The development of problem-solving abilities in typical and atypical development

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Problem Solving

- Everyday practical applications (getting dressed, making a sandwich, catching a bus)
- Multi domain (verbal, spatial, working memory, executive function...)
- Problem space (Newell and Simon, 1972)
- A well-defined problem has an initial state, goal state, legal moves, move restrictions (Kahney, 1993)
PhD Overview (1)

- Cross syndrome comparison of development
  - Typical development, autism (ASD), Down’s syndrome (DS) and Williams Syndrome (WS)
- Developmental disorders; different strengths and weaknesses
  - Separate cognitive system components (e.g. working memory, attention) examined in neurodevelopmental disorders: but how are they brought together in problem solving?
- Might problem solving develop in different ways:
  - between typically and atypically developing groups?
  - between different different atypical groups?
PhD Overview (2)

- Based on how participants approach problem solving, how can problem solving performance be improved?
- In order to investigate problem solving in atypical groups, typical performance needs to be explored.
- Existing literature on problem solving still has some questions...
- Study 1 focuses on the Tower of London task in typical development.
The Tower of London (TOL)

Parameters include:

- goal configuration
- minimum number of moves
- search depth
- number of Intermediate moves
- number of Counter-intuitive moves ('goal-subgoal conflict moves'; Kaller et al., 2011)

Shallice (1982)
Which abilities contribute to TOL performance? (1)

Inhibition?
The ability to suppress a response.

Types of inhibition?

Shifting/Switching?
Being able to move attention between different features.
Important for tower tasks (e.g. Bull et al., 2004)
Which abilities contribute to TOL performance? (2)

Working memory?
Keeping items in short term memory for long enough to engage with them (e.g., Kaller et al., 2008; Alloway et al., 2006)

Planning?
Generating and executing a set of responses: Are counter-intuitive moves really just about searching ahead?

Mixed results concerning contributing factors: study 1 includes a task for inhibition, shifting, working memory and planning
Evidence of...

• Intermediate move differences at age 4-5 (Kaller et al., 2008)
• Inhibition and shifting more important for more counter-intuitive moves at age 4 (Bull et al., 2004)
• Inhibiting a strategy accounting for TOL performance differences between age 3-4 and 5-6 (Baughman & Cooper, 2007)
Study 1

• Are 5 year olds more able to solve problems with counter-intuitive moves than 4 year olds?

• So far, 21 participants of a potential 40 aged 4-5 years; TOL varying in the number of counter-intuitive moves

• Which abilities contribute to performance?
Some Future Directions

• Study 2: extended age range for the Tower of London task in typical development, with subsequent comparison to atypical groups

• Results from current studies and parental questionnaires to inform next steps: what are challenging problems for individuals with each disorder in real life contexts?

• How can problem solving be improved? What are the implications for problem solving in real life contexts?
Thank you!