The development of mental simulation as a strategy for solving problems with multiple alternatives

1 Background & Aims

- Mental simulation enables us to internally explore alternatives without incurring the costs of acting in reality.
- Adults readily engage in mental simulation across several domains [1-3].
- Little work has investigated how children approach problems in which they are faced with a choice between multiple alternatives.
- Children from around 4 years have some capacity to consider basic alternative actions [4], and recognise that multiple future outcomes are possible [5,6].
- However, some evidence suggests that younger children are quicker to act on tasks requiring planning [4] and more likely to explore risky options [7] than older children and adults, suggesting, perhaps, a lack of mental simulation.

Aim: examine developmental changes in the use of mental simulation when solving problems with multiple alternatives

2 Method

Participants
Target N = 150; to date: 30 4-5 year olds, 31 6-7 year olds, 33 adults

Task
18 unique mazes; computer-based task programmed in PsychoPy
"Which colour entrance do you want to drop this ball into?"

Effective strategy: simulate the path the ball will take through the maze

Examples of the mazes presented to participants

Measures
For each trial:
- Correct (ball reaches goal) or incorrect (ball misses goal)
- Response latency (proxy for mental simulation)

End of task:
Strategy question: “When you were trying to solve the mazes, how did you decide where to drop the ball?”

3 Preliminary Results

- Trials correct increases across age groups (F(2,93)=49.47, p<.001, \( \eta^2 = 0.52 \))
- Latency to choice decreases across age groups (F(2,93)=39.15, p<.001, \( \eta^2 = 0.46 \))

Strategy question:
- 4-5 year olds mostly unable to articulate strategy
- 6-7 year olds frequently mention 'following the lines'
- Older participants more likely to report starting from goal and working up

4 Discussion & Next Steps

- Ability to solve the mazes increases with age, whereas time taken to choose where to drop the ball decreases with age.
- Differs from previous finding that younger children act more quickly/spend less time planning in a similar maze-based task [4]
- Here, even young children seem to consider alternative options prior to acting (they spend the most time doing so) but this does not always translate into accurate choices.
- Perhaps young children do spontaneously engage in mental simulation, but their simulations are inaccurate, or they struggle to hold in mind and compare the outcomes of their simulations.
- Is latency to choice an appropriate proxy for mental simulation?

Next steps:
- Explore how maze features influence performance – e.g., position of correct entrance relative to goal; number of turns on path.
- Individual differences study: large variability in younger children’s performance – does executive function play a role?
- Eye-tracking study to better understand strategies used across development.

References

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