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NOTTE EUROPEA DEI RICERCATORI

Developmental Trajectories of Fluid Intelligence in Terms of Accuracy and Error Types Using a New Digital Tool: MatriKS

Matilde Spinoso

Department of Psychology "Renzo Canestrari", University of Bologna, Cesena, Italy.
PhD Program in Psychological Sciences - 38° cicle;
Supervisors: Prof. Sara Giovagnoli & Prof. Mariagrazia Benassi.

Background

Fluid Intelligence (FI) represents the ability to think logically and solve problems in novel situations. It is typically assessed using non-verbal tasks (e.g., Raven's Progressive Matrices). However, considering only the total FI score flattens the richness of the information we can obtain from the test, as the same score can result from solving different items and/or using different strategies. Error analysis can provide insight into the cognitive processes involved in task resolution and, therefore, help to better understand individual differences.To date, we know that FI improves during development, but there is no clear evidence regarding developmental changes in the types of errors made. Error categorization and analysis using traditional tools is time-consuming for clinicians, and existing classification systems are not always consistent.MatriKS is a new digital tool that allows precise and automated assessment of FI and error categorization.

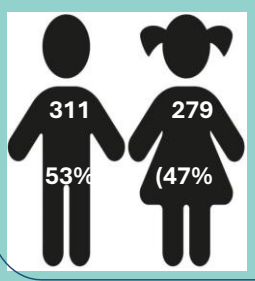
Project Goals

The objective is to evaluate the ability of the new digital tool *MatriKS* to detect age-related changes in fluid intelligence (FI), both in terms of overall cognitive performance and individual differences in error patterns.

Experimental Approach

Participants

N = 590 children- age range: 4-12 (M= 8.39, sd= 2.19)



Exclusion Criteria:

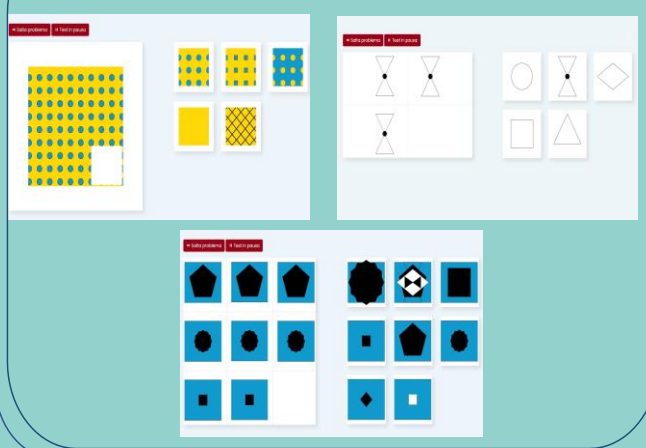
Presence of motor, visual, or hearing impairments; diagnosis of language disorder, intellectual disability, or psychiatric disorders.

Instrument and procedure

Psyc Assist https://psycassist.fisppa.unipd.it/

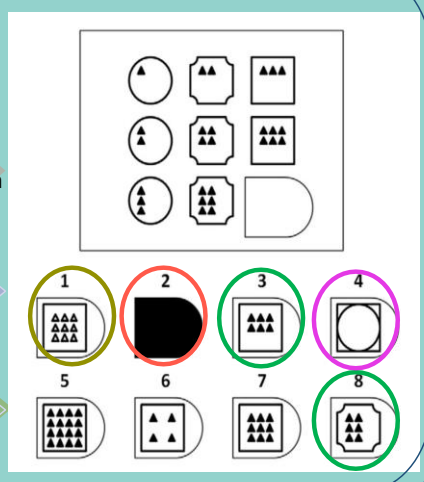
Instructions video — Example sections — Execution

Examples of Matrices



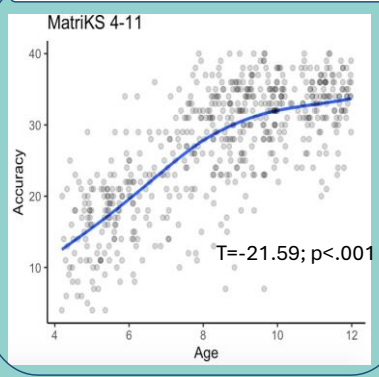
Types of Errors

- **Repetition**: Refers to an error response corresponding to a cell adjacent to the missing one
- **Difference**: Refers to an error response characterized by a pop-out effect since it is perceptively different from all the other responses
- **Wrong principle**: Refers to an error response that applies an incorrect combination of rules
- **Incomplete correlate**: Refers to an error response with a missing modified transformation rule.

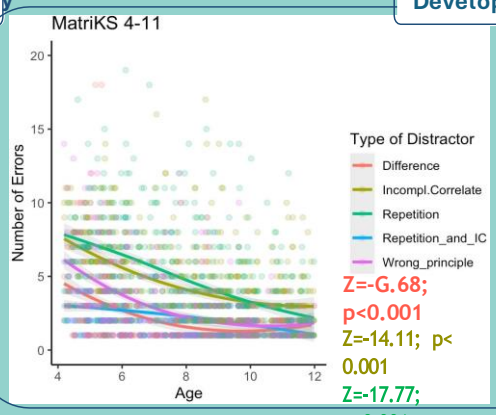


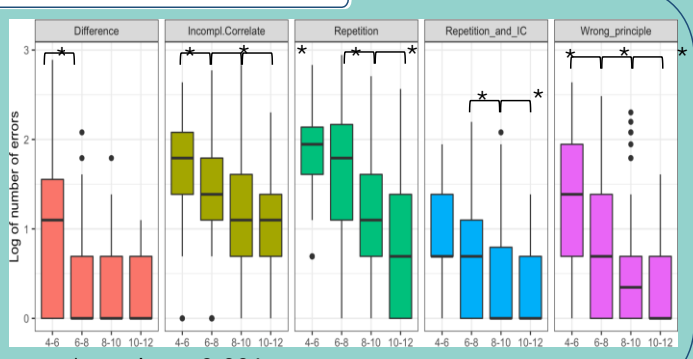
Results

Developmental Trajectories of Accuracy



Developmental Trajectories of Errors





* p-value < 0.001

Accuracy: The developmental trajectory is non-linear, with rapid improvement between ages 4 and 8, followed by a more gradual increase after 8 years.

Error analysis: The number of errors decreases with age across all types of distractors. This appears to reflect the maturation and development of underlying cognitive functions. The higher number of *Difference* errors in younger children seems to be associated with the perceptual salience of the distractor, which captures attention and leads to impulsive stimulus selection. From age 6 onwards, working memory, processing speed, and executive control develop, supporting logical reasoning and reducing impulsivity.*MatriKS* is able to capture age-related developmental differences in fluid intelligence (FI), similarly to traditional matrices. Additionally, it provides information on error characteristics and how they change with age, which is essential for understanding individual differences and based on this knowledge, planning targeted and personalized interventions across different clinical populations.

SUSTAINABLE DEVELOPMENT GOALS

4 QUALITY EDUCATION