Spatial abilities in Down syndrome: characterising the profile of spatial skills and models of spatial development.

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This research investigated spatial ability in Down syndrome and how this differs to typical development. We hope you find this research summary interesting and useful.

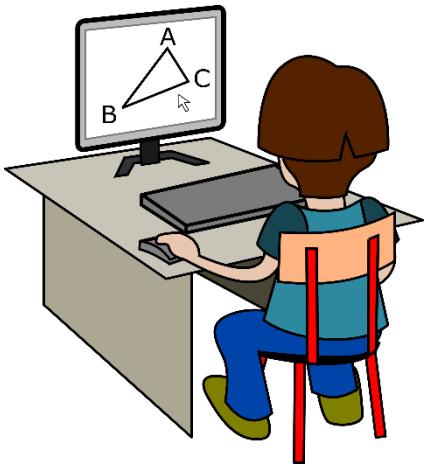
What did we already know?

Spatial ability is the ability to understand the location (position) and dimensions (length, size) of objects and how objects are related to each other. We use spatial abilities all the time, for example spatial skills allow us to pack a bag or navigate around a new place. Therefore, spatial abilities are important for everyday, independent living. Spatial abilities can be either intrinsic or extrinsic. Intrinsic spatial skills relate to the size and orientation of objects, and extrinsic spatial skills relate to the location of an objects.

Previous research shows that spatial abilities may be a relative strength in people with Down syndrome. For example, studies have found people with Down syndrome perform better in non-verbal tasks compared to verbal tasks, e.g., showing better spatial memory than verbal memory. However, there is no previous research comparing different types of spatial ability and whether spatial skills develop similarly in people with Down syndrome and those with typical development.

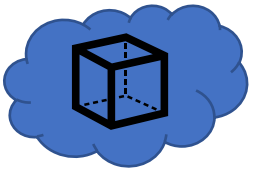
What did we want to find out?

1. What is the profile of strengths and weaknesses in spatial abilities in people with Down syndrome compared to typical development?
2. Does the development of spatial abilities differ between people with Down syndrome and people with typical development?



What did we do?

There were 164 participants in the study, 33 were individuals with Down syndrome aged 10-35 years, and 131 were typically developing children aged 4-11 years. Participants completed three sets of tasks. Set 1 measured general skills including verbal and non-verbal ability. Set 2 measured mathematics skills (not relevant to this study). Set 3 measured spatial skills which included tasks measuring intrinsic spatial ability using mental rotation, mental transformation, and mental folding tasks, and extrinsic spatial ability using scaling, perspective taking and exploration tasks.



What did we find?

Spatial performance was very similar between individuals with Down syndrome and typically developing children aged 4-5 years, who achieved a similar score on a general non-verbal measure (mental-age matched group). The only exception was the mental transformation task where those with Down syndrome had lower scores. The typically developing group also had higher overall intrinsic scores than participants with Down syndrome.

We compared the development of spatial skills in people with Down syndrome to a wider age group of typically developing children, using mental-age (scores on the general non-verbal task) instead of age. There were no group differences in spatial ability at the starting points, however, participants with Down syndrome had a slower rate of spatial development than typically developing participants.

What do our findings tell us?

Individuals with Down syndrome performed similarly in spatial tasks to mental-age matched typically developing children. This tells us that the profile of spatial abilities is not generally atypical in people with Down syndrome compared with their non-verbal abilities. However, individuals with Down syndrome had lower scores on the mental transformation task than the typically developing mental-age matched group which suggests that this skill is an area of weakness for people with Down syndrome. We also found that spatial skills may develop differently in people with Down syndrome. Although individuals with Down syndrome had similar starting points to the group of typically developing children, the rate of spatial skill development was slower for the Down syndrome group.

What are the implications?

This research has established that typically developing children and people with Down syndrome have similar spatial profiles, but that spatial ability develops at a different (slower) rate in people with Down syndrome. We know that spatial skills are very susceptible to change through cognitive training in typical development. This suggests the possibility for improving spatial abilities in people with Down syndrome through training interventions. From our research, it appears that these interventions should particularly target intrinsic spatial skills. Future interventions like this may improve spatial skills in children with Down syndrome, with far-reaching positive effects including enhanced independent living skills and academic outcomes.

Thank you: We owe a big thank you to the Baily Thomas Charitable fund who funded this research. Thank you to everyone who took the time to participate in this study without whom the research wouldn't be possible. We hope this summary provides an insight into the importance of understanding spatial abilities in people with Down syndrome.

Access the full paper: You can read our full paper here.