



Overall, the combined analysis showed no performance difference in complex problem-solving between typically developing and autistic participants.

## Does fluid reasoning develop differently in school-aged autistic children?





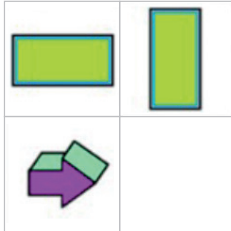
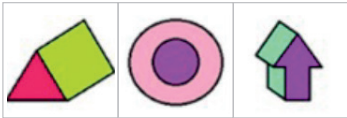
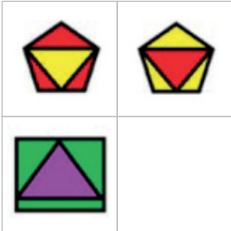

By SOPHIA DRAAOUI

### What is fluid reasoning?







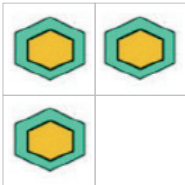

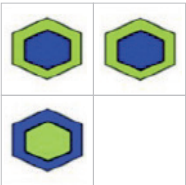

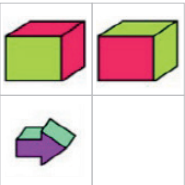
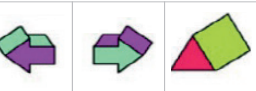
Fluid reasoning is a cognitive skill allowing people to problem-solve. In linking different sources of information, people are able to find logical solutions to problems. In typically developing children, fluid reasoning mainly develops during the primary school years, reaching full maturity during adolescence. It is an essential skill for learning (notable in science and mathematics) but also for communication (ex. Understanding expressions and humour).

Fluid reasoning can be assessed in a number of ways. The main method used to measure this skills is to ask the person to solve matrix-type problems. Matrices are a series of figures which one must complete with the missing item amongst a selection. These problems can have different levels of complexity: the number of relationships to establish between objects can vary (0, 1 or 2 relationships) and certain items may be present to induce errors, meaning an item that has some link to the figures, but not the correct relationship (ex. We ask a child to find the witch's mode of transportation, the

Matrix problem examples with different levels of complexity and presence/absence of misleading items

	No misleading items	With misleading items
Semantic problems	 	 
Visuospatial problems	 	 

Number of relationships to consider when problem-solving

	0	1	2
Semantic problems	 	 	 
Visuospatial problems	 	 	 

These results indicate that developmental trajectories of fluid reasoning are similar in autistic and typically developing children and that both groups present better performances in semantic rather than visuospatial problems.

Brain areas related to visual perception seem to be more involved in reasoning processes for autistic children, as this has been observed in autistic adults.

correct answer would be a broomstick, but a cauldron may also be included as a possible answer of items generally related to witches). These problems can include varying content, they may be visuospatial in nature, or semantic, numerical or verbal. The example problem given of the witch is a semantic problem in that it asks the child to recall previous knowledge, and a language problem because it presumes knowledge of certain terms like “witch” and “mode of transport”.

Research has shown that autistic adults display typical or supervisor performances in fluid reasoning when compared to typically developed adults. What about autistic children ?

A study published in the Journal of Autism and Developmental Disorders explores this question. Eliane Denis and her colleagues **compared fluid reasoning development in school-aged autistic children to the development of this same skill in typically developing children of the same age**. More specifically, the researchers aimed to measure the impact of a problem's content (semantic or visuospatial) but also the effect of a problem's complexity and presence of error-inducing items, on performance on a reasoning task. The team recruited 43 autistic children and 41 typically developing children, aged between 6 and 13, with similar intellectual capacities. The researchers then presented each participant with 240 matrix-type problems on a computer.

### Main study results

Final results suggest that typically developing children gave more correct answers than autistic children. However, autistic children solved complex problems faster than typically developing children.

The researchers therefore analysed their results by combining these two variables, meaning they considered both accuracy and response time. Overall, the combined analysis showed no performance difference in complex problem-solving between typically developing and autistic participants.


Furthermore, they found that performances in the two groups varied similarly with age. In both autistic and typically developing children, **performances on complex problems and problems containing misleading items improved with age**. In other words, the older a child is, the more accurate their response and faster their response time.

Finally, both groups **had better performances** in **1) Semantic rather than visuospatial problems, 2) Simple problems** compared to complex problems and **3) problems without misleading items**.

### What are the main takeaways?

These results indicate that developmental trajectories of fluid reasoning are similar in autistic and typically developing children and that both groups **present better performances in semantic rather than visuospatial problems**. This is a surprising result, because it is often reported that autistic people do not perform as well on semantic tasks.

It is however important to note that semantic tasks are often presented verbally and require a verbal response from the child. For example, cognitive tests could ask how a bus and a car are similar. In the present study, researchers presented each problem in an exclusively visual manner. This method is in line with autistic people's preference for visual information processing. Presenting content in a visual manner therefore benefits autistic people not only for visuospatial information, but also for semantic-type problems.

Lastly, though fluid reasoning performances were similar in autistic and typically developing participants, they could result from different reasoning strategies. For example, brain areas related to visual perception seem to be more involved in reasoning processes for autistic children, as this has been observed in autistic adults. It could be that these different reasoning strategies appear in early child development. The researchers will be furthering these results by investigating underlying brain processes during fluid reasoning in autistic children. Using brain imaging techniques, they will be able to observe which brain areas are involved in reasoning in this developing clinical population. Stay tuned for more study results ! 

#### Original article:

Danis E, Nader AM, Degré-Pelletier J, Soulières I. Semantic and Visuospatial Fluid Reasoning in School-Aged Autistic Children. J Autism Dev Disord. 2022 Sep 22. doi: 10.1007/s10803-022-05746-1.