



Main effect of trial and age on performance predictions



Older children are more likely to stick with a challenge

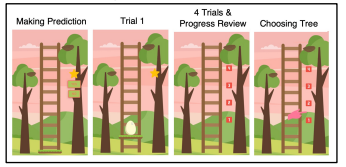
Experiment 4: Online Version

121 4-6-year-olds (48 F)
61 Constant, 60 Increasing

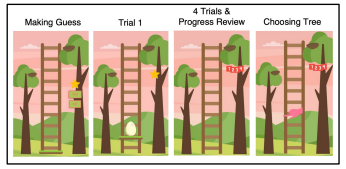
matched rewards as in Exp 2 & **predictions** as in Exp 3

Online Web-based game:

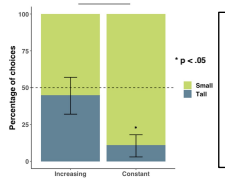
Increasing



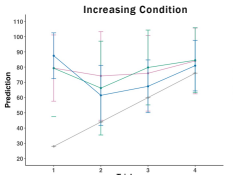
Constant



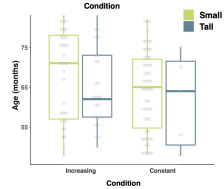
Preregistered OSF



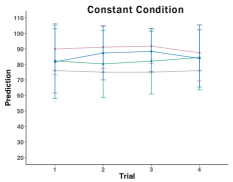
Children are more likely to stick with the Tall tree in Increasing than Constant



Increasing Condition: Main effect of trial, but no effect of age on performance predictions



No effect of age on tree choice in either condition



Constant Condition: No effect of trial or age on performance predictions

Conclusions

Children are sensitive to the trajectory of their past performance over time and use this information to determine if they should stick with a challenge. Children are more likely to stick with a challenge when their performance increases over time rather than stays the same.

Reward contingencies shift preferences: children integrate their chances of getting a reward (learning curve) with the magnitude of that reward to calibrate their effort.

With in-person testing, older children are more likely to stick with a challenge and are less optimistic about their performance than younger children regardless of their performance. However, these results are not found in online testing.

Older children are more accurate at updating performance predictions than younger children across in-person and online contexts.

References

1. Duckworth, A. L., Peterson, C., Matthews, M. D., & Kelly, D. R. (2007). Grit: Perseverance and Passion for Long-Term Goals. *Journal of Personality and Social Psychology, 92*(6), 1087–1101. https://doi.org/10.1037/0022-3514.92.6.1087
2. Baranes, A. F., Oudeyer, P.-Y., & Gottlieb, J. (2014). The effects of task difficulty, novelty and the size of the search space on intrinsically motivated exploration. *Frontiers in Neuroscience, 8*. https://doi.org/10.3389/fnins.2014.00317
3. Metcalfe, J., & Kornell, N. (2005). A region of proximal learning model of study time allocation. *Journal of Memory and Language, 52*(4), 463–477. https://doi.org/10.1016/j.jml.2004.12.001
4. Ten, A., Kaushik, P., Oudeyer, P.-Y., & Gottlieb, J. (2020). Humans monitor learning progress in curiosity-driven exploration. https://doi.org/10.31234/osf.io/7dbr6
5. Flavell, J. H., Friedrichs, A. G., & Hoyt, J. D. (1970). Developmental changes in memorization processes. *Cognitive Psychology, 1*(4), 324–340. https://doi.org/10.1016/0010-0285(70)90019-8
6. Metcalfe, J., & Finn, B. (2013). Metacognition and control of study choice in children. *Metacognition and Learning, 8*(1), 19–46. https://doi.org/10.1007/s11409-013-9094-7
7. Schneider, W. (1998). Performance prediction in young children: Effects of skill, metacognition and wishful thinking. *Developmental Science, 1*(2), 291–297. https://doi.org/10.1111/1467-7687.00044
8. Stipek, D. J., & Hoffman, J. M. (1980). Development of Children's Performance-Related Judgments. *Child Development, 51*(3), 912–914. https://doi.org/10.2307/1129485
9. Leonard, J. A., Lee, Y., & Schulz, L. E. (2017). Infants make more attempts to achieve a goal when they see adults persist. *Science, 357*(6357), 1290–1294. https://doi.org/10.1126/science.aan2317
10. Lucca, K., Horton, R., & Sommerville, J. A. (2020). Infants rationally decide when and how to deploy effort. *Nature Human Behaviour, 4*(4), 372–379. https://doi.org/10.1038/s41562-019-0814-0
11. Smiley, P. A., & Dweck, C. S. (1994). Individual Differences in Achievement Goals among Young Children. *Child Development, 65*(6), 1723–1743. https://doi.org/10.2307/1131290
12. Stipek, D., Recchia, S., McClintic, S., & Lewis, M. (1992). Self-Evaluation in Young Children. *Monographs of the Society for Research in Child Development, 57*(1). https://doi.org/10.2307/1166190