Research Plan:

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

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Background & Motivation

- When deciding between multiple courses of action, we can simply pick one and try it out. Or, we can *mentally* try out the options prior to acting (i.e., mental simulation).
- As adults, we readily engage in mental simulation across several domains [1-3].
- Despite a recent surge of interest in the development of the ability to represent and prepare for alternative possible events [4,5], little work has investigated *how* children approach problems in which they are faced with a choice between multiple alternative courses of action.
- Children from around 4 years have some capacity to consider basic alternative actions [6], mentally project themselves into the future [7], and recognise that multiple future outcomes are possible [4,8].
- On other tasks however, younger children (4-5 years) are quicker to act on tasks requiring planning [6] and more likely to explore risky options [9] than older children and adults, suggesting, perhaps, a lack of mental simulation.

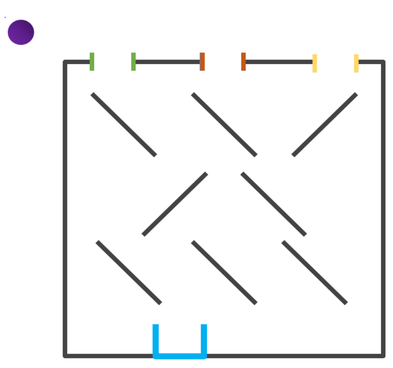
Research Aims: **(1) examine developmental changes in the use of mental simulation when solving problems with multiple options; (2) investigate the influence of resource availability on the tendency to simulate vs. act without simulating across development**

Planned Methods

Participants 4- to 7-year-old children (target N = 120 participants)

Materials & Procedure – Computerised vertical maze task

Block 1: ***Aim is to get ball into blue box; only 1 ball available***

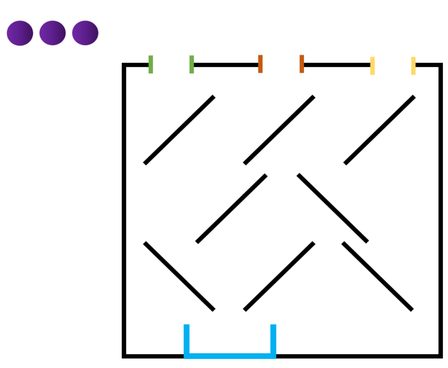


"Which colour hole do you want to drop this ball into?" (green/left is correct)

20 trial-unique configurations (via manipulation of diagonal pieces' orientation & blue box location)

Measures:
For **each trial**:
- Success (ball reaches box) or failure (ball misses box)
- Ball chosen (colour; left, centre or right)
- Response latency (time between end of question & child choosing a ball)

Block 2: ***Aim is to fill blue box with 3 balls. Manipulate no. balls available between-participants: minimum required (3) vs. excess (5)***



3-ball condition example

For each ball "Which colour hole do you want to drop this ball into?" (orange/middle is correct)

20 trial-unique configurations

Measures:
For **each trial**:
- Success (box filled with 3 balls) or failure (box not filled)
- No. of balls in box
- No. balls used (5-ball condition only)

For **each ball**:
- Maze entrance chosen (correct or incorrect; left, centre or right)
- Response latency

End of each block: Reported strategy (response to open question about approach used; coded as simulate/not simulate)

Analysis

GLMMs with trial outcome (success/failure) as a binary outcome variable; age (months), latency to act (ms), reported strategy (simulate/not simulate); and trial number as predictors; participant ID as a random factor. Block 2 additional predictors: no. balls available (min/excess); no. balls used (3-5).

Predictions

Block 1: Age (older), response latency (longer) and reported strategy (simulate) will be predictive of success

Block 2: In addition to the above: response latency will be longer in the 3-ball vs. 5-ball condition (especially for 1st ball); older children will use fewer balls than younger children in the 5-ball condition

Acknowledgements

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References

[1] Hegarty (2004); [2] Buckner & Carroll (2007); [3] Kappes & Morewedge (2016); [4] Redshaw & Suddendorf (2020); [5] Leahy & Carey (2020); [6] Tecwyn et al. (2014); [7] Atance (2015); [8] Beck et al. (2006); [9] Gopnik (2020)