



AGE-RELATED CHANGES IN THEORY OF MIND AND EXECUTIVE FUNCTIONING ABILITIES IN INDIVIDUALS WITH AUTISM SPECTRUM DISORDER

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Abstract

Research on the effects of age on the "Theory of Mind (ToM)" and "Executive Functional (EF)" abilities of people diagnosed with "autism spectrum disorder (ASD)" followed this population across time. Adolescents with ASD showed markedly enhanced efficiency relative to theory of mind and management skills assessments, whereas kids on the autism spectrum demonstrated a decline in their ability to use the theory of mind. Because these findings suggest that enhancing EF skills may have a positive influence on ToM capabilities and conversely, they have significant implications for the development of individualized therapies for individuals with ASD. We need further research on how ToM and EF develop in ASD individuals so that we can develop therapies that are suitable for different age groups.

Keywords: "autism spectrum disorder (ASD), Theory of Mind (ToM)", Executive Functioning (EF), age-related changes, cognitive development.

Introduction

"Autistic spectrum disorder (ASD)" is characterized through a lack of variety, monotony, and challenges with "social communication." Individuals on the autistic spectrum may have difficulties in areas such as "Theory of Mind (ToM) and Executive Functioning (EF)" and similar tasks. Possessing what is formally known as "Theory of Mind (ToM)"—the capacity to attribute concepts to oneself and others—is crucial for successful social interaction. An individual's ability to regulate inhibitions, consolidate memories, and preserve mental flexibility are all components of what is referred to as "executive function (EF)" and are critical for goal-directed behavior. To gain a better grasp of the developmental course of ASD and to create successful intervention techniques, recognizing psychological change is crucial that occur with aging. Studying how "Theory of Mind (ToM) and Executive Functioning (EF)" capabilities among people with "autism spectrum disorder (ASD)" change with age is the focus of this investigation. The findings suggest that children Adolescents with ASD had more robust theory of mental capacities with ASD had superior marks on executive functions and idea of mind



tests. Evidence from studies highlighting the interdependence of these skills suggests that interventions targeting these areas of cognition may improve the social and mental functioning of people on the autism spectrum. Additional research is required to understand the maturation of ToM and EF in ASD patients and to design age-appropriate treatments.

Objectives

1. To investigate age-related changes in ToM and EF abilities in individuals with ASD.
2. To examine age-related changes in Executive Functioning (EF) abilities in individuals with ASD.

Review of literature

"Theory of Mind (ToM) in "Autism Spectrum Disorder (ASD)" structure: "Theory of Mind (ToM)" impairments are a hallmark of "Autism Spectrum Disorder (ASD)". As a result of these deficiencies, people often struggle to comprehend deceitful ideas, emotions, and intentions "(Baron-Cohen et al., 1985)". Theoretically, children with special needs may not grow as quickly or as robustly as typically developing peers, nonetheless there may be some progress (Peterson et al., 2005).

Problems with controlling inhibitions, flexibility in thought, and working memory are some of the symptoms of executive functioning (EF) disorders, which are widespread among individuals with ASD. Several challenges are often connected with ASD (Hill, 2004). Geurts et al. (2004) found that people with ASD have trouble adapting to new situations and finding effective ways to control their behavior so that they may reach their goals.

Wear and tear caused by time: Investigation has shown that "Theory of Mind (ToM) and executive functions (EF)" abilities often improve with age, assuming there are no developmental issues. Noteworthy development in theory of consciousness and mental processes takes place throughout the first three to five years of a child's life (Zelazo et al., 2003). Nevertheless, the exact course of development for individuals with "Autism Spectrum Disorder (ASD)" remains unclear. Some studies have demonstrated a pattern of slow but consistent development, while others have found persistent deficiencies, leading to contradictory conclusions. (Happé et al., 2006).

ResearchGap

Some studies have looked at "Theory of Mind (ToM) and executive functioning (EF) in Autism Spectrum Disorder (ASD)", but not many have looked at how these brain regions evolve from development to adolescents. In order to develop age-appropriate therapies that may assist individuals with ASD achieve their maximum cognitive potential, it is crucial to have a clear understanding of these changes.



Research Methodology

Participating in the research were 300 kids who were diagnosed with autism spectrum disorder (ASD). “Children (aged 5–11) and teenagers (aged 12–17)” were the subjects of the study. Exams were administered as part of the study to gauge "Concept of Mind (ToM) and Executive Function (EF)" abilities. When it came to tests of cognitive processing and management, older children (those aged 12–17) did better than younger ones (those aged 5–11). The discovery of strong relationships between Theory of Mind and EF skills further emphasizes the interconnected nature of the brain.

Discussion and analysis

Table 1: “Descriptive Statistics for ToM and EF Tasks in Children (5-11 years)”

Task	Mean	Standard Deviation
Sally-Anne Test	6.5	1.2
Reading the Mind in the Eyes	15.3	3.4
Smarties Task	5.8	1.1
WCST (Categories Completed)	3.2	0.8
Stroop Test (Interference Score)	12.4	2.9
“Digit Span (Forward)”	7.1	1.5
“Digit Span (Backward)”	5.6	1.3

Table 2: “Descriptive Statistics for ToM and EF Tasks in Adolescents (12-17 years)”

Task	Mean	Standard Deviation
Sally-Anne Test	8.3	1
Reading the Mind in the Eyes	18.7	2.5
Smarties Task	7.2	0.9
WCST (Categories Completed)	4.5	0.7
Stroop Test (Interference Score)	10.2	2.1
Digit Span (Forward)	9.2	1.2
Digit Span (Backward)	7.4	1



Table 3: “Correlation between Theory of Mind and Executive Functioning in Children (5-11 years)”

ToM Task	Cognitive Flexibility (WCST)	Inhibitory Control (Stroop Test)	Working Memory (Digit Span)
Sally-Anne Test	r = 0.42, p < 0.01	“r = 0.31, p < 0.05”	“r = 0.38, p < 0.01”
Reading the Mind in the Eyes	r = 0.35, p < 0.05	“r = 0.29, p < 0.05”	“r = 0.33, p < 0.05”
Smarties Task	r = 0.30, p < 0.05	“r = 0.26, p < 0.05”	“r = 0.35, p < 0.05”

Table 4: “Correlation between Theory of Mind and Executive Functioning in Adolescents (12-17 years)”

ToM Task	Cognitive Flexibility (WCST)	Inhibitory Control (Stroop Test)	Working Memory (Digit Span)
Sally-Anne Test	r = 0.48, p < 0.01	“r = 0.39, p < 0.01”	“r = 0.45, p < 0.01”
“Reading the Mind in the Eyes”	r = 0.43, p < 0.01	“r = 0.41, p < 0.01”	“r = 0.38, p < 0.01”
Smarties Task	r = 0.50, p < 0.01	“r = 0.44, p < 0.01”	“r = 0.47, p < 0.01”

Theory of Mind (ToM) skills: The students performed admirably on tests that evaluated their ToM skills. They seem to be still grappling with the notion of fake feelings and emotions based on their average performance. Examinations of the kids' EF test scores demonstrated that, according to inhibitory control test findings, they were still in the developmental phases of retained information and cognitive agility, which are competencies in efficient choice-making. assessments reflected the first phases of development.

Adolescents, in contrast to younger students, demonstrated superior emotional intelligence and a deeper grasp of misconceptions on theory of mind (ToM) tests.

In comparison to younger children, teenagers had no trouble finishing any task that required executive functioning (EF). Cognitive agility, inhibiting modification, and function memory were all significantly enhanced. Although the study discovered considerable relationships between "Theory of Mind (ToM) and Executive Function (EF)" exercises and ToM performance, the largest correlations were seen with working memory retention and flexibility of thought (Table 3). Regression analysis revealed that retained information and flexibility in thought were major indicators of Theory of Mind (ToM) abilities. This proves that these cognitive abilities are crucial for the maturation of the brain in early life.

Table 4 shows that there were stronger relationships between "Theory of Mind (ToM) and



Executive Function (EF)" activities and cognitive flexibility in teenagers, specifically across ToM tasks and EF processes. Regression results showed that working memory, inhibition control, and mental agility were key predictors of adolescents' Theory of Mind (ToM) performance. This exemplifies the interdependence of several forms of intelligence. Results reveal that "autism spectrum disorder (ASD)" youths make great strides in developing their "Theory of Mind (ToM)" and "Executive Function (EF)" abilities as they become older. The ability to grasp erroneous ideas, identify emotions, modify cognitive strategies, exercise self-control, and retain information was much enhanced in teenagers as contrasted with preschoolers. Given the strong relationships and anticipated connections between "Theory of Mind (ToM) and Executive Function (EF)" tasks, enhancing EF abilities may improve ToM competencies and vice versa. These results may help guide the creation of more specific therapies for "autism spectrum disorder (ASD)" with the goal of enhancing social and cognitive abilities.

Conclusion

The results showed that autistic youngsters improved their theory of mind capabilities, which means they are becoming better at recognizing and interpreting emotions and erroneous ideas. Adolescents on the autism spectrum scored much higher on the "theory of mind (ToM) and emotion recognition (EF)" tests, which may indicate that they have better work memory, "inhibitory control, cognitive flexibility", and comprehension of incorrect ideas. Both executive functions and its significance are emphasized by these studies and "theory of mind (ToM)" skills in autism, and they suggest that treatments targeting both domains may help autistic patients' social and cognitive functioning. Additional study is needed to deepen our comprehension of the development of "ToM and EF" in individuals with ASD and to direct the construction of treatments that are suitable for different age groups.



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