Universitat Autònoma de Barcelona

Theory of Mind in Down syndrome and Autism Spectrum Disorder: A study in Iran and Sweden

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PhD Thesis

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Programa de Doctorat en Psicologia Clínica i de la Salut
Dept de Psicologia Clínica i de la Salut
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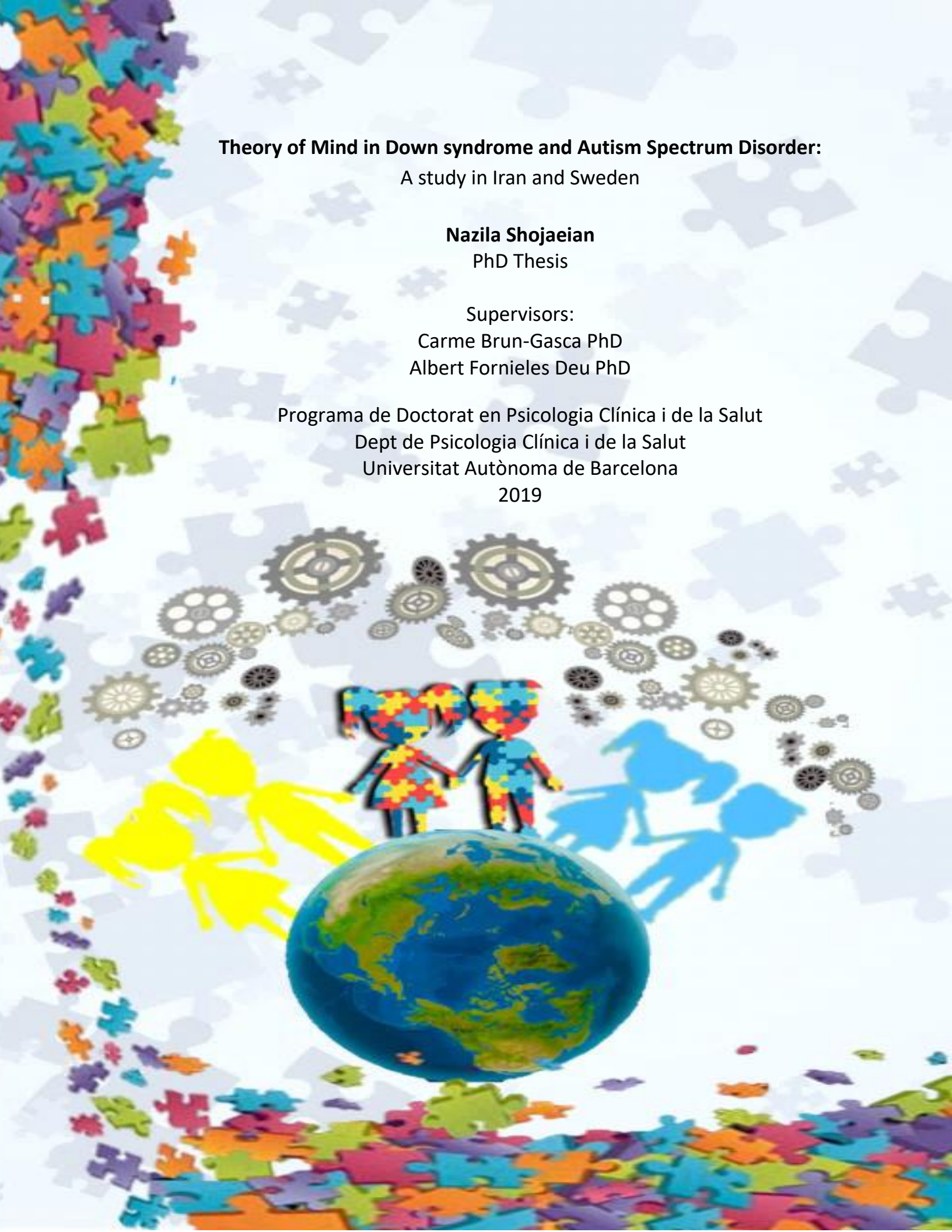

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"I have learned that success is to be measured not so much by the position that one has reached in life as by the obstacles which he has had to overcome while trying to succeed."

Booker T. Washington

ABSTRACT

In English

The study reported herein, explored the comprehension of Theory of Mind (ToM) implemented in children with Down syndrome (DS), Autism Spectrum Disorder (ASD), and Typically Developing (TD) individuals during middle childhood and early adolescence. The participants included 74 Iranian and 66 Swedish schoolers ranged between 6 to 12 years old in these groups of children. To examine the role of the IQ and the first-second and-third order of Theory of Mind tasks, participants' were assessed using the Raven's Progressive Matrices (RPMs), and Sally and Anne, Smarties Tube Task, Representational Change Task, New ToM test to access mental state understanding in belief-attribution abilities. The TRF and CBCL behavior scales were administered to obtain the medical and behavior problems or psychological information about children behavior at home and school. Additionally, Socioeconomic Status (SES) was used to assess family socioeconomic status. The results were analyzed using SPSS 25 for analysis of variance (ANOVA) and correlation coefficient to assess the differences between the groups on ToM tasks. The level of significance was set at .05. In line with previous studies the first order results reveal that Iranian individuals with ASD reach to better scores than children with DS, and that TD group performed better than both groups of children with ASD and DS. Similarly, in Sweden, the pattern, except one task was the same and no significant differences found. Next, TD children performed better than clinical groups for the second-order and there was no significant difference between ASD and DS in both countries. The same picture was found for Iranian sample for third order; however, in Sweden, children with ASD scored significantly better than children with DS. Children with higher intelligence quotient performed better in ToM tasks in all cases

except for Smart_ RQ and SAR tasks which is previously documented. Behavior function was assessed through teachers' scores but not from a parent's point of view in the scores of social problems, and thought problems. Indeed, thought and social problems scales would show stronger correlation to ToM results. The results highlight that the effect of the culture is partially verified in specific tasks that the children develop during their childhood, but not for the whole construct of ToM. To addressing family SES concerning children's ToM understanding that did not report a clear link in any case of these groups.

Key words: Theory of Mind, Autism Spectrum Disorder, Down syndrome, IQ.

RESUMEN

In Spanish

El estudio presentado aquí, explora la comprensión de la teoría de la mente (ToM) en niños con síndrome de Down (DS), trastorno del espectro autista (TEA) y personas con desarrollo típico (TD) durante la infancia y la adolescencia temprana. Los participantes fueron 74 escolares iraníes y 66 suecos con edades comprendidas entre 6 y 12 años. Para examinar el papel del cociente intelectual y el primer y segundo orden de las tareas de Teoría de la mente, se evaluó a los participantes utilizando las Matrices progresivas de Raven (RPM), y Sally y Anne, y Smarties, Tarea de cambio representacional, Nueva ToM prueba para acceder a la comprensión del estado mental en las habilidades de atribución de creencias. Las escalas de comportamiento TRF y CBCL se administraron para obtener problemas médicos y de comportamiento o información psicológica sobre el comportamiento de los niños en el hogar y la escuela. Además, se obtuvo información sobre el Estado Socioeconómico familiar (SES). Los resultados fueron analizados con SPSS 25. Se llevaron a cabo análisis de varianza (ANOVA) y coeficientes de correlación para evaluar las diferencias entre los grupos en las tareas de la TOM. El nivel de significación se fijó en .05. En línea con estudios anteriores los primeros resultados revelaron que los individuos iraníes con ASD logran puntuaciones mejores que los niños con DS, y que el grupo TD obtiene mejores puntuaciones que ambos grupos de niños con ASD y DS. El patrón en Suecia fue muy parecido, excepto en una tarea en la que no es encontraron diferencias significativas. Los niños del grupo TD obtienen mejores que los grupos clínicos para el segundo orden y no hubo diferencia significativa entre ASD y DS en ambos países. El mismo patrón fue encontrado para la muestra

iraní en el tercer orden; aun así, en Suecia, los niños con ASD puntuaron significativamente mejor que los niños con DS. Los niños con cociente de inteligencia más alto obtuvieron mejores resultados en las tareas deTOM en todos los casos, excepto en las tareas Smart_ RQ y SAR. La función de comportamiento se evaluó a través de la evaluación de los maestros pero no desde el punto de vista de los padres en las escalas de problemas sociales y problemas de pensamiento. De hecho, las escalas de pensamiento y problemas sociales mostraron una correlación más fuerte con los resultados de ToM. Los resultados destacan que el efecto del origen se verifica parcialmente en tareas específicas que los niños desarrollan durante su infancia, pero no para todo el constructo de ToM. El nivel socieconómico de la familia no mostró una relación clara con la comprensión de la ToM en ninguno de los grupos.

Palabras claves: Teoría de Mente, Trastorno del Espectro del Autismo, Síndrome de Down, CI.

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Nazila Shojaeian

List of Abbreviations and/or Glossary of Terms of Alphabet

AAIDD	American Association on Intellectual and Developmental Disabilities
ACC	Children with Agenesis of the Corpus Callosum
ADHD	Attention Deficit/ Hyperactivity Disorder
APM	Advanced Progressive Matrices
ASD	Autism Spectrum Disorders
ASEBA	Achenbach System of Empirically Based Assessment
CBCL	The Child Behavior Checklist
CPM	Colored Progressive Matrices
DB	Disruptive Behavior
DS	Down syndrome
DSM	Diagnostic and Statistical Manual of Mental Disorders
FB	False Belief
HFASD	High Functioning Autism spectrum disorder
ICD	International Classification of Diseases
ICF	International Classification of Functioning, Disability and Heath
ID	Intellectual Disability
IDD	Intellectual Developmental Disorders
IQ	Intelligence Quotient
MR	Mental Retardation
NDDs	Neurodevelopmental Disorders
NTT	Now Theory of Mind Test

PDD	Pervasive Developmental Disorders
PDD-NOS	Pervasive Developmental Disorder Not Otherwise Specified
RCPM	Raven's Colored Progressive Matrices
Repr	Representational Change Task
SAC	Sally and Anne Task
SES	Hollingshead Four Factor Index of ***Socioeconomic Status***
SIS	Social Interaction Style
SLI	Specific Language Impairment
Smart	Smarties Test
SPM	Standard Progressive Matrices
ToM	Theory of Mind
WHO	World Health Organization

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Introduction

1 Introduction

1.1 The Neurodevelopmental Disorders (NDDs):

The neurodevelopmental disorders (NDDs) are the group of different disabilities manifested in early child's developmental period (Meredith 2015), before the children start their primary school, and are characterized by developmental impairments which can be manifested in various areas, such as deficits in the personal, academic, social, and occupational functioning. It can affect memory, emotion, cognitive abilities and behavior. The range of developmental impairments varies from the specific limitations of learning and control of executive functions to the other remarkable deficits of social abilities and intelligence (American Psychiatric Association, 2013).

In addition, this group of disorders (or NDDs) frequently occurs along with other conditions, such as intellectual disability in the children with autism (ASD), development of Alzheimer disease in individuals with Down syndrome and signs of specific learning disorder in individuals with Attention Deficit/ Hyperactivity Disorder (ADHD). Moreover, NDDs are associated with various factors such as medical conditions (e.g. epilepsy), genetic conditions (e.g. Rett syndrome, Fragile X syndrome, Down syndrome, tuberous sclerosis) and environmental factors (e.g. very low birth weight and fetal alcohol exposure). These factors play an important role in the diagnosis of the different disorders (American Psychiatric Association, 2013). The following table shows the list of neurodevelopmental disorders according to DSM-5 (see the table *1-1).*

Table 1-1 *Classification of neurodevelopmental disorders (American Psychiatric Association, 2013)*

Disorders	Groups
Intellectual Disabilities (intellectual developmental disorder)	Mild, moderate, severe, profound, global developmental delay, unspecified intellectual disability.
Autism Spectrum Disorder	Social communication and behavior deficits inherent to autism spectrum disorder, associated with a known medical or genetic condition or environmental factor, associated with another neurodevelopmental, mental, or behavioral disorder.
Attention-Deficit/ Hyperactivity Disorder (ADHD)	Combined presentation, predominantly inattentive presentation, predominantly hyperactive/impulsive presentation (in partial remission), other specified-Attention-Deficit/Hyperactivity-Disorder, unspecified Attention-Deficit/Hyperactivity Disorder.
Specific Learning Disorder	Specific learning disorder (e.g. special with impairment in reading, in written expression, and in mathematics).
Communication disorders	Speech sound disorder, difficulties with language and speech, childhood-onset fluency disorder (stuttering), social (pragmatic) communication disorder, an unspecified communication disorder.
Motor Disorders	Developmental coordination disorder, stereotypic movement disorder (e.g. with self-injurious behavior and without self-injurious behavior), and tic disorders.
Tic Disorders	Tourette's disorder, persistent (chronic) motor or vocal Tic disorder, provisional Tic disorder, other specified Tic disorder, Unspecified Tic disorder.
Other Neurodevelopmental Disorders	Other specified neurodevelopmental disorder (e.g., "neurodevelopmental disorder associated with prenatal alcohol exposure"), unspecified neurodevelopmental disorder (the symptoms characteristic of a neurodevelopmental disorder that cause impairment in social, occupational, or other important areas of functioning predominate).

The neurodevelopmental disorders (dyslexia, ADHD, intellectual disability, and autism) have an estimated global prevalence ranging from 3 to 8 percent of the children in the USA (Weiss and Landrigan 2000). The prevalence of the different conditions, according to the DSM-5, are 1% of the general population for intellectual disability approximately, about 1% for the autism spectrum disorder, ADHD about 5% of the children and 2.5% for the adults for most of the

cultures. The specific learning disorders (including reading, writing, and mathematics) have a prevalence of 5 to 15% among the school-age children in different languages and cultures. Finally, the language impairment wherein prevalence would be approximately 7.4% by Tomblin et al. (Tomblin, Records et al. 1997), and in children in kindergarten (5–6 years old) by 12.6% as reported by Beitchman et al. (1986) (Beitchman, Nair et al. 1986) can be a specific disorder, but it is often associated with some neurodevelopmental disorders, like specific learning disorder, attention-deficit/ hyperactivity disorder (ADHD), autism spectrum disorder, developmental coordination disorder, and social communication disorder (American Psychiatric Association, 2013).

The autism spectrum disorder (ASD) and intellectual disabilities (ID) are the most common neurodevelopmental disorders and can be derived from multifactorial origins such as genetic (Chromosomal or gene disorders), and physiological and environmental factors (advanced parental age, low birth weight, or fetal exposure to valproate etc.).

1.2 Intellectual Disability (ID) and Down syndrome (DS)

Intellectual Disability (ID) is defined by the "American Association on Intellectual and Developmental Disabilities" (AAIDD) as *significant limitations which are evident in both areas of intellectual functioning and practical adaptive behavior* (American Psychiatric Association, 2013). It manifests before the age of 18 (Schalock, Borthwick-Duffy et al. 2010, Nemerimana, Chege et al. 2018).

AAIDD has a multidimensional classification within the area of intellectual disability and is used as a framework to evaluate the severity of ID (Katz and Lazcano-Ponce 2008). The five dimensions, are intellectual aptitudes, adaptation level, participation and interaction social roles, health, and social context. The participation, interaction and social networks dimensions were added most recently to the AAIDD framework (American Psychiatric Association, 2013).

The *intellectual disability* classification of the AAIDD is in agreement with IASSID (International Association for the Scientific Study of Intellectual and Developmental Disabilities), and also with the suggestions from Disability and Health (ICF) that describes some areas of people's lifes , such as their activities and participations, mental and physical functions and environmental factors. ICF uses a multiaxial system to explain the different aspects of intellectual disability (Katz and Lazcano-Ponce 2008).

The World Health Organization (WHO) uses two classifications of ID: ICD-10, (International Classification of Diseases) (World Health Organization, 1992) for the diagnosis of MR (Mental retardation) which is still in use today, and the ICD-11 which suggests terminology of IDD (Intellectual Developmental Disorders) (World Health Organization, 2013., Carulla, Reed et al. 2011).

The DSM-5 criteria for the diagnosis of intellectual disability (Diagnostic and Statistical Manual of Mental Disorders, 5th edition) are:

A) Deficits in general mental abilities or intellectual functions, such as reasoning, problem-solving, planning abstract thinking, judgment, academic learning and learning from experience, confirmed by two or more standardized and individualized assessments resulting in an IQ below 70.

B) Impairments of adaptive functioning fail to meet the developmental and sociocultural standards for personal independence and social responsibility in one or more aspects of daily life, including communication, social participation, independent life, academic or occupational functioning at school or at work without ongoing support.

C) Onset of intellectual and adaptive deficits during the developmental period (American Psychiatric Association, 2013).

Four subtypes of intellectual disability have been coded depending on the severity specified in the ICD-10-CM, such as: mild, moderate, severe and profound level (American Psychiatric Association, 2013).

The individuals with mild Intellectual Disability (ID) show inadequacy in their behavior, emotion, and social skills. Although they often have specific needs such as support with academic skills, they have the capacity to live independently in their community with additional support. This support may cover assistance with life decisions, money management, etc. (American Psychiatric Association, 2013; Lindblad, 2013). Additionally, in the *DSM-5 criteria "*severity is classified based on daily skills, like the ability to live independently with minimum levels of support. *AAIDD* criteria specify the intensity of the intermittent support which is needed during transitions or periods of uncertainty (National Academies of Sciences & Medicine, 2015).

The individuals with moderate ID have the capacity to take care of themselves with support. They have the ability to learn basic skills, such as safety and health. According to *DSM-5 criteria,* they are able to live independently and may have achievement by moderate levels of support. The moderate ID in AAIDD criteria is limited to the need of support in daily situations (National Academies of Sciences & Medicine, 2015).

The individuals with Severe ID manifest delay in their development. They have potentiality to understand speech, but they show the limitation in their communication skills (Sattler and Hoge 2006). The ability to learn the simple daily routine and simple self-care may be impaired in severe ID level. Needs are defined by daily assistance in some activities such as self-care and safety supervision in the DSM 5 criteria. In addition, their profile in *AAIDD criteria* is determined by the extensive need of support for daily activities (National Academies of Sciences & Medicine, 2015).

The individuals with profound ID do not have the possibility to live independently because they need a close supervision and help with self-care activities, their ability for communication is limited and show a physical limitation. Furthermore, regarding the *DSM-5 criteria,* they need 24-hour care and *AAIDD criteria* mention the pervasive support needed for every aspect of the daily routine (National Academies of Sciences & Medicine, 2015).

Down syndrome, caused by an extra copy of chromosome 21, is the most prevalent known cause of intellectual disability affecting about 1 in 660 live births (Robinson, Roberts et al. 2019).

Down syndrome is caused by trisomy 21 in 95% of cases (Pueschel and Pueschel 1994). The average IQ in individuals with Down syndrome ranges from 25-35 to 70 (Deci and Ryan 2004, Baddeley and Jarrold 2007). There are different causes for Down syndrome: trisomy 21 or nondisjunction (results in an additional copy of chromosome 21) (Perkins 2017), Robertsonian translocation (a long arm of chromosome 21 breaks off and attaches to another chromosome through cell division, which is typical for chromosome 14 or other chromosome like 13, 15, or 22, or even two 21 chromosomes to each other (Perkins 2017), and mosaicism (results in multidivisional after fertilization, leading to two cell lineages) (Perkins 2017). In other words, the cytogenetic studies showed that a person with mosaicism of Down syndrome (mDs) has some cells

with 46 chromosomes and some with 47 (which contains the extra chromosome 21). Indeed, a percentage of cells with an extra copy of the 21st chromosome and the remaining cells are unaffected, It is believed that the characteristics seen with mosaicism vary depending on how many cells are affected (Perkins 2017).

Jean-Etienne-Dominique Esquirol (Esquirol 1838) presented the first description of the trisomy 21 phenotype. Later, "J. Langdon Down" published an article in 1866 in which he described some facial features of people with intellectual disability calling them "Mongolian" for the characteristics of their face (Down 1867). However, it was not until 1959 that the genetic cause was described by Lejeune, et al (Lejeune, Turpin, & Gautier, 1959). DS is one of the most studied disorder in human aneuploidy researches (Freeman, Allen et al. 2007).

1.2.1 The physical phenotype associated with Down syndrome:

Down syndrome is characterized by substantial physical and behavioral abnormalities and delay in both physical and cognitive development. The physical phenotype is the most common and recognizable manifestation of Down syndrome. The individuals with DS often have a congenital heart defect, growth retardation, muscle hypotonia and joint hyperlaxity (Sinet, Theophile et al. 1994). Furthermore, they have facial dysmorphology, a small and hypocellular brain and the histopathology of Alzheimer disease (Roper and Reeves 2006). Morphological abnormalities and physical characteristics can be found in their hands and feet (Sinet, Theophile et al. 1994), they have some features in their bodies like big toes, short fingers and anomalous

form of fingerprints (Asim, Kumar et al. 2015). Other features are protruding tongue and flat face (Roper and Reeves 2006).

1.2.2 The behavioral phenotype associated with Down syndrome:

The individuals with Down syndrome have an uneven profile of cognitive, social and language development. The behavioral phenotype in some syndromes may be determined by a chromosomal or genetic aetiology (e.g. Williams syndrome, Prader-Willi syndrome, Angelman syndrome, Down syndrome, and Fragile-X syndrome). The behavioral phenotype is accompanied by specific deficits in expressive language development or linguistic, speech-motor, adaptive behavioral (consistent with general intelligence) skills and poor problem solving (Chapman and Hesketh 2000) and is also characterized by difficulties in social function or social competence. (Gibbs and Thorpe 1983, Rodgers 1987, Wishart and Johnston 1990).

Down syndrome is associated with some impairments of cognitive ability, for instance difficulties in verbal working memory and learning outcomes, delay in expressive, morphology, syntax (Hesketh and Chapman 1998, Laws 1998) and verbal short-term and explicit long-term memory (Jarrold, Baddeley et al. 1999). In addition, good visio-spatial constructive skills, as the key features of the cognitive phenotype, are evident in Down syndrome individual's abilities (Klein and Mervis 1999, Abbeduto, Warren et al. 2007). Also, problems with abstract thinking and learning and delay in cognitive development are common in Down syndrome (Sanchez, Heyn et al. 2012).

Individuals with Down syndrome usually have specific language impairments and also show delays in speech development (American Psychiatric Association, 2013). These delays in

language are mainly found in the area of predicate constructions, pronouns and verb agreement, and syntax (Chapman and Hesketh 2000). They are weaker with their expressive language than their receptive language (Sigman, Ruskin et al. 1999). These language difficulties often persist into adulthood (Fowler 1990).

1.3 Autism Spectrum Disorders (ASD):

Autism Spectrum Disorders (ASD) are the most common neuro-developmental disorders (Abrahams and Geschwind 2008) and are characterized by core symptoms which are present in some domains: atypical development in socialization, communication, and behavior (Rice 2009). The degree of these impairments among individuals with Autism spectrum disorders is variable and typically emerge in the first two or three years of life and persist throughout life, but they can be diagnosed in all age groups (Mustard & Gulabivala, 2014). In addition, impaired social communication and social behavior deficits are referred to as the identity of autism disorder.

According to DSM-IV-TR, the prevalence of autism (or PDD) was 2.5 in 1,000 (American Psychiatric Association, 2000), but the prevalence of ASD within the new diagnostic criteria (DSM-5) has increased. It is reported to be as much as 1% of the population in the U.S. and other countries, with similar estimates in child and adult sample. The current estimate is around 1 in 68 children in the U.S. (Christensen, Braun, Baio, Bilder, Charles, Constantino, & Lee, 2018). The reasons for this increase can be attributed to improvement and changes in practices for diagnosing ASD and expansion of diagnostic criteria, or increase in awareness of this disorder, the patient

referral and availability of services over the recent years (American Psychiatric Association, 2013).

Theodore Heller described one syndrome in early childhood in 1908 and named it " Infantilis" which was previously known as "childhood disintegrative disorder" (CDD) (Heller, 1908). But it was Leo Kanner who introduced a first clear definition of the autism disorder. His study describes 11 children from 2.5 to 8 years old who were incapable of establishing normal interpersonal connections and showed stereotyped behavior and an astonishingly high memory capacity. It was primarily the definition of a pattern of behavior that Kanner called "early infantile autism" as a new psychiatric condition in 1943, which was characterized by severe impairments of social interaction and communication or intense resistance to change. Also, Kanner suggested autism was an innate disorder that is present since birth. He also suggested the differences between autism and schizophrenia (Kanner, 1968), however, the knowledge of the pathology of autism is not new. Jean-Marc Gaspard Itard is recognized as one of the founding fathers of special education. He worked with Victor, known as "The Wild Boy of Aveyron" (region of France). The child was found mute and naked with an animal-like behavior who lived in isolation from other people and society completely (Pinel, 1800). Itard formed first clinicians to describe this as "Intellectual Mutism," or "Autism" in 1828 and rejected the diagnosis of "idiocy" for these cases. He also showed some ways of distinguishing children with mental retardation from those with pervasive developmental disorders. The studies suggested that Victor displayed signs of autism (Carrey 1995).

However, the definition of autism has been modified to critical analysis of the development of diagnostic criteria to the previous version of DSM-IV-TR, until the latest revision of DSM-5

(See the particular definition of ASD in the Diagnostic and Statistical Manual 5th edition (DSM-5) criteria, in the *Table 1-2*.

Table 1-2: Diagnostic Criteria for Autism Spectrum Disorder DSM-5(American Psychiatric Association, 2013)

A	Persistent deficits in social communication and social interaction (that severity is also based on social communication deficits, restricted and repetitive patterns of behavior) across multiple contexts as manifested by all three of the following, currently or by history	1.Deficits in social emotional reciprocity	2. Deficits in nonverbal communicative behaviors used for social interaction	3. Deficits in developing, maintaining, and understanding relationships	
B	Restricted, repetitive patterns of behavior, interests, or activities (that severity is based on social communication impairments and restricted, repetitive patterns of behavior) as manifested by at least two of the following (currently or by history)	1. Stereotyped or repetitive motor movements, use of objects, or speech	2. Excessive adherence to routines, ritualized patterns of verbal or nonverbal behavior, or excessive resistance to change	3. Highly restricted, fixated interests that are abnormal in intensity or focus	4. Hyper-or hypo-reactivity to sensory input or unusual interest in sensory aspects of environment.
C	Symptoms must be present in early childhood (but may not become fully manifest until social demands exceed limited capacities or may be masked by learned strategies in later life				
D	Symptoms cause clinically significant impairment in social, occupational, or other important areas of current functioning				
E	These disturbances are not better explained by intellectual disability (intellectual developmental disorder), or global developmental delay				

DSM-IV-TR defined autism and related disorders as “pervasive developmental disorders (PDDs)” This definition has been replaced in DSM-5 with “autism spectrum disorder”. DSM-5 as new diagnostic criteria have several significant changes for the whole PDDs to ASD. The most remarkable changes are as follows: 1) Replace four of these subtypes (Autism disorder, Asperger disorder, other childhood disintegrative disorder and pervasive developmental disorder not otherwise specified should be given the diagnosis of autism spectrum disorder (PDD-NOS)) with

autism spectrum disorder (ASD) as one central diagnosis. Rett syndrome is no longer included in the DSM-5. 2) The three traditional domain symptoms (social reciprocity, communication, and restricted and repetitive behaviors) have been reduced to two domains by combining 'social and communication symptoms' area. 3) Addition of other symptoms (restricted repetitive behaviors, interests, or activities) which were not previously included in DSM-IV-TR, 4) Addition of a new diagnostic category, "Social communication disorder (SCD)," because some children may present deficits in the social use of communication without having repetitive/restricted behaviors. 5) DSM-5 changed the specification for age at onset, from 3 years old to "early childhood." (American Psychiatric Association, 2013; Gibbs, Aldridge et al. 2012, Mandy, Charman et al. 2012, Kim, Fombonne et al. 2014). The unusual sensitivity or hypersensitivity to sensory stimuli feature is not included in the DSM-IV and the language impairment is no longer included in DSM-5 (Vivanti, Hudry et al. 2013).

Each of these updates and changes has been met with controversy, the latest changes in diagnostic criteria for autism spectrum disorder as defined by the DSM-5 to help diagnose ASD can be seen below (see criteria in "A, B, C, D and E in the Table *1-2*). According to the International Classification of Diseases by the WHO (ICD-11), ASD diagnosis is based in two domains: social communication and interaction and restricted to repetitive behaviors and interests (World Health Organization, 2013). The diagnostic features in the social communication dimension present three principles: 1) Social-emotional reciprocity, 2) Nonverbal communicative behaviors and 3) Impairments in developing and maintaining relationships. The social-emotional reciprocity includes: problem with sharing interests or affections, turn taking, conversation or

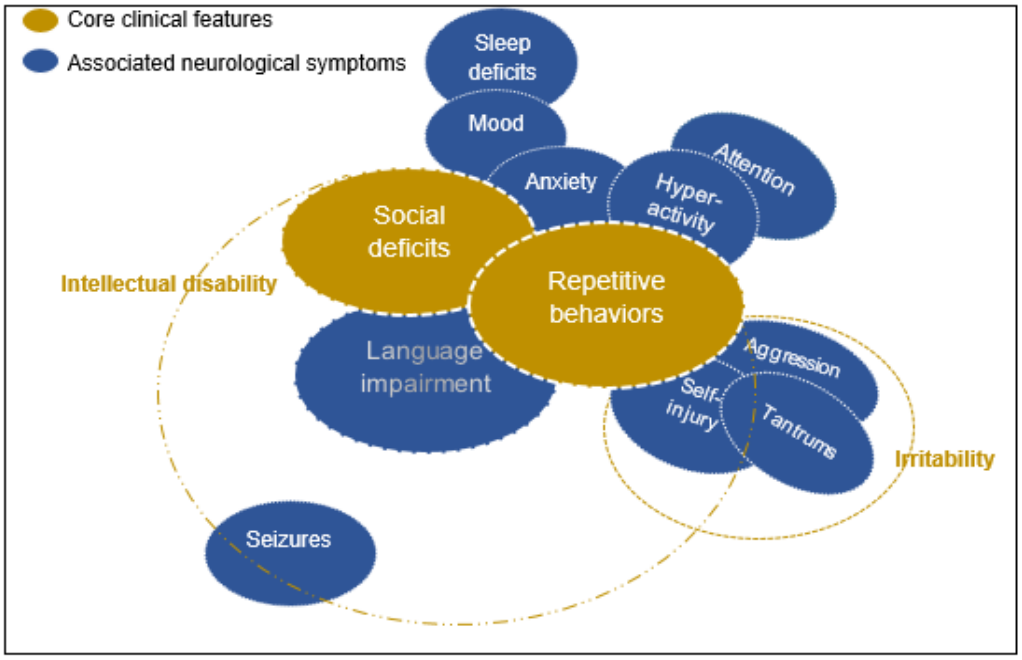
relative failure to initiate or sustain conversational interchange and lack of initiation or social approach, and resist physical contact. The non-verbal communication impairments include body language, eye contact, gesture, facial expression and integration of language or non-verbal behaviors. The area of impairments in developing and maintaining relationships manifest in the following areas: impairments in relationships such as acceptable adjusting behavior in different social contexts, problems in forming and maintaining communications suitable to the age and developmental level (World Health Organization, 2013).

The second domain is repetitive behaviors and interests or stereotyped patterns of behavior. Within this domain, the diagnosis of ASD from World Health Organization is as follow: 1) An encompassing pre-occupation with some stereotyped and restricted patterns of interest which are abnormal in content or focus or in their intensity and circumscribed nature, even though not abnormal in their content or focus and sometimes they indicated a sensory processing difficulties (e.g. laugh or cry at unusual time and not having emotional response when expected) or an unusual response or hyperactivity to touch, sound, smell, taste, look, feel etc., 2) Superficially compulsive adherence to specific, non-functional routines, 3) Arm/hand movements, finger flapping or twisting, and complex whole-body movements may manifest stereotyped and repetitive motor movements, 4) Preoccupation with part-objects and non-functional elements of play materials 5) Suffering from small changes and non-functional details of the environment (World Health Organization, 2013).

Children with autism spectrum disorder manifest the signs and symptoms within different areas, as mentioned in *Table 1-2*. The other symptoms are difficulty in speech and language comprehension, which include: delay in learning to speak, an abnormal tone of voice, and repeating words for the several times or repetitive use of language (some individuals with ASD can speak very well, some of them can speak very little, and around 40 percent of ASD individuals do not talk at all), or have the abnormalities to use language such as: pitch, stress, rate, rhythm and intonation of speech (Hollander, Phillips et al. 2003, Wilcox and Reid Duffy 2015).

Other common problems in individuals with ASD are lack of fear or more fear and phobias, sleep disturbance and limited diet or eating disturbances/eating non-food. The disruption of mealtime behavior is around 90 percent (Ahearn, Castine et al. 2001, Lydon, Healy et al. 2015). In addition, maintenance of imposed postures (catalepsy), absence of movement (akinesia), waxy flexibility, extreme negativism, and seizures are the other motor abnormalities in some individuals with ASD *(see Figure 1-1)* (Hollander, Phillips et al. 2003, Wilcox and Reid Duffy 2015). The behavioral problems in some individuals with ASD are manifested by attention difficulties or short attention span, effective instability or temper tantrums, challenging behavior or disruptive behavior (DB)(e.g. aggression), and self-injurious behavior (Hollander, Phillips et al. 2003, Wilcox and Reid Duffy 2015). Abdominal pain, constipation and diarrhea are the most common medical conditions in children with ASD (Kral, Eriksen et al. 2013).

Figure 1-1: *Core and associated symptoms in Autism Spectrum Disorders (Klinger, Dawson, Burner, & Crisler, 2019)*



The individuals with ASD do not have the initiative, spontaneity and creativity to organize their free time. It is difficult for them to put their concepts and decisions into tangible work. They often encounter difficulty understanding the complexity of different roles in their work. The evidence of autism changes with age, but the limitations continue into adulthood (World Health Organization, 2013).

1.4 Theory of Mind

Theory of Mind (ToM) was originally suggested by two primatologists named Premack and Woodruff. According to their report, chimpanzees may infer mental states (Premack and

Woodruff 1978). After that, many theoretical studies focused on the ability in chimpanzees as the Theory of Mind like humans. In different ToM studies on chimpanzees the results show that they may not completely understand others' belief-desire, but can understand that the others have mental representations (Hare, Call et al. 2000, Hare, Call et al. 2001).

Theory of Mind is one of the abilities that distinguishes us from the other primates, known as a cognition. This capacity enables us to deceive, cooperate, empathize and read the body language or even the people's minds and their behaviors (Gallagher and Frith 2003). Also, we can assess different mental states (desires, emotions, knowledge, and beliefs) that people could have in different situations. ToM is a progressive process throughout preschoolers, middle childhood and adolescence (Hughes and Devine 2015). The definition of ToM can be summarized as the experience and expectations of people's behavior that constitute our general knowledge of the world, which could help us to predict people's behavior in terms of our expectations.

According to Baron Cohen (1999) Theory of Mind in humans can be present in different behaviors, such as follows:

Intentionally communicating with others: This communicative performance refers to the acts that are produced in order to change the knowledge state of the listener. To inform the others intentionally requires the belief that the others have minds that can be informed or uninformed (e.g. a mother who wants to keep her child away from a fire screams at the child and that leads to changing the knowledge state of the fire in the child).

Repairing failed communication: Theory of Mind is needed in order to recognize that a message may not be understandable and that the speaker needs to communicate the same message in a different method.

Teaching others: This behavior is produced with the intention of changing the knowledge state of the others.

Intentionally persuading others: Persuading is changing somebody's belief about something and causing someone to do something through reasoning or an argument. The goal is often to change the behavior of people, but it is perceived as a change of belief.

Intentionally deceiving the others: A behavior aimed at changing the belief state and mental state of an individual to accept something false and wrong as being right to change the belief state of the other people (e.g. a soldier saves himself from getting captive by camouflaging).

Building shared plans and goals: Sharing a plan or goal with another person requires "meeting of minds" that both of them must recognize the intention of the other one and, then, work out how to interact with the other person to achieve the shared goal.

Intentionally sharing a focus or a topic of attention: People can coincidentally look at the same target. This is not shared attention, if each person is simply only aware of his or her own viewpoint. People must also be aware of the other person looking at the same target.

Pretending: Behave as if something is true when you know that, in fact, it is not true. The intention of pretending is to temporarily treat one object as if it is another, or as if it had attributes that it clearly does not have. Also pretending only exists in the mind of the pretender, who has to switch between thinking about his own knowledge of the real identity and the pretended identity of it.

The typically developed children are often developed in their understanding of the mental states and perform ToM abilities around 3 to 5 years of age. In addition, they can understand the different emotions and cognitive states in other people and the mental world (Happé, 1995). When typically developed children are in preschool years, they often achieve the capacities to produce complex, embedded justifications or have some ideas about the emotions and social cognition. This is when the true Theory of Mind emerges and appears to have a good distinction between mental and physical entities. They tend to mention the situational factors like neglecting, but not making an explanation of a person's mental experience. They can keep the mental state that different persons might think in different ways. This ability differs from child to child according to the different capacity they have (Denham 1986, Rieffe, Terwogt et al. 2005). The typically developed children have the ability to show the relationships between two or more person's epistemic states at 4 to 6 years old, but they are unaware of the distance between the internal mental world and objective reality (Wellman & Estes, 1986; Wimmer & Perner, 1983). They tend to understand that people can have different desires, beliefs, and predict emotions (even the undesirable desires or beliefs) at five 5 years (Rieffe, Terwogt et al. 2001). At six years old, they can recognize the distinction between real and apparent emotions and mental entities, and that non-existing things are covered by the mental entities. This ability becomes very accurate at the 6- 10 years old and they can distinguish other's emotions (Harris, Donnelly et al. 1986, Wellman and Estes 1986, Rieffe, Terwogt et al. 2005).

The ability to understand visible behavior and social cognition in humans as mental representations is often assessed with "*False Belief Tasks*". As an important, False Belief (FB) is necessary for development in ToM and it marks the emergence of a representational concept of

mind (Astington and Gopnik 1991, Perner 1991, Wellman 1992, Rhodes and Brandone 2014) between mental representations and real state, which is called *False Belief* (Rhodes and Brandone 2014). Behavior prediction has an important mental states role, particularly when a person doing the behavior is misinformed. The false belief task appear with behavioral subsequences of holding a mistaken belief. They understand that mental states are subjective representations, independent and congruent with reality (Maulik, Mascarenhas et al. 2011). "The False Belief task" was developed for preschool-aged children, originally (Saxe 2009). By 5 years old, children understand that people demonstrate the world in their minds, and demonstration specify the person's acts, even in cases where they are misrepresentations of the real condition in the world (Milligan, Astington et al. 2007).

Theory of Mind is extensively divided into first-order of ToM which evaluates the capacity to understand another person's thought, second-order of ToM measures the capacity to infer what one person thinks about another person's thoughts and third order of ToM that performed more complicated mental state attributes follows the classical structure of first- and second-order false-belief tasks (recognition of "faux pas" or "social blunders") (Baron-Cohen, 1985, Brüne 2005). The third order is more advanced aspect of ToM order, which refers to children ability to know about the how mind actively mediates the interpretation of reality, which previous experiences have effects on the current mental states like emotions and social inferences (Muris, Steerneman et al. 1999).

1.4.1.1 First order false belief "Precursors of Theory of Mind" (ToM 1):

The simple level of a person's mental state refers to the first order (Happé, 1995). The typically developed children begin to understand the first-order tasks by 3- 4 years old; they are able to pass tasks at the mental verbal stage (Johnson and Wellman 1982, Flavell, Flavell et al. 1983, Wellman and Estes 1986). Children show their needs, emotions, and other mental states such as" thinking, believing and intending", using cognitive words such as "know," "remember," and "think". Also, recognition of emotions and pretense are two important factors in the first order of the false belief task (Muris, Steerneman et al. 1999). Although the children with autism may reach the first order, they delay until 6-7 years old. The majority of the individuals with autism can pass the first order only from 5.5 years old, but high-functioning autism individuals or some children with autism are able to succeed in simple tasks of the first order of Theory of Mind at 3 to 4 years of age (Happé, 1995). The individuals with Down syndrome have a well-developed capacity in ToM tasks, when they are compared with their peers from the ASD group (Shaked and Yirmiya 2004).

1.4.1.2 Second order false belief "First Manifestations of a Real Theory of Mind "(ToM 2)*:*

When children gain the knowledge that the mental and physical world are two different and separated worlds, the second order takes place. Second-order of the belief is about "what children think about other people's thoughts"(Perner and Wimmer 1985). The ability for the second level in the typically developing individuals is manifested later and is completed around 6 - 8 years old (Perner and Wimmer 1985, Frith 2001). The mind can represent events that are accurate or

inaccurate. This representation can be false with respect to a real object or event (false belief task). Also, behavior can be false with respect to a mental state “when someone has different feelings and perceptions (an unhappy person smile)” or when two people have different perspectives and beliefs (Muris, Steerneman et al. 1999). The high functioning individuals with autism (HFA) may succeed and develop in the second order tests in their teens by higher verbal mental age to pass this order FB tasks than the children with intellectual disability (Frith, Morton et al. 1991, Bowler 1992, Happé 1995).

In a paper through a comparative study between children with autism and non-autism, Baron Cohen (1989) showed that the children with autism spectrum disorder succeeded in 80 percent of first order tests, while only 20 percent succeeded in the second order of Theory of Mind tests. The typically developed children were about 90% successful to pass the second order tasks, and the children with Down syndrome were 60% for passing the belief questions. Furthermore, the children with ASD had developed in the lower level of ToM (Baron-Cohen 1989). Typically, the individuals with Down syndrome in adulthood performed worse on the Theory of Mind tasks than children of average intelligence at five years old (Zelazo, Burack et al. 1996).

1.4.1.3 Third order false belief “More Advanced Aspects of Theory of Mind “(ToM 3):

The children find that the mind actively mediates the interpretation of reality. Previous knowledge affects present mental states of emotions and social inferences (Muris, Steerneman et al. 1999). Although "Real" Theory of Mind at third to fourth orders probably emerges more slowly around 6 years of age (Muris, Steerneman et al. 1999), the typically devolved individuals in their school-age get adapted in the first and second level of Theory of Mind at 10 and 11 years old. In

long run, they may achieve the third level above chance, and the fourth level of ToM by chance (Liddle & Nettle, 2006). The individuals with High Functioning Autism Spectrum Disorder (HFASD), in particular adolescents, had a slight advantage over the advanced ToM task compared to the typically developed children, even after controlling the chronological age, however, they may still experience profound difficulties in understanding the mental state of the others. It can be seen that they suffer a specific impairment at a higher order of Theory of Mind (Baron-Cohen, Leslie et al. 1986, Scheeren, de Rosnay et al. 2013).

1.4.1.4 Another classification of Theory of Mind orders:

Flavell et al., (1983) discussed that five successive development stages of the Theory of Mind exist during childhood. At first, children adopt the notion of mind and mental states, some of them include thinking, believing and intending (first stage), the mind has connections to the physical world and differs from the physical world (second and third stage). Also, they are able to represent objects and events accurately or inaccurately (fourth stage). In the fifth and last stage they understand that the mind actively mediates the interpretation of reality (Previous experiences affect the new experience of mental states which in turn affect emotions and social inferences, and certain stimuli lead to behavior and mental states that can be inferred from stimulus-behavior links) (Flavell, Flavell et al. 1983).

1.5 Theory of Mind in Autism Spectrum Disorders (ASD):

Some evidence in different studies demonstrated that, in terms of the DSM-IV categories, children with high functioning autism (HFA), Asperger's syndrome (AS), and pervasive developmental disorder not otherwise specified (PDD-NOS) (aged 4 to16) showed a delayed ToM onset compared to their TD counterparts. In older age their scores in the ToM increased as well. But for low-functioning autism (LFA) children ToM had fit the deviant development model (age did not predict ToM). However, the verbal IQ and age could support the ToM development in ASD individuals because they used some cognitive compensatory strategies, but it is not supported in TD group. For the individuals who had a poor verbal ability, age could not predict ToM. Also, high functioning ASD showed much delayed ToM development, whereas low-functioning ASD performs both delayed and deviant in ToM (Hoogenhout and Malcolm-Smith 2014).

The development of false belief understanding in some children with ASD appears very late when they are in their teens (Joseph and Tager-Flusberg 2004). This deficiency of ToM is more unique in the individuals with ASD (Zelazo, Burack et al. 1996) with different mechanisms (development of ToM delayed, and this developmental patterns could be stray from normal) than in other groups of children (Hoogenhout and Malcolm-Smith 2014). In the study of Ozonoff, Pennington, & Rogers (1991) the High-Functioning Individuals with Autism (HFA) usually presented a significant difference in EF, ToM, emotion perception and verbal memory tests when compared to their control counterparts. The majority of HFA individuals responded to the second order of ToM correctly, although they showed executive function impairment in their ability. Also, in fewer studies in the first order of Theory of Mind tasks (Ozonoff, Pennington et al. 1991).

Theory of Mind development has been studied in different groups of children with disabilities given its importance for the development of daily living skills. In a study from Peterson, Slaughter, Moore, & Wellman (2016), 195 children with typical development, autism, and deafness (both native and late signers) were evaluated at 5 - 13 years old. Children performed differently: deaf children with late-signing were especially delayed even compared with the children with ASD in ToM understanding, and ASD individuals were especially delayed even related to deaf late signers in peer social skills, as well as TD, and deaf children were in the same level of ability of ToM. Additionally, in both conditions of native-and late-signer for the deaf children, peer social skills over and above age, gender and language ability could be related to the development of their ToM understanding. The pattern was different in the ASD individuals, suggesting that ToM development could be significantly mediated by language ability (Peterson, Slaughter et al. 2016).

Other researches explored the difficulties in ToM (with predicting and explaining effective false-belief tasks) and cognitive domains or EF (with planning and cognitive shifting tasks) in preschoolers with autism and typically developed children (aged at 3–6). The differences were found especially in the EF and ToM, in favor of TD individuals. Some scales like-planning skills, EF-cognitive shifting and Verbal IQ (VIQ) contributed meaningfully (Kimhi, Shoam-Kugelmas et al. 2014). Furthermore, the internalizing and externalizing behaviors scores could be associated with ToM performance. Both scales, with varied subdivisions, have been discussed in several types of research. An example is the difficulty that children or individuals with ASD have in mentalizing, in which aggressiveness and socially withdrawn behavior are negatively correlated with their ToM abilities (Badenes, Clemente Estevan et al. 2000).

A number of studies have further documented the effect of impairments in social skills and ToM abilities in the individuals with ASD, compared to children with typical development, and also investigated whether these social abilities could be mediated by ToM ability (Mazza, Mariano et al. 2017). Additionally, to explore the effectiveness of a ToM treatment in ASD (7 to 12 years old) group and how they could succeed in Social Interaction Style (SIS) or display Disruptive Behavior, the finding from a study confirmed a positive effect of this treatment on ToM understanding, as well as a positive effect on parent-reported ToM behavior or autism features, although this confirmation was not found for parents or teacher-reported social behavior. The results supported the hypothesis that ToM could improve the social skills and the behavior (Begeer, Howlin et al. 2015). In a study by Loukusa, Mäkinen, Kuusikko-Gauffin, Ebeling, & Moilanen, (2014) with children with Specific Language Impairment (SLI), ASD children and typical development (TD) groups, the results showed that both SLI and ASD children had difficulties solving verbal ToM measurement tasks, although these differences did not seem to be related to measuring the tasks of non-verbal contextual ToM. Thus, the children with SLI showed a stronger association between Verbal ToM tasks and language tests compared to individuals with ASD (Loukusa, Mäkinen et al. 2014).

Empathy and ToM in individuals with ASD is another subject for ToM studies. According to their teachers, children with ASD showed less empathy than typically developed children, and the ToM understanding was not related to empathy for the ASD group, but it was for the TD group. But when some factors like age and verbal maturity were controlled, the data of the subgroup of the children with ASD in older age showed that they could be able to pass

false belief tests and have greater ToM skills, and significantly less in empathy compared to younger children (Peterson 2014).

Finally, in another research (O'Nions, Sebastian et al. 2014) unusual neural processing of ToM was studied in three groups of children (10- 16 years old); individuals with ASD, individuals with conduct problems and high levels of Callous-Unemotional (CU) traits (CP/HCU) and Typically Developing (TD) individuals. ASD group showed more difficulty in ToM understanding, and unusual processing was evident at behavioral and neural levels. The group with CP/HCU showed a reduction of responsiveness to people's feelings or displayed some problems in their interacting with others (this group performed at a normal level in ToM tests). In summary, ASD and CP/HCU groups are categorized by social problems, but only ASD group displayed unusual neural processing associated with ToM, and this correlated with symptom severity in individuals with ASD which is measured with the Autism Diagnostic Observation Schedule (ADOS test) (O'Nions, Sebastian et al. 2014).

1.6 Theory of Mind in Down syndrome (DS):

Various Theory of Mind studies have compared different groups of children with ID: DS and ASD individuals with ID, non-specific ID, and individuals with learning disabilities. Thus, it indicated that children with DS performed more poorly than the children with non-specific ID and TD, and that the TD children did not perform significantly better than the children with non-specific ID in their ToM abilities and cognitive skills (Giaouri, Alevriadou et al. 2010). Some studies of ToM in Down syndrome (Shaked and Yirmiya. 2004, Yirmiya, Erel et al. 1998)

suggested that individuals with Down syndrome (DS) displayed a unique profile of ToM skills (presentation of specific strengths in attentional, social, and emotional abilities or skills) (Yirmiya, Erel et al. 1998, Shaked and Yirmiya 2004).

However, the comparison between children with Down syndrome and children with ASD indicated that DS individuals were attentive to the emotions of other people, and were socially sensitive with a higher degree of social competence, and the ability to pass the ToM tasks correctly. But both groups (Down syndrome and individuals with ASD) were not as good as typically developed children to solve ToM tasks (Yirmiya, Erel, Shaked, & Solomonica-Levi, 1998, Kasari, Freeman et al. 2001).

In a study with twelve low-functioning preschoolers with DS and 12 non-handicapped children, the first group performed worse than the second on several standard ToM tasks and on a color-shape card-sorting task. The finding shows that ToM reflects specific psychological functions, for instance; individuals with DS insisted on focusing on a single state of affairs or using a single set of rules on trials in these tasks (Zelazo, Burack et al. 1996). In another study exploring 25 individuals with ASD, 21 with ID of unknown etiology, 19 individuals with Down, and 21 typically developed children on false belief and deception tasks, TD individuals achieved better ability than the rest of groups. Likewise, on the value task, ID children scored better than the group with autism (Yirmiya, Solomonica-Levi et al. 1996).

To show the difficulties of ToM in different diagnostic disorders, Down syndrome children are much closer to the TD children in terms of ToM skills and showing less difficulty than ASD individuals (Baron-Cohen 1989, Yirmiya and Shulman 1996) this difficulty can be overcome in individuals with DS. To address this challenge, Cobos & Castro (2010) documented that the

participants with Down syndrome had difficulties answering correctly to what they know about other people. On the other hand, they are able to put themselves in his/her place in different situations (Cobos and Castro 2010).

Baron-Cohen et al (1985) in a study with children with high functioning autism (HFA) (mean age: 11; 11, mean IQ: mostly in the average and borderline range), Down Syndrome (mean age: 10; 11, mean IQ average of 64), and children with TD (mean age: 4; 5) evaluated with the Sally and Anne task (Wimmer and Perner 1983) showed the following results: 86% of Down syndrome children, and 85% of the typically developed children passed it, while 80% of the ASD children failed in this test (Baron-Cohen, Leslie et al. 1985).

In the current study, we investigated on achieving a better knowledge of DS and ASD individuals. DS is an appropriate group for comparison with the individuals with autism spectrum disorder or other groups with disability for the assessment of ToM. While the process of achieving the Theory of Mind abilities in the children with autism and the typically developed children has received considerable attention, the same process in Down's syndrome has not achieved such attention in the researches.

1.7 Other relevant factors regarding Theory of Mind:

1.7.1 Language and Theory of Mind

Language skills are described as the ability for the reception and production of syntax and semantics as measured with a standard scale. Language level has an important role in the Theory

of Mind development (Astington and Jenkins 1999). The typically developing children can develop in language ability at 3 years old, which is as a predictor of performance on later ToM tasks (FB tasks and appearance-reality tasks). Nevertheless, earlier ToM did not predict later language task performance. But early language abilities development is linked to the later appearance of children's understanding of the representational mind (Astington and Jenkins 1999, Farrar and Maag 2002). It means that after the children start to speak, their skills become stabilized in their mind, and show an ability to pass the false belief task or the other representational ToM tasks at around 4 years old. It is the progressive social cognitive understanding of belief that continues to develop during the middle childhood life. The most frequent symptom related to language in the individuals with autism is that they often show lack of spoken language by two years old and have a delay or deviant in language development in their early years (De Giacomo and Fombonne 1998). Language abilities play an important role in Theory of Mind development, which contributes to false belief understanding, independent of age and family background. In addition, language is fundamental to Theory of Mind development and is an application for false belief distinction of reality and acknowledgement for children's belief (Astington 2001). Deaf children are a clear example to show the significant role that language plays in the development of false belief tasks because of strong theoretical claims about the role of language acquisition in the development of an understanding of false beliefs (Schick, De Villiers et al. 2007). To demonstrate this fact, some studies show significant delay on ToM tasks in deaf children of hearing parents, who typically demonstrate language delays, compared with their hearing peers (Schick, De Villiers et al. 2007). In contract, deaf children from deaf families have no delays in ToM development, and

performed the verbal and low-verbal ToM tasks more successfully than the same-aged hearing controls (Schick, De Villiers et al. 2007).

However, the false belief tasks can be passed at preschool age, around 3 to 5 years old, by a typical child, however, the changes and development can be manifested in a correct and right belief and conception (definitive test) (Wellman, Cross et al. 2001).

1.7.2 Age and Theory of Mind

Happé (1995) suggested that children with autism spectrum disorder need a far higher verbal mental age and ability to pass ToM tasks. In a research study in this line, results showed that 31 percent of the high-functioning individuals (HFASD) succeeded to pass the ToM tasks. The typical or HFASD children, and Asperger Syndrome individuals showed a potential to pass ToM tasks at the verbal mental age around 4 years old. But the individuals with autism achieved these abilities later than the TD children (Happé, 1995). The development in executive functioning with age helps make it possible for the acquisition of Theory of Mind abilities. Briefly, individuals with autism do acquire ToM abilities at later ages and with higher verbal mental abilities compared to individuals with Down syndrome and typical developing children. The literature has been in line with the findings in the present study in Persian, Kako Jouybari, Shaghaghi, Baradaran (2013) indicated that significant differences in orders of Theory of Mind between the older individuals and younger individuals succeeded to obtain higher scores with increased age and their evolution (Kako Jouybari, Shaghaghi, Baradaran, in Persian 2013). Importantly the ageing (Girli and Tekin 2010) and having higher verbal mental age (VMA) (Ozonoff and McEvoy 1994, Happé and Frith

1996) could affect the performance in ToM tasks in the groups (Girli and Tekin 2010). To further confirm these findings, it is possible to say that Theory of Mind impairments can be explained by connectivity between the brains regions into networking abnormalities which in turn modular deficits are cues of ASD impairments of Theory of Mind development (Belmonte 2009). However, the differences between the groups on the ToM are measured in the current study.

1.7.3 IQ and Theory of Mind

A number of studies documented the relevance of the cognitive level to the ToM development. The evidence about Theory of Mind deficits with intellectual disability, and more pronounced ToM deficits come from the children with comorbidity of low IQ and psychiatric disorders like autism or psychosis (Anto Praveen, 2007). The comparative study between the individuals with autism spectrum disorders and typically developed children suggests that ASD group with the higher verbal IQ scores and with higher verbal mental age in their older ages can pass first or second order ToM (Kaland, MøllerNielsen et al. 2002). However, these difficulties of solving ToM tasks in the individuals_with autism cannot be referred to as low IQ because the individuals with Down syndrome could get better scores on false belief tasks with similar or lower IQ scores (Baron-Cohen, Leslie et al. 1985).

Wechsler IQ tests contain some tasks assessing verbal intelligence (vocabulary and comprehension), and performance intelligence (matrix reasoning and picture completion). The verbal task of Wechsler is often used to assess in children with autism; however, the results display

that comprehension difficulty in this group may reflect their poor ability of Theory of Mind, regardless of ToM performance (Happé 1994b).

Three groups of children including the children with autism disorders, a pervasive developmental disorder not otherwise specified, and non-autism psychiatric disorders were participants from "Utrecht Department of Child Psychiatry". Buitelaar, Wees, Swaab-Barneveld, van der Gaag (1999) reported that both verbal Memory and Performance IQ factors were used as the best predictors of social cognitive ability. The results showed that the individuals with autism displayed lower Verbal than Performance IQ. All participants were assessed with different orders of ToM tasks including the first-order Theory of Mind (appearance-reality task, mental-physical distinction task, the concept of the brain task, M&M's false belief task, and ''Sally-Ann'' false belief task). For the second-order Theory of Mind tasks, Emotion recognition task, and Memory control tasks have been used and to measure verbal memory the Rey Auditory Verbal Learning test has been used (Buitelaar, van der Wees et al. 1999).

Other studies have also claimed to understand the role the IQ plays in psychical desires in young children and adults. For instance, Mo, Su, Chan, and Liu, (2008) compared 29 patients with schizophrenia who were diagnosed using DSM-IV criteria, and 22 healthy controls from Beijing's Anding Hospital, in China were assessed with metaphor and irony comprehension tasks and both orders of Theory of Mind tasks (first- and second orders). Moreover, the criteria examined the role of IQ and a Theory of Mind. The schizophrenic patients were impaired in their comprehension of metaphor and irony in comparison with their counterparts. Findings revealed a deficit of Theory of Mind in patients with remitted schizophrenia. The authors argued that when IQ and verbal IQ were controlled, the schizophrenic patients' impairments remained. In other words, IQ does not

explain the significantly high level of impairments within both factors (comprehension of metaphor and irony) independent of group membership (Liu, Wellman et al. 2008).

In a study of Sanz-Cervera (2015) parents and teachers with autistic disorder (N= 41, 5 to 8 years old) completed the Sensory Processing Measure, the Gilliam Autism Rating Scale (GARS-2), the nonverbal Raven's Colored task, and a set of items to assess the number of inattention and hyperactivity/ impulsivity signs in children. Findings suggested that children with ASD disorder displayed the sensory processing, social participation, praxis characteristics, and some characteristics like (nonverbal IQ, severity of the ASD symptomatology, and ADHD symptoms) at their home and main-classroom (Sanz-Cervera, Pastor-Cerezuela et al. 2015).

In another case, Brüne, (2003) studied 23 patients with schizophrenia (the IQ controlled) and assessed the understanding of metaphor, mental state attribution, and strategic social thinking. Brüne argued that the Theory of Mind deficits may be related to general impairment domains like intelligence and working memory load (Brüne 2003).

The reason which motivates us to use the nonverbal intelligence task is that the majority of the children with autism and children with intellectual disability have limited narrative language skills and this could play an important role in the worse performance on the false belief tasks. Nevertheless, more research is still needed to have a better understanding and knowledge of how non-verbal IQ works to influence the development of ToM.

1.7.4 The role of behavior

While past studies have shown inconsistent results between ToM and behavior difficulties, the findings highlighted the relevance of executive functioning of Theory of Mind with different

behavioral problems. Fahie and Symons (2003) in a study on 26 children (aged 5-9), found that social problems had a clear negative relation with ToM and overall executive functioning rated by parents and teachers. Both these factors may be an index of metacognitive deficits which could underlie social and attention problems in clinical participants (Fahie and Symons 2003). The majority of studies confirmed a direct relevancy with executive function in ToM performance with different psychological disorders even though this relevancy needs further examination (Partridge 2007).

In order for children to understand themselves and others, the internalization processes in them were examined with the Theory of Mind development. The findings reveal that children can internalize this understanding more easily than the minds of others, because this is a basic level of internalization (Symons 2004). The children tend to have more advanced social understanding, and internalization of the specific features has a key role in their own/other self of mental states (Symons 2004). The behavioral problems score and ToM abilities could be evaluated with several indexes, like executive function, mental speech, and sibling interactions (Hughes 1998, Hughes, Jaffee et al. 2005). Also, to understand the specific prevalence of social and behavioral problems in "children with agenesis of the corpus callosum (ACC)" parents completed the Child Behavior Checklist (CBCL) by a survey study from parent observations. The younger children with ACC (2-5 years old) displayed problems in their sleep. Other problems in attention, social function, thought, and somatic complaints appeared in older children with ACC (6-11years old). In the comparison of this group including 52 children with autism, the ACC group was significantly more likely to present problems in attention, anxiety/depression, social function, and unusual thoughts, and reported more obvious behavioral problems during the school years (Badaruddin,

Andrews et al. 2007). According to parents report the individuals with autism particularly have problems in their attention, thought and social function in terms of the CBCL profile.

1.7.5 The role of culture

Culture is defined as the complex whole system which is characterized by a common concept or idea, customs, ethnic and arts, religious belief, social behavior, laws, and language of a particular people or society (Satcher 2001., Tylor 1871). Regarding *DSM-5,* culture is defined within the family and other social systems and it is transmitted, revised, and recreated through generations, and it also provides the diagnosis for symptoms, signs, behaviors, and provides an explanation of the shape of experience and expression of them. The interpretive frameworks of illnesses across places and regions, and over time, which accuse a person to have different experiences, symptoms and behaviors from socio-cultural norms are the cues to the problems for adaptation into the cultures of origin, specific social and family contexts (American Psychiatric Association, 2013). However, culture and socioeconomic factors can affect recognition of diagnosis for treatment decisions, clinical outcomes, prognostic considerations and affects the course of illness or recovery, and it also influences the conduct of the clinical encounter (American Psychiatric Association, 2013).

Cultural differences have a central role in the norms for nonverbal and social communication and relationships, in the context of the individuals with ASD. On the other hand, other disorders as intellectual disabilities occur in all cultures and races of people, which have been remarkably mentioned in the cultural studies. In addition, cultural sensitivity and knowledge as

two major factors are required during the assessment. Other factors are the individuals ethnic, available experiences, cultural and linguistic background, and adaptive function of communication; however, the cultural setting must be taken into consideration in cultural researches (American Psychiatric Association, 2013).

Cross-Culture and theory of Mind:

An important point in cultural studies of ToM is that a child could perform better ability in a particular ToM task in his/her culture in comparison with his/her counterparts in other cultures. For instance, in a major study carried out on cultural and family influences on children's Theory of Mind development comparing Australian and Iranian children (3 to 9 years old), the majority of Australian children showed an ability to understand the diversity of beliefs and desires tasks, while the majority of Iranian children could understand "the knowledge access" and "sarcasm" tasks. The evidence highlighted the role of the interpersonal relationships in Iranian collective culture. The authors found a relationship between having siblings and better performance for Australian children but not for the Iranian (Shahaeian, Nielsen et al. 2014).

In another research by Shahaeian, Nielsen, Peterson, Aboutalebi & Slaughter (2014) to investigate knowledge and belief understanding, 167 Iranian and Australian children ranged between 3 to 5 years old participated in the study. Different tasks were used to assess ToM and receptive language abilities. The results showed that Iranian individuals had a more advanced understanding of the how and when knowledge tasks. Usually, obtaining the knowledge tasks requires a high level of semantics (using the words and phrases). The receptive language ability

could be correlated with several contexts of Theory of Mind (Shahaeian, Nielsen, Peterson, Aboutalebi, & Slaughter, 2014).

In another study, 56 individuals at 4 - 5 years of age were tested by various false belief tasks, Self-concept, and Self-View questionnaire. The finding suggested that across highly different cultures, Korean children outperformed in false belief and gained higher scored on the self-dimension of traditionalism than children from the USA. They display a lower ability on the dimension of Social Potency compared to their American counterparts (Ahn and Miller 2012).

Accordingly, Executive Functioning (EF) skills are necessary to express theory-of-mind concepts. A research by Sabbagh, Xu, Carlson, Moses, Lee, (2006) have shed light on the current topic. In a comparison, Chinese preschoolers performed advanced capacity on executive-functioning tasks than their age-matched U.S. counterparts (N=109 China, ages 36 to 59 months, and N=107 U.S. ages 36 to 59 months). The performance of theory-of-mind tasks for U.S. preschoolers was at 4 years old while Chinese preschoolers' was at 3.5 years old. Both verbal ability and theory-of-mind tasks showed no cross-cultural differences in these countries (Sabbagh, Xu et al. 2006).

Similarly, Wang, Devine, Wong, Hughes (2016) with widespread samples, from Hong Kong and United Kingdom (N=262, mean age=12.42 y and 10.81y, respectively) found differences in belief understanding assessed by similar tasks followed by two ToM tasks (Silent Film and Triangles), three executive function tasks, and a language test. These tasks were administered in English in both countries. The results indicated that individuals in Hong Kong outperformed the British children on executive function tasks (Wang, Devine et al. 2016).

There are various aspects of false-belief understanding across culture and ToM development. The children from Mainland, Cantonese, China and Hong Kong were compared with those of the U.S. and Canada. This study allows us to determine that the pathway of false belief understanding in Chinese and North American individuals is coupled with significant variation in the timing of development across communities, and finding a way to maintain the importance of empirical factors in the development of ToM (Liu, Wellman et al. 2008).

The false belief development among the cultural studies usually indicated controversial results, and that different cultures could present mixed results, is probably because of different methods used in various cultures. A study to point out the false-belief understanding has been carried out on five various cultures including Canada, India, Peru, Samoa, and Thailand (30 to 72 months aged, N=267). The outcome from this study shows that the universal acquisition of the belief desire understanding occurs during the childhood, but the universal understanding of false-belief depends on their culture's practices, for instance, children could pass such tasks at 5 years old in Western cultures (Avis and Harris 1991, Callaghan, Rochat et al. 2005).

Another study based on previous research aimed to evaluate the executive function and mental state understanding in preschoolers. The Korean individuals younger than 3.5 years old presented ceiling effects on some inhibition measure, although they had more tough protocols; in addition, findings suggest that the British samples in executive function and mental state understanding performed better than Korean participants. The executive system development and relevance to social understanding are the key results in the study (Oh and Lewis 2008).

1.7.6 The role of socioeconomic status and family background

Another focus of research is socioeconomic (SES) status in correlation with ToM performance (Hughes, Jaffee et al. 2005). Thus, most of the evidence linked family background (social-economical state) to the Theory of Mind development and false-belief understanding in different groups. The cross-cultural studies directly suggested that family size has a rigorous contribution in children's false belief understanding with less linguistic competence. Thus, slower language development in developing false belief understanding could be compensated with having siblings in the family. Family background has significant implications for social cognition in the children and makes a strong contribution to the development of their understanding of false belief and Theory of Mind development (Happé 1995, Jenkins and Astington 1996). Indeed, children from higher SES backgrounds are often advanced in their language development, and children's ToM scores appears as a significant predictor for household income and self-reported life stress. The factors which influence the enhanced children's understanding of false-belief and emotion consist of differences in language ability, and certain aspects of family background. These factors affect their understanding to know themselves and others (Cutting and Dunn 1999). Parental occupational class and mothers' education were taken into account as a particular factor in past literature study for the understanding of false-belief and emotion (Cutting and Dunn 2002), maternal talkativeness , maternal speech , and understanding of other people's feelings and beliefs.

Furthermore, as others have noted (Ebert, Peterson, Slaughter, Weinert, 2017), social cognition in young German children from middle-class families, well-educated backgrounds, and fairly wealthy, reported that mental state language and family socioeconomic status were positively linked to the development of ToM. Most evidence linking parental SES to preschoolers'

ToM performance and language scores to family comes from several studies. In addition, it indicates that higher levels of "parental education and occupational prestige" are linked with faster acquisition of ToM in children.

A number of studies have discussed the influence of *socioeconomic status* (*SES*) (from various SES backgrounds) on ToM performance, executive functioning (EF) in U.S. preschool children 3 to 5 years old. During the preschool years, ToM can protect the component of cognition in the potential negative implications of low-SES on child development. The results bring new insights, which are consistent with the majority of previous findings that SES was related to EF but not ToM; also, EF was not related to ToM after controlling the age. The studies on children from low-SES families showed that they are more likely to fall behind at the start of school, and this achievement gap is perhaps to broaden within the school years (Molzhon 2016).

Twenty-six preschool children at 6 to 9 years old were tested on different standard false belief tasks. This study reported the executive function (which is critical for social function), and the potential impact of psychosocial risk which were evident from various plot analysis given that children from the lowest SES had the lowest executive function scores and the poorest ToM performance (Fahie and Symons 2003). A more direct study to support our hypothesis has been conducted on 128 children from South London in nursery schools (mean age = 4.16 years) with equal backgrounds. The results showed that family background in a young child has a significant contribution in his/her understanding of emotion development and false belief, and there is a correlation between family factors like emotions and siblings' communication, and children's later understanding of emotions. To understand how young children attain beliefs or feeling in other people, Dunn, Brown, Slomkowski, Tesla, Youngblade **(**1991), observed and tested 50 children at

home with mother and sibling at 33 months age, then tested at 40 months on affective-labeling, by following tasks; affective-labeling, perspective-taking, and false-belief tasks. Individual differences in social understanding were marked, and they were associated with participation in family discourse about feelings and verbal fluency of mother and child and cooperative interaction with the siblings. Differences in understanding feelings were also associated with the discourse measures, the quality of mother-sibling interaction, SES, and gender, with girls more successful than boys. The results confirmed that discourse about the social world may in part mediate the key conceptual advances reflected in the social cognition tasks; interaction between child and sibling and the relationships between other family members are also implicated in the growth of social understanding (Dunn, Brown et al. 1991).

Objectives

2 Objectives

The objectives of the current study are:

1) To evaluate the differences in terms of ToM between three groups of children: Autism spectrum disorder, Down syndrome, and typically developed.

2) To study the impact of culture in the Theory of Mind in these three groups of children,examined in two countries: Iran and Sweden.

3 Hypothesis

H-1: Children with ASD will score significantly lower than children with DS, and children with DS will score significantly lower than typically developed children in all orders of Theory of Mind tests.

H-2: Children with higher Intelligence Quotient will perform better in ToM tasks despite the group that they belong to.

H-3: Behavior, as measured with CBCL, and TRF will be related to ToM scores. Children with with higher scores of internalizing or externalizing scales will perform worse in the ToM tasks. Thought and social problems scales will show a stronger correlation to ToM results.

H-4: The effect of the culture for the ToM will be related to specific tasks not for the whole construct of ToM.

H-5 Socioeconomic status may have a significant relation with ToM scores for each group: children from families with higher levels of SES will perform better in ToM tasks.

Method

4 Method

4.1 Participants

The initial sample was 155 children between 6 to 12 years old; 86 Iranian children, and 69 from Sweden. And the final sample was 140 children, 74 from Iran and 66 from Sweden.

In the modified sample size, the participants of Iran consisted of a total of 74 (43 boys, 31 girls), from 6 to 12 years old divided into three groups: one with autism spectrum disorder (ASD) N= 24 (16 males, 8 females), one with Down syndrome (DS) N= 24 (13 males, 11 females), and another with typical development (TD), N= 26 (14 males, 12 females).

For the Iranian group, all participants were born in Iran, and Persian (Farsi) was their local primary language. They were chosen in Tehran (Tehran is the capital of Iran) and (Karaj, known as the capital of Alborz Province, a suburb of Tehran) with a population of 12.183.391 and 2,412,513 million respectively (Statistical Centre of Iran, 2011).

Our three groups in Iran were selected from various places; it is nevertheless important to consider that Iranian children are usually separated in different schools in terms of their sex for all age groups. Thus, the typically developed group was provided from Kasnavie and Ghalam schools. In addition, Down syndrome children were selected from Marjoie, Emaan, and Freshtegan Asemani as the special schools, and also Educational and Rehabilitation Center of Golbarg in Alborz (Karaj) area. The ASD group was collected from Aiene Mehrvarzi School in Tehran province, and Educational and Rehabilitation Center of Golbarg, as well as, Center for Education and Rehabilitation of Penetrating Disorders of Growth (Autism Spectrum), Comprehensive training and rehabilitation center, Mehr and Bavar clinics in Alborz province.

Similarly, the Swedish sample consisted of 66 children (33 boys, 33 girls) between 6 to 12 years old. Children diagnosed with autism spectrum disorder (n= 26; 13 males, 13 females), Down syndrome (n= 18; 9 males, 9 females); and typical developed group (n= 22; 11 males, 11 females).

The Swedish samples had Swedish as a primary language. They were recruited in Stockholm (952.058, reported Statistical Centre in 2014) the capital of Sweden, and Götheborg, a major city and known as the second-largest city, with 572.779 population, in Sweden.

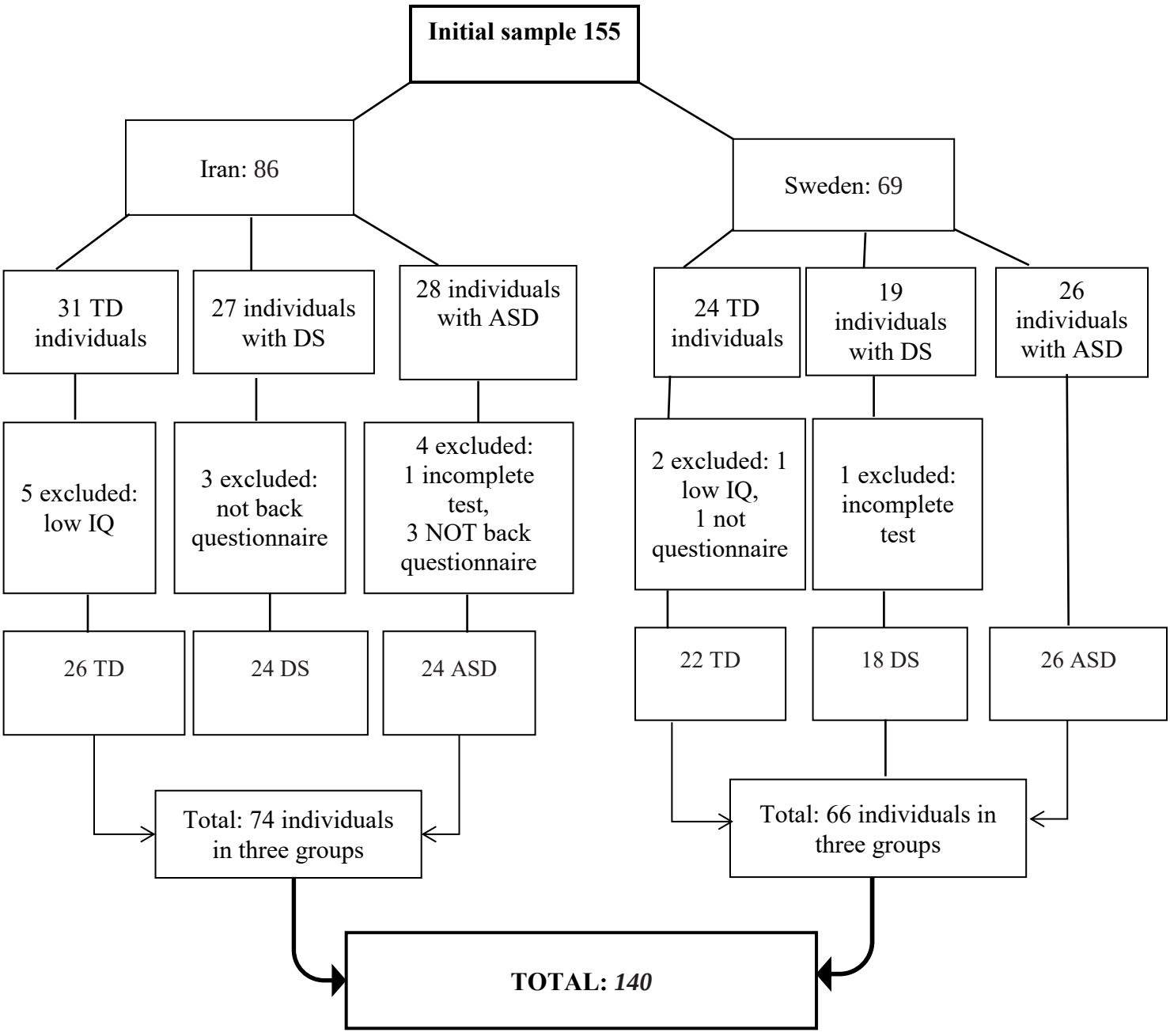
The Swedish typically developed children were chosen from Engelska Skolan (school) Upplands Vasby in Stockholm. For Down syndrome groups, Laban Skolan (school), Uppsala, in Stockholm, and also, some DS children were from a school in Gothenburg. Additionally, the ASD group was recruited from Ingrid Skolan, in Solna and Markusskolan, in Stockholm, Sweden. All these three groups (ASD, DS, and TD) were matched on socio-economic status, gender, and age.

As for the Iranian group, 4 participants in the ASD group (N= 2 boys, 2 girls), and 3 participants from the DS group (3 girls) were excluded because their families did not return the questionnaires. For the TD group, 5 participants (3 boys and 2 girls) were excluded because their IQ was lower than 70.

In the same way, for the Swedish group, 1 participant in the DS group was excluded (because the test was incomplete), and 2 participants from the TD group (1 boy and 1 girl) were also excluded because their IQ was lower than 70, and their families did not return the questionnaires. In both countries, 2 children (1 Swedish TD child, and 1 Iranian ASD child) did not complete all tasks for different reasons (e.g., non-cooperation, fatigue or lack of attention, etc.). Children who did not reveal a satisfactory understanding of different ToM tasks and Raven's

Matrices by their performance on their answer to a number of questions were excluded from further analysis.

Figure 4-1*: The number of participants in each group in both countries (Iran and Sweden)*



Inclusion and Exclusion Criteria in the Groups

Inclusion criteria:

Subjects had to meet all of the following criteria to be eligible for enrollment into the study:

Autism Spectrum Disorder (ASD):

- Clinical diagnosis of autism spectrum disorder (ASD) by a clinician according to the Diagnostic and Statistical Manual for Mental Disorders (DSM-5) criteria.
- Age between 6 to 12 years old
- Language level good enough to answer the tests questions

Down syndrome (DS):

- Genetic diagnosis of Down syndrome
- Age between 6 to 12 years old
- Language level good enough to answer the tests questions

Typically Developing Children (TD):

- IQ > 70
- Age between 6 to 12 years old
- Not diagnosed of any developmental disorder or sensory impairment

Exclusion criteria:

Subjects who meet any of the following criteria were excluded from study participation:

Autism Spectrum Disorder (ASD):

- Hearing impairment
- Diagnosed with any genetic condition.
- Evidence or history of any severe, moderate or uncontrolled systemic disease

Down syndrome (DS):

- Hearing impairment
- Diagnosed with comorbid conditions such as cerebral palsy or autism spectrum disorders

Typically Developing Children (TD):

- IQ < 70
- Hearing impairment
- History of severe head trauma or stroke
- History of clinically significant neurological disorder or disease and psychiatric disorder

Table 4-1: *Subject Variables: Number of Participants, Total and Means Ranges of Chronological Age in Each Group in Both Countries*

Country	Diagnose	Gender	N	Total	Countries Total	Age Mean & (SD)	Total mean age
Iran	*ASD*	Boy	16	24	**74**	7.06 (.928)	7.16
		Girl	8			7.37 (1.685)	
	DS	Boy	13	24		9.15 (2.086)	8.95
		Girl	11			8.72 (1.009)	
	TD	Boy	14	26		8.64 (1.750)	8 .76
		Girl	12			8.91 (1.605)	
Sweden	*ASD*	Boy	13	26	**140**	9.38 (2.292)	10.15
		Girl	13			10.92 (1.255)	
	DS	Boy	9	18	**66**	11 (1.197)	11.22
		Girl	9			11.44 (.462)	
	TD	Boy	11	22		8.36 (2.062)	8.86
		Girl	11			9.36 (1.433)	

4.2 Procedures, Tasks and Scoring:

4.2.1 Procedures:

An analytic cross section design was implemented. Furthermore, in this search; totally 23 clinics, normal and special needs schools (private and public) provided the Iranian sample. Thus, we contacted 3 regular and normal schools to provide our typical group (1 for boys, 2 for girls), who agreed to cooperate with us. And also, to employ the Down syndrome children from 9 special needs schools whom we contacted, 4 of them agreed to participate. Finally, 9 clinical centers or Speech Therapy Centers and 2 schools whose referral were the children with ASD agreed to take part in the current study.

For the Swedish participants both typically developed and Down syndrome children were recruited from regular schools, these schools were known as Särskolan in Swedish. More than 40 centers were contacted to obtain consent for the study but only one of them agreed to cooperate with us. We found our Down syndrome groups in 2 special schools in Stockholm and Götheborg, whoever. Finally, from a total of 7 schools and institutes, 2 of them agreed to participate in the research.

After agreeing to participate, the consent forms were sent to the parents. The schools contacted all families, and the questionnaires were sent to the family's home with the child's consent form and took it back from school one week later.

We asked parents to complete the Child Behavior Checklist (CBCL) questionnaire. This was used to obtain the medical and behavior problems or psychological information about the child

from the parents in diagnosed groups of individuals. Similarly, the teachers filled out the Teacher Report Form (TRF) to give information about behavioral problems in children behavior.

The author individually or with cooperation with a local research assistant tested all children individually in a quiet room in their school or in the clinics. Most children with autism were tested in an individual room with one parent. On the other hand, if children's parent would not be available at the moment, a teacher or some professionals from the school, stayed with them throughout the tests.

All tasks were implemented by the author as a native person in child's own language, Persian (Farsi), for the Iranian individuals. Similarly, the Swedish children were tested in similar situation at their school or in their own home by an experienced local research assistant who was a native Swedish person.

The tasks and procedures were performed exactly for both Swedish and Iranian children: a single testing session lasting 45 to 60 minutes depending on children diagnoses and conditions.

4.2.2 Tasks and Instruments:

THEORY OF MIND

In the current study, we used four ToM tests, who measured "first false-belief task" to access mental state understanding in self and other belief-attribution abilities, included: Sally and Anne, Smarties Tube Task, Representational Change Task, new ToM test.

4.2.2.1 Sally and Anne Task; (Baron-Cohen, Leslie & Frith 1985):

Sally-Anne task is a standardized version of first-order false belief to measure a person's social cognitive ability designed by Baron-Cohen, Leslie, & Frith (1985). First, two characters were introduced to check if children knew which doll was Sally and which was Anne (Naming Question). Sally places a marble into a basket and leaves the room. Then, another character, Anne, comes in and moves the marble to a box. When she returns, the experimenter asked: "Where will she look for her marble?" Or "Where does Sally think her marble is?" (False Belief). If children point to the previous location of the marble's location (in the basket) they have acknowledge of false belief and could pass the question (they should respond that she will look in the box because she wants his marble and that is where it was expected to be) (score = 1). But if children point to the basket the answer is incorrect because they are not taking Sally's false belief into account and the child has failed the test (score = 0). Finally, children's answers to two control questions as a reality question 'Where is the marble really?' (Reality Question) should be based on their own prediction and knowledge of reality, for instance *in the box* which is more specific. In addition, "Where was the marble in the beginning?" (Memory Question) was asked to investigate ToM understanding by children's response: *in the basket*. In the present study, a Persian version of this test is used; we changed the names into well-known Iranian names as Ali and Maryam (Shiri, Nejati, Pouretemad, Chimeh, in Persian 2014). Similarly, in Swedish version, the material consists of a doll (Sara) and a teddy bear, as well as a box with a lid and a key, so the teddy bear puts the key in the box and then leaves the toy, then Sara takes the key out of the box and puts it under the

lid (Dahlgren, Sandberg et al. 2010, Sundqvist 2010). In the current study, “Karin and Ella” were chosen as well-known Swedish names, because children had a better communication with common and local names.

In this task, children were given 1 score for each correct response. Thus, the children were required to get all total ToM scores ranging between 0 to 3 for the questions (Baron-Cohen, Leslie et al. 1985). To our knowledge, a study to address the reliability and validity tasks reported value.78 in terms of Kuder-Richardson test (KR21) (Girli and Tekin 2010).

4.2.2.2 Smarties tube task; Perner, Leekam, and Wimmer (1987) and Perner et al. (1989):

In the other standard test, “Smarties test” was changed into well-known Iranian and Swedish smarties brand with the shape of smarties box so children were able to recognize the box very easily. Children were asked three questions. The child is shown a familiar smarties tube that was actually containing pencils and is asked, "What do you think is in here?” According to children beliefs, they (usually) reply "Smarties, “sweet” or “chocolate”. Then, the experimenter shows the children the content and recloses the box and follows this up with two ‘belief questions:”when the next child comes in what she or he will think is inside here?” The child passes the task if predicts what other persons will think (Other-oriented belief attribution), or spontaneously says Smarties or “chocolate because they will guess what is inside the box before it is opened (Perner, Leekam et al. 1987).

The scores are from zero to one (Muris, et.al 1999). The last reality question was measured by: *What was really in the box?* The correct response is pencil in typical individuals. The total scores in this task are between "0" (failed), and "1" (passed) (Muris, Steerneman et al. 1999). As mentioned earlier, in a similar study for reliability and validity in smarties task the reported value was.82 in terms of Kuder-Richardson test (KR21) (Girli and Tekin 2010).

4.2.2.3 Representational Change Test (Picture Task); Gopnik & Astington (1988):

This task was developed by Gopnik and Astington (1988). In this task, first, children are shown some animal pictures with different colors such as Rabbit, Frog, Giraffe, Lion as a deceptive pictures and the true nature of the pictures to the individuals. Next, the examiner shows the animals (objects), whose body parts are hidden, except for one part. Indeed, the objects are the same as the first objects the children had seen before, except for the last picture (the lion). Then, the procedure followed by three questions as *what a child thought the object (thing) is at the beginning?* Then, while the examiner showed the last picture to the child asked a question as to *what he/she thought about it*. (Representational change understanding), the answer to which is "lion", for instance. And the final question is *what another child would think the thing (picture) is* (false belief understanding). When another child who hasn't seen the last object comes in, this question is asked as to "*what will he/she think the object is?*'' The typical individuals' answer was "the lion". The last question as to *what the object looks like in reality* is asked to access to an understanding of the appearance-reality distinction. We did not find any study on the reliability and validity for Representational Change Test.

4.2.2.4 The New Theory of Mind (ToM) Test; Muris et al., (1999):

The Theory of Mind (ToM) test was developed in 1999 by Muris, Steerneman, Meesters, Merckelbach, Horselenberg, van den Hogen & van Dongen and formatted in 2013 by *Karen L. Anderson*. The test consists of vignettes, stories, and drawings and children have to response to a number of questions. It takes around 35 minutes to administer. The Children could pass the current task at 5 to 12 years old. We used the formatted version by *Karen L. Anderson* (2013). It contains 38 items, with three subscales: A) Precursors of Theory of Mind (ToM 1); 20 items from the following subdomains: recognition of emotions, pretense (e.g. who in a picture is afraid, or pretend to comb your hair). The scores vary between 0 and 20. B). First Manifestations of a Real Theory of Mind (ToM 2) 13 items; subdomains: first-order belief, an understanding of false belief (e.g. "how can I see you are feeling cold?" / "Does father know why Pat is crying?"), Scores between 0 and 13, and C) more advanced aspects of Theory of Mind (ToM 3); 5 items, subdomains: second-order belief, understanding of humor, (e.g. why does the man say: "Wow, we have nice weather today!"). Scores were between 0 and 5. The total ToM scores range either incorrect response (failed = 0) or correct response (passed =1) (Muris, Steerneman et al. 1999).

The raw scores for each three area scores must be multiplied by specific numbers which are as follows; the specified number for ToM of the first order was 1.4, and for the second order (ToM 2) was = 2.5, and finally for the third order was (ToM 3) =3.3. Then these products would be added for total score.

For our research, we used the same ToM item test in Iran and Sweden and presented it in the child's native language (Farsi in Iran and Swedish in Sweden). The task was translated into Swedish by an official Swedish translator to ensure the comparability with the English and Persian versions, and then back-translated by two native speakers (Swedish), one of them was a psychologist with native language. All children were tested by a native examiner. A Persian (Farsi) version of the new Theory of Mind task from Muris et al., (1999) tested by the author (Shojaeian) who was a native speaker of the child's language (Persian). This task (ToM test-38) has been previously used with Iranian children in several studies. And the evidence indicates that this test could be used as a valid instrument in Iran (Ghamarani, Alborzi, & Khayer, 2006).

In a study by Muris et al. (1999), the reliability of the ToM test showed the internal consistency of the ToM test were α=.92 for the total ToM-scale, α=.84 for ToM 1, α= .86 for ToM 2, and α = .85 for ToM 3 (Muris, Steerneman et al. 1999).

COGNITIVE MEASURE

4.2.2.5 The Raven's Progressive Matrices (RPMs); John C. Raven (2002):

Raven's Progressive Matrices (RPMs) is a well-validated nonverbal group of tests to estimate the intelligence cognitive functioning in children and adults. It was originally developed by John C. Raven (Raven 1936), who designed it primarily to investigate how genetic and environmental aspects influence intelligence. This test has specific items to test in a group or individually, by asking to identify the missing element to complete a larger a pattern and the right missing item must be selected from a set of answer choices, which can be used at all age levels.

Three published versions are currently used for different groups including 1) the Standard Progressive Matrices (SPM) (for the entire age range or abilities, appropriate for ages 8 to 65), 2) Colored Progressive Matrices (CPM) (for children between 5 to 11 years old, the elderly, and mentally and physically impaired individuals and non-English speakers), and 3) Advanced Progressive Matrices (APM) (for adults with higher intelligence, around individuals at 11 years old to adult). This is an untimed test, but it takes approximately between 15-45 minutes to complete. For our research, we used the same version of CPM in Iran and Sweden for the TD group under 12 years old and for all children and with specific disabilities (DS and ASD). For the typically developed 12-years-old children, the SPM version was used.

For each task an answer to be considered correct with 1, and 0 for an incorrect response. Thus, there are six choices (answer alternatives) in the CPM, with 36 matrices distributed equally into three sets of 12 (A, AB, B) (the total raw scores ranges were 0 to 36) (Raven, Court & Raven, 1998, 2002). The CPM consists of 60 items arranged in five sets (A, B, C, D, & E) of 12 items each (60 items in 5 sets of 12), and total raw score was from 0 to 60). However, it is important to keep in mind that we used identical versions in both countries to establish the children's IQ and mental age from Raven's progressive matrices (Raven, Court, & Raven, 1986). British norms were used to assess mental age in Sweden, since there is no Swedish standardized version (Dahlgren, Sandberg et al. 2010). For standardization of Raven test previous studies were documented with Iranian individuals (Rajabi 2008).

To address the validity function of the current task, Spearman evaluated the SPM as the best assessment of G factor. However, large of body studies for analyzing the SPM along with

other cognitive measures showed higher than .75 on a general factor in Western cultures. Concurrent validity coefficients between the SPM and the Stanford-Binet and Weschler scales range between .54 and .88, with the majority in the .70s and .80s. Reliability results in some studies for the SPM Task, KR-20 value is from .60 to .98, with a median of .90 (Sivasankari, 2018).

Test-retest correlations range from as low as .46 for an eleven-year interval to as high as .97 for a two-day interval. The median test-retest value is approximately .82. Coefficients close to this median value have been obtained with time intervals of a week to several weeks, with longer intervals associated with smaller values (Sivasankari, 2018).

BEHAVIOUR

4.2.2.6 The TRF and CBCL behavior scales 6/18; T. M. Achenbach (1991):

The Achenbach System of Empirically Based Assessment (ASEBA) is used to provide an intervention planning, outcome evaluation and an assessment among school, mental health, medical, and social service practitioners. The rating forms for the individuals in this system assessed based on the competencies and problems in their behavior as reported by different references: 1) Parents or parent surrogates (the Child Behavior Checklist, CBCL), 2) Teachers, daycare providers or other school personnel (Teacher Report Form, TRF), and 3) Youth Self-Report YSR" completed by youths to describe their functioning as well as by the child or adolescent himself or herself (Achenbach 1991).

The multiple perspectives on the individual's profile are comprised of eight narrowband syndromes. The following syndrome scales are assessed; Anxious/Depressed, Withdrawn/ Depressed, Somatic Complaints, Social Problems, Thought Problems, Attention Problems, Delinquent Behavior, and Aggressive Behavior. There are two broadband scales known as Internalizing Problems (Withdrawn/ Depressed, Somatic Complaints and Anxious/Depressed) and Externalizing problems (Rule-Breaking Behavior and Aggressive Behavior). A summation of Total Problems is the average of all syndrome scales (Achenbach, 1991). The ASMSA systems have a quite compatibility with different assessments or diagnostic procedures, while the DSM-oriented following scores from the CBCL/6-18, YRS/11-18 and TRF/6-18 that contain Affective Problems, Anxiety Problems, Somatic Complaints; Attention Deficit/Hyperactivity Problems; Oppositional Defiant problems; and Conduct Problems scales. The ASEBA forms contain 113 questions describing behavior. Each item is scored on a three-point Likert scale for applicability to the child: 0 = not true, 1 = somewhat or sometimes true, 2 = very true or often true, or was within the past 6 months and these three forms offer a raw score, *T* scores, and percentiles in relation to gender and age-specific (Achenbach 1991). In the current study, we used CBCL and TRF for ages 6 to 18 versions that are described in the distinct parts, these questionnaires to recognize different strengths in screening various disorders are considerable.

The Child Behavior Checklist (CBCL):

The Child Behavior Checklist (CBCL) is part of the ASEBA and used as a checklist. Parents (who spend the most time with the child) complete it to detect emotional and behavioral

problems and social problems in children and adolescents aged 6–18 years old (Achenbach & Rescorla 2001). The evidence of studies about validity and reliability of this instrument indicated that it is an effective tool for recognizing emotional or behavioral problems during the childhood (Achenbach & Rescorla 2001).

The Teacher Report Form (TRF):

The Teacher Report Form (TRF) is displayed on profiles of background information and evidence, scores of academic performance, and scores of four aspects of adaptive functioning which could be completed by a teacher or a school personnel, that have a well-acknowledged of a child in the school setting who is over 2 months (Achenbach 1991). This measurement that is derived from the CBCL similarly provided different perspectives of children's behavior and can identify eight syndromes (Achenbach & Rescorla 2001).

All these questionnaires were completed by parents in both countries by their own language, most of which were turned back to examiner, but unfortunately some of the parents did not return it. We have currently used the TRF and the CBCL 6/18; 1991 profiles through Iranian (Minaei 2005, Dadsetan, Bayat et al. 2010), and Swedish versions (Larsson & Frisk 1999, Achenbach and Rescorla 2000).

The substantial normative data are assessable for children at 6 to 18 years of age, and to address validity and reliability of the syndrome and *DSM*-oriented scales Achenbach et al. (2001, 2003) (Achenbach, Dumenci et al. 2003) documented some reports in several studies that should be considered when using the CBCL and TRF to assess the mental health of other clinical

conditions. The reliability and validity of this instrument have been used in previous studies of patients with ID (Graham & Rosner et al. 2005).

MEASURE OF SOCIOECONOMIC STATUS

4.2.2.7 The Hollingshead Four Factor Index of Socioeconomic Status (SES); Hollingshead (1975):

The Hollingshead Four Factor Index of Socioeconomic Status (SES) was used to assess family socioeconomic status (Hollingshead 1975). This questionnaire is a survey designed to measure social status of the individual through the education level and profession of the parents. The child participant's parent's education level and occupation status code are rated on a predetermined scale, the education code is scored on a 7-point scale through the following by highest grade completed by seven for graduate/professional training state. The standard college or university graduation (Bachelor's degree (diplomas)) is equal to six. The partial college, at least one year of specialized training (Incomplete University or college) is also five. The high school graduate, partial high school, 10th or 11th grade is coded by 4, the junior high school, including 9th grade (Incomplete Higher Secondary School or Incomplete 2nd Grade FP, under High School) is coded by 3, the less than 7th grade (Completed Primary Studies, and Primary) is by2. Finally, no studies, first grade or unfinished GBS or Analfabeten coded is one. Thus, the education score range is 1 to 7 (Hollingshead 1975). In concern with occupational status, a 9-point scale following by the higher executive owner of large businesses, major professional: 9) Administrators, Lesser professionals, owner of a medium-sized business. 8) Smaller business owners, farm owners,

managers, minor professionals. 7) Technicians, Semi-professionals, Small business owners. 6) Clerical and sales workers, small farm and business owners. 5) Smaller business owners, skilled manual laborers, craftsmen, tenant farmers. 4) Machine operators and semi-skilled workers. 3) Unskilled workers. 2) Farm laborers, menial service workers, students, and housewives. 1) Dependent on welfare, no regular occupation. 0) Not applicable or unknown an SES score is then calculated for a total parental SES score. The occupation range is 1 to 9. These codes are multiplied by specific values (Profession, and occupation level × 5 + education × 3 = Divided by 2 if there are two parents) respectively.

The resulting values determined the individuals positions or the family's status position following by 54 to 66 = 1 very High, 40 to 53.5 = 2 High, 30 to 39.5 = 3 Medium, 20 to 29.5 = 4 Medium-low, and 8 to 19.5 = 5 Low (Hollingshead 1975). Parents' education and occupation were reported for every parent who completed the questionnaire in both countries.

Reliability was examined both within (inter-rater agreement) and across (inter-measure agreement) measures. Inter-rater reliability and classification agreement were high for the total sample (range r = .86 to .91), as were inter-measure correlations and classification agreement (range r = .81 to .88) (Cirino, Chin et al. 2002).

4.2.2.8 AD HOC QUESTIONNAIRE

A questionnaire was used to obtain the medical or psychological diagnostic information about the child from the parents for both samples with intellectual disability and autism from both counties. The diagnose pursuers included the Genetic test, blood test, clinical specific tests or

diagnosed by specialist doctors or clinical psychologists. Iranian parents from the ASD children completed the questionnaires, their age ranged from 28 to 56 years. For the ASD group 72.22 % of parents returned the questionnaire and 27.78 of parents did not (13 of 18). Also, they were diagnosed by doctor based on tests (N= 3, 23.07%), and based on doctor clinical diagnoses (N=7, 53.84%), or their diagnosis was based on DSM (N=2, 15.38%), and finally by other reference (e.g. School's director) (N =1, 7.69%).

4.2.3 Data analysis

The statistical analysis was performed using SPSS 25 (IBM Corp, 2013). A descriptive analysis was carried out on the sociodemographic findings and the variables of the sample, obtaining the mean and standard deviation in the quantitative variables, and the frequency and percentage in the categorical variables.

Analysis of variance was used to assess the differences between the groups on ToM tasks. Scores on the measures were analyzed through ANOVA method. Post-hoc contrasts were performed with the Bonferroni test. Association between variables was evaluated with one-way ANOVA. The relationship among the indicators of the theory of mind ability, on the one hand, Intelligence Quotient, Thought and social scales (internalizing or externalizing of ASEBA), and Socioeconomic status indicators on the other was computed through ANOVA and correlation coefficient. The level of significance was set at .05.

Results

5 Results

The current study aimed to concentrate on the Theory of Mind development in different groups of children. Az hypothesized, (Hypothesis 1): the children with ASD score lower than DS significantly, and children with DS rate significantly lower compared to typically developed children in all three orders of ToM. Iranian and Swedish participants were evaluated through the separate sessions; the following result explained each order of ToM tasks into the groups.

First Order of ToM Tasks in Iran:

As mentioned, we examined the first order of ToM through four various scales: Sally and Anne task, Smarties tube task, Representational Change Task, and New Theory of Mind Test.

Table *5-1* provides the results for "the Sally and Anne task" (SAC). It presents percentages of children who correctly answered all the tasks. For instance, we can see the children respond correctly on Sally and Anne task with the following ranges; and show significant differences in scores ($\chi^2_{(2)}$ =26.468, p < .001) on the first order of SAC task (SAC_F).

Further, in the task smarties (smart_ FT) typically developing children displayed significantly better than the other group. There were significant differences in passing the task ($\chi^2_{(2)}$ = 9.676, p = 0.008).

There is a suggestion that the representational change task (Repr-FB) has a clear and significant relationship between the groups ($\chi^2_{(2)}$ = 14. 263, p < .001). The other subscale is Repr_Q, also shows a significant relationship ($\chi^2_{(2)}$ = 11.225, p = .004).

In conclusion, in all cases of first orders, children with ASD scored better than children with DS, and TD performed better than both groups of children with ASD, and DS.

The test which directly studied the difference in the orders of ToM is the now Theory of Mind test (new ToM test). The typical development group passed the first-order task (NTT_1) better than the individuals with ASD, and DS ($F = 27.02$, $P < .001$), and we did not find any significant differences between ASD and DS groups. See Table *5-2* and Table *5-3*.

Second Order of ToM Tasks in Iran:

According to second order task of the new Theory of Mind test (NTT_2) the TD group achieved better scores than the individuals in both DS and ASD groups ($F= 55.13$, $P < .001$), furthermore, we did not find any significant differences between ASD and DS groups, Table *5-2* illustrates the statistic results.

Third Order of ToM Tasks in Iran:

We found significant differences for the third order of ToM between the groups ($F= 4.99$, $P = 0.010$). The results of the current task in Iranian sample showed that the ASD group were significantly more impaired than TD children, but there were not any significant differences between DS and ASD groups, neither between TD nor DS groups. See Table *5-2* which presented the statistic results for all orders.

Table 5-1 *The Number and Children Who Passed Each Task in groups (Iran)*

Tasks	ASD (N=24) N / (passed %)	DS (N=24) N / (passed %)	TD (N=26) N / (passed %)	$\chi 2$	P
	24	24	26		
SAC_F	10/23 (43.5%)	3/22 (13.6%)	22/25 (88%)	26.468	< .001
Smart_ FT	12/21 (57.1%)	5/24 (20.8%)	16/26 (61.5%)	9.676	.008
Repr-FB	7/23 (30.4%)	2/23 (8.7%)	15/25 (60.0%)	14. 263	< .001
Repr_Q	10/23(43.5%)	8/23 (34.8%)	20/25 (80.0%)	11.225	.004

Note. SAC-F (Sally and Anne test, False belief), Smart_FT (Smarties tube task, False belief), Repr-FB (Representational change task, False Belief), Repr_Q (Representational change task, Question)

Table 5-2 *Means and Standard Deviations in Diagnostic Groups (Iran)*

ToM Orders	Group (N)	Mean ($\bar{x}$), and (SD)	Desv. Error	95% confidence interval		F	Sig. (P)
				Lower Limit	Upper Limit		
NTT_1	ASD (22)	11.96 (4.35)	.929	10.03	13.89	27.02	<.001
	DS (21)	11.33 (5.00)	1.09	9.05	13.61		
	TD (26)	19.76 (4.02)	.789	18.13	21.38		
	Total (69)	14.71 (5.90)	.711	13.29	16.12		
NTT_2	ASD (22)	6.25 (4.80)	1.02	4.12	8.37	55.13	<.001
	DS (21)	7.02 (3.50)	.764	5.42	8.61		
	TD (26)	17.69 (4.29)	.842	15.95	19.42		
	Total (69)	10.79 (6.83)	.823	9.15	12.44		
NTT_3	ASD (22)	0.45 (1.54)	.328	-.234	1.13	4.99	.010
	DS (21)	1.57 (2.24)	.489	.550	2.59		
	TD (26)	2.91 (3.65)	.716	1.44	4.39		
	Total (69)	1.72 (2.86)	.344	1.03	2.40		

Number of samples in each groups (N), Mean ($\bar{x}$), Standard Deviation (SD).

As concluded, the children with autism (ASD), and Down syndrome (DS) performed significantly worse than the typical counterparts in the majority of measures.

Table 5-3 *Multiple comparisons Bonferroni (Iran)*

	Group	Groups, Difference of Means (Sig.)	
	ASD	**TD**	**DS**
		-7.79 **(**.001**)**	.63030 (NS,1.000)
	DS	**TD**	**ASD**
		-8.42 **(**.001**)**	-0.63 (NS, 1.000)
	TD	**DS**	**ASD**
NTT1		8.42 **(**< .001**)**	7.79 (< .001**)**
	ASD	**TD**	**DS**
		-11.44**(**.001**)**	-.77 (NS,1.000)
	DS	**TD**	**ASD**
NTT2		-10.66 **(**.001**)**	.77381(NS,1.000)
	TD	**DS**	**ASD**
		10.66 **(**< .001**)**	11.44 **(**< .001**)**
	ASD	**TD**	**DS**
		-2.46 (.007)	-1.12 (NS, .538)
	DS	**TD**	**ASD**
NTT3		-1.34 (NS, .284)	1.12 (NS, .538)
	TD	**DS**	**ASD**
		1.34 (NS, .284)	2.46 (.007)

Note. NTT1 (New ToM Test-first order), NTT2 (New ToM Test-second order), NTT3 (New ToM Test-third order).

To evaluate whether these effects are the same in Sweden too, we implemented the procedure of analysis of the ToM tasks precisely for the Swedish participants.

First Order of ToM Tasks in Sweden:

The Sally and Anne task, which introduced into well-known Swedish names such as Eva and Karin, showed that the typically developed children scored better than their peers in both groups. But this difference does not reach signification ($\chi^2_{(2)} = 5.365$, p =. 068). Also, between clinical groups; children with ASD performed better than children with DS, but this difference does not reach signification. Except for the representational change- false belief (FB) task where we did not find differences between these groups. The analysis of the smarties tube task in the Swedish groups showed that the children with Down syndrome had difficulties in comparison with the other groups such as ASD and TD. However, a significant difference was revealed in the groups on the first-order false-belief task at ($\chi^2_{(2)} = 18.321$, $p < .001$). More information for corrected response to each task in the groups is presented in the following Table *5-4*.

As shown in Table *5-4*, the representational change task with two trials as Representational change_FB and Representational change_Question (Q) determined that TD children scored higher than the children with ASD and DS only in the Repr_ Q subscales ($\chi^2_{(2)} = 14.349$, $p < .001$).

On the other hand, for Representational change_ FB revealed no differences for the clinical groups, but children in TD group scored higher than two other groups. But this difference does not reach signification.

Table 5-4 *The Number and Children Who Passed Each Task in groups (Sweden)*

Tasks	**ASD (N=26) N (passed %)**	**DS (N=18) N (passed %)**	**TD (N=22) N (passed %)**	$\chi 2$	**P**
	26	18	22		
SAC_F*	12 (46.2%)	7 (38.9%)	16 (72.7%)	5.365	.068*
Smart_ FT	19 (73.1%)	6 (33.3%)	21 (95.5%)	18.321	< .001
Repr-FB*	6 (24.0%)	5 (27.8%)	10 (45.5%)	2.697	.260*
Repr_Q	20 (80.0%)	8 (44.4%)	21 (95.5%)	14.349	< .001

Note. NOT Significant *
SAC-F (Sally and Anne test, False belief), Smart_FT (smarties tube task, False belief), Repr-FB (representational change task, false belief), Repr_Q (representational change task, Question)

Second Order of ToM Tasks in Sweden:

The second order task of the new Theory of Mind test (NTT_2), the TD group, performed better scores than the individuals in DS and ASD groups. But the difference with ASD was not significant. On the other hand, we did not find any significant differences between ASD and DS groups. See table 5 and 6.

Third Order of ToM Tasks in Sweden:

Finally, the results of the new ToM test (NTT_3) showed that the children with ASD scored significantly better than the children with DS. TD also performed better than children with DS. But we did not find any significant difference between TD and ASD children .See Table *5-5* and Table *5-6.*

Table 5-5 Means and Standard Deviations in Diagnostic Groups (Sweden)

ToM Orders	Group (N)	Mean ($\bar{x}$), and (SD)	Desv. Error	95% confidence interval		F	Sig. (P)
				Lower Limit	Upper Limit		
NTT_1	ASD (24)	14.00 (6.92)	1.41	11.07	16.92	7.77	<.001
	DS (17)	11.52 (5.20)	1.26	8.85	14.20		
	TD (22)	18.51 (4.34)	.925	16.59	20.44		
	Total (63)	14.91 (6.26)	.788	13.33	16.48		
NTT_2	ASD (24)	10.72 (7.27)	1.48	7.65	13.80	4.15	.020
	DS (17)	9.26 (6.35)	1.54	5.99	12.53		
	TD (22)	14.77 (4.99)	1.06	12.55	16.98		
	Total (63)	11.74(6.62)	.834	10.07	13.41		
NTT_3	ASD (24)	2.47 (2.95)	.604	1.22	3.72	6.79	.002
	DS (17)	.194 (.800)	.194	-.217	.605		
	TD (22)	3.45 (3.45)	.735	1.92	4.97		
	Total (63)	2.20 (3.02)	.380	1.43	2.96		

Note. Number of samples in each groups (N), Mean ($\bar{x}$), Standard Deviation (SD).

Table 5-6 *Means and Standard Deviations in Diagnostic Groups (Sweden)*

	Group	Groups, Difference of means (Sig.)	
NTT1	**ASD**	**TD** -4.51 **(**.027**)**	**DS** .2.47 (.524)
	DS	**TD** -6.98 **(**.001**)**	**ASD** -2.47 (NS, .524)
	TD	**DS** 6.98 **(**< .001**)**	**ASD** 4.51 (< .027**)**
NTT2	**ASD**	**TD** -4.04 **(**.102**)**	**DS** 1.46 (NS,1.000)
	DS	**TD** -5.50 **(**.027**)**	**ASD** -1.46 (NS, 1.000)
	TD	**DS** 5.50 **(** .027**)**	**ASD** 4.04 **(NS,** .102**)**
NTT3	**ASD**	**TD** -.975 (.715)	**DS** 2.28 (.036)
	DS	**TD** -3.25 (.002)	**ASD** -2.28 (.036)
	TD	**DS** 3.25 (.002)	**ASD** .975 (NS, .715)

Note. NTT1 (New ToM Test-first order), NTT2 (New ToM Test-second order), NTT3 (New ToM Test-third order)

In order to illustrate the quantitative results, we show the following figures with the means for all groups in both countries.

Figure 5-1 *Comparison of the new ToM _first order (NTT_1) task in Iranian and Swedish individuals in the groups*

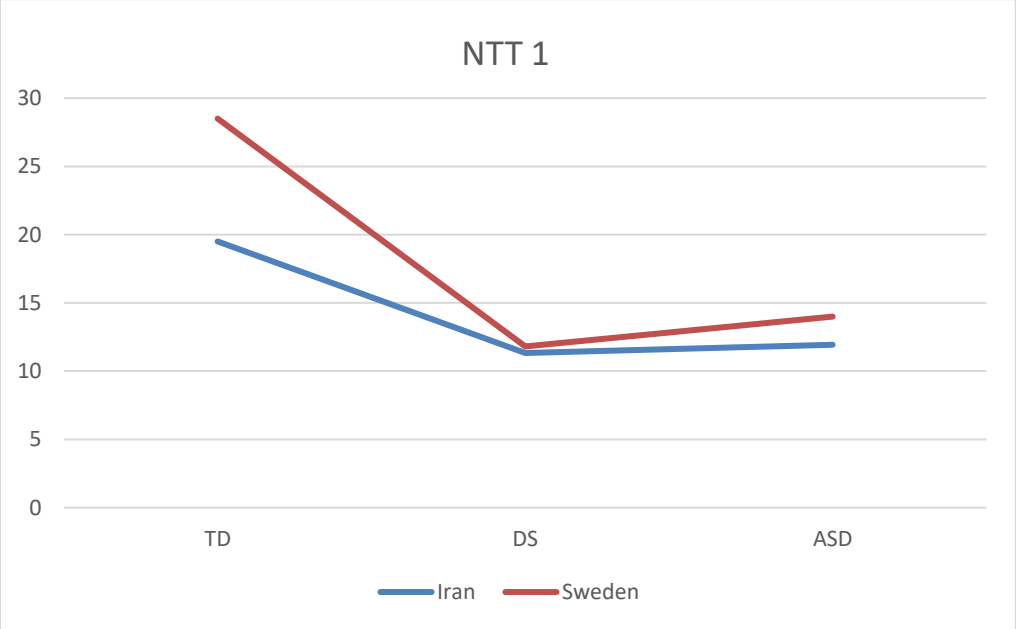


Figure 5-2 *Comparison of the new ToM _Second order (NTT_2) task in Iranian and Swedish individuals in the groups*

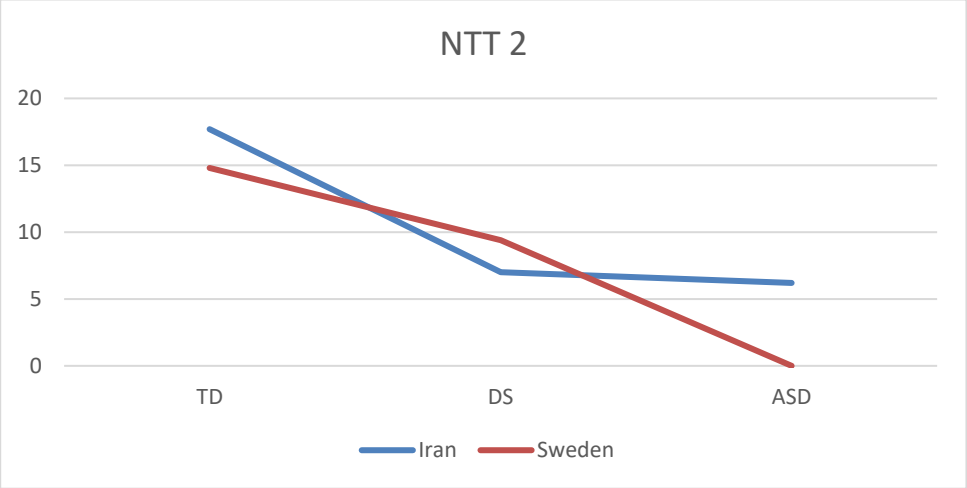
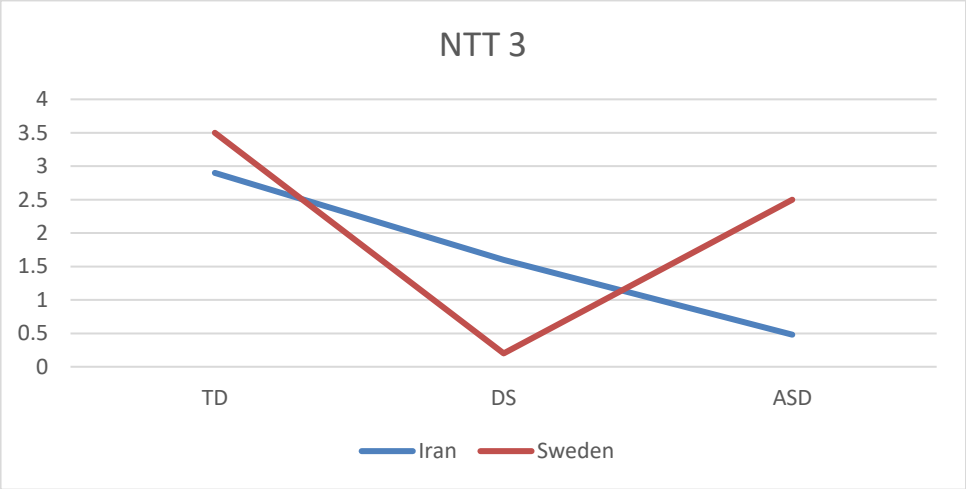


Figure 5-3 *Comparison of the new ToM _Third order (NTT_3) task in Iranian and Swedish individuals in the groups*



In figure 1, 2, and 3 we can see the differences for three orders of ToM between the groups and countries, as well.

H-2: We hypothesized that children with higher Intelligence Quotient (IQ) will perform better in ToM tasks despite the group that they belong to. We examined the relationship between the IQ scores and the performance of Theory of Mind tasks computed among four subscales on all orders of the Theory of Mind. Table 5-7.

Table 5-7 *Statistical Analyses of Correct and Incorrect Answers on ToM Tasks in Terms of IQ (Iran and Sweden)*

		Mean ($\bar{x}$), and (SD)	**T/F**	**Sig.**	**95% confidence interval**	
					Lower Limit	**Upper Limit**
Smart_FT	No answer	72.05 (21.110)	-3.348	< .001	-20.857	-5.366
	Answer	85.16 (23.504)				
Smart_N	No Answer	66.73 (15.499)	-2.915	.004	-25.916	-4.962
	Answer	82.17 (23.854)				
Smart_RQ*	No Answer	73.79 (19.750)	-1.876	.063	-16.920	.448
	Answer	82.03 (24.373)				
S_A_C_FT	No Answer	71.46 (21.179)	-4.194	< .001	-23.550	-8.454
	Answer	87.46 (22.888)				
S_A_M	No Answer	64.77 (19.788)	-5.631	< .001	-29.715	-14.266
	Answer	86.76 (21.688)				
S_A_R*	No Answer	77.03 (24.727)	-.723	.471	-12.977	6.032
	Answer	80.50 (23.067)				
Repr_Q	No Answer	68.06 (21.528)	-4.558	< .001	-25.573	-10.095
	Answer	85.90 (21.887)				
Repr_RD	No Answer	70.11 (18.554)	-2.977	.003	-21.661	-4.367
	Answer	83.12 (24.001)				
Repr_FB*	No Answer	76.31 (23.291)	-2.324	.022	-18.017	-1.450
	Answer	86.04 (22.206)				
NTT_3	No Answer	74.37 (23.554)			69.16	79.58
	1 Answer	83.70 (19.430)			76.02	91.39
	2 Answer	96.60 (23.071)			83.82	109.38
			F=5.73	.001		
	3 Answer	94.00 (5.802)			88.63	99.37
	Total group	79.93 (23.344)			75.88	83.98

Note. Mean ($\bar{x}$), Standard Deviation (SD), T-test for equality of means (T), significate (Sig.)
SAC (Sally and Anne test; FB: False Belief, M: Memory, R: Reality), Smart (smarties tube task;FT: false belief, N: Naming, RQ: reality question), Repr_BF (representational change task, false belief), Repr_Q (representational change task, Question), Repr_RD (representational change task, Reality Distinction), New ToM test (NTT1-2-3: first-second-third order).

The data analyses for the IQ relationship with the current variables are presented in Table 5-7.

The first order of false belief subscales we found significant relationships in the Theory of Mind scales. Thus, there is a clear relationship between nonverbal IQ, mentalization and first order of false belief subscales: Smart_ FT (T = -3.348, p < .001), S_A_C_FT (T = *-2.915*, p < .001), S_A_M (T= *-5.631*, p < .001), Repr_Q (T= *-4.558*, p < .001).

For the quantitative variables NTT1 and NTT2 the correlations with IQ were .473 (p < 0.001) and .411(p <0.001) respectively.

The equations for both models are: (NTT_1), y = 0.1083 ×+ 6.227. (See *Figure 5-4*), and r =.41 y = 0.1191× +1.7914 for NTT2 (see *Figure 5-5*).

Figure 5-4 *Correlation of New Theory of Mind Test with IQ in Terms of First Order*

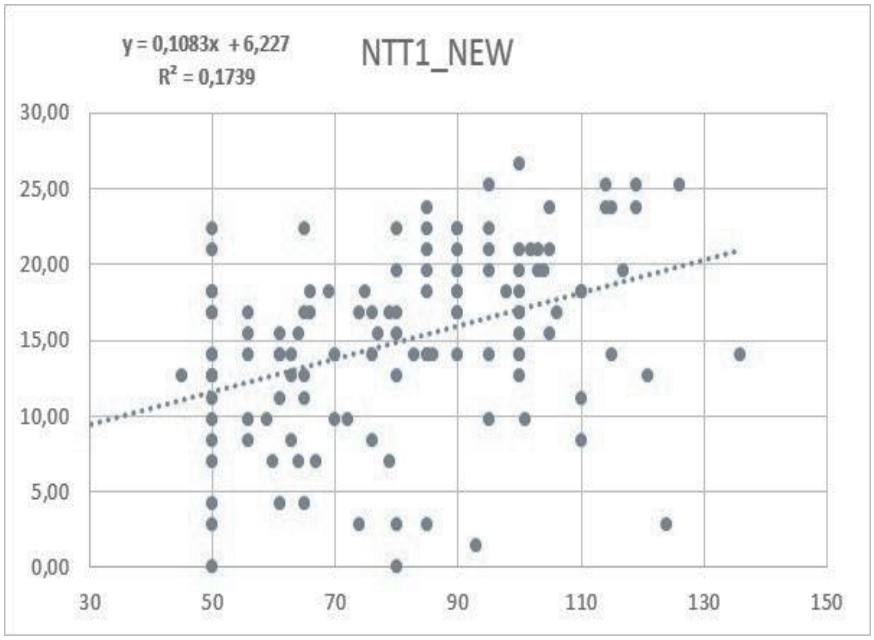
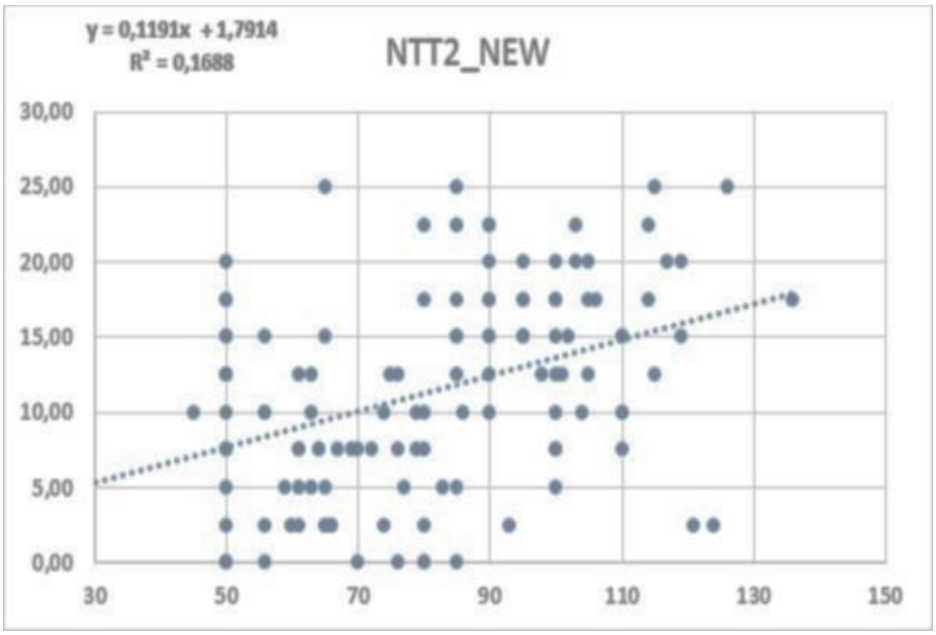


Figure 5-5 *Correlation of New Theory of Mind Test with IQ in Terms of Second Order*



For NTT3 the effect was significant (F = 5.73; p = 0.001). The only significant contrast was between “no answer” and “2 answer” (p = 0.003).

As predicted, the previous evidence aligned with our hypothesis, so a high correlation was found in the third order of ToM test (NTT_3). Also, we can conclude the clear appreciation between the groups of children with DS and ASD diagnostic disorders and typically developed children, in orders of false belief ToM tasks to demonstrate the development of abilities with higher IQ scores. The multiple-column shows the IQ Mean scores of incorrect, and correct responses of all variable’s tasks (See Figure 5 4 and Figure 5 5).

Figure 5-4 IQ Means the Incorrect and Correct Answer in Each Tasks of ToM

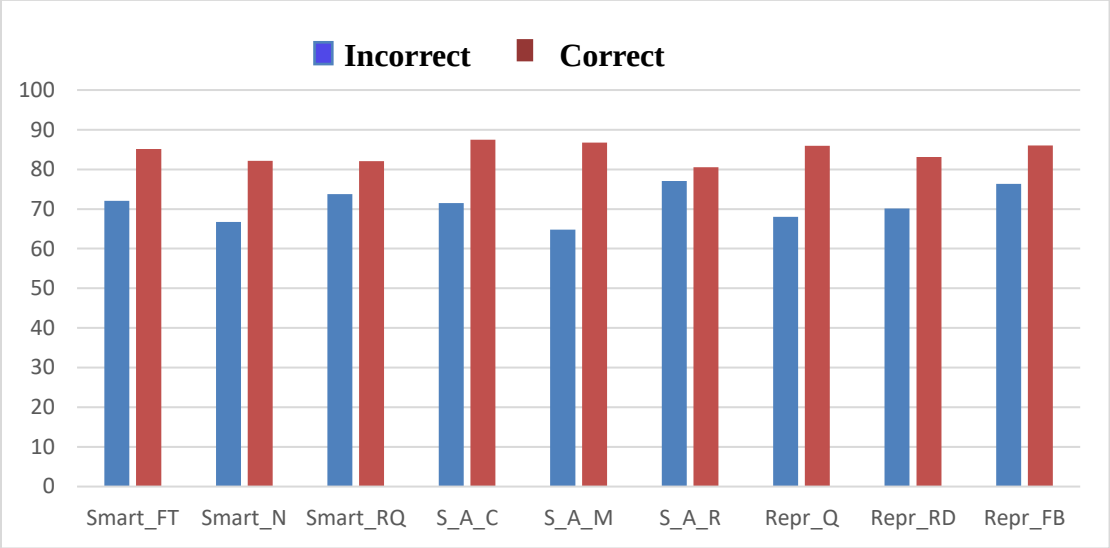
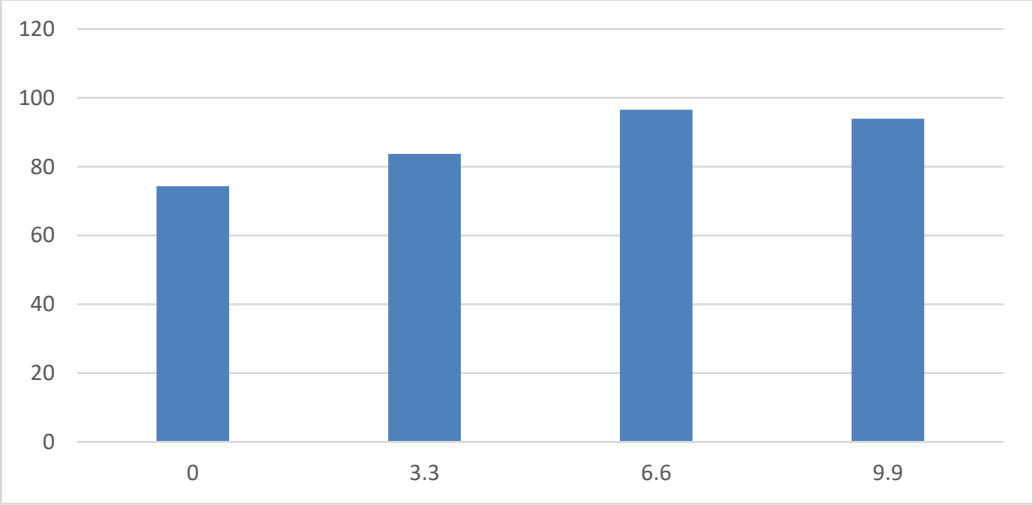


Figure 5-5 *IQ Means for Each Response of NTT3 Category*



*Note. *0 = No Answer, 3.3= 1 Answer, 6.6 = 2 Answer, 9.9= 3 Answer*

The instrument to analyze data for internalizing and externalizing disorders was the Achenbach System of Empirically Based Assessment (ASEBA). **H-3:** Therefore, we hypothesized that children with higher scores of internalizing or externalizing scales will perform worse in the ToM tasks. Thought and social problems scales will show stronger correlation to ToM results. Both scales were measured through parent and teacher ratings for each group. As we can appreciate in the table 5-8, we found significant differences in the TRF between subjects that answered correctly and those who did not in the scores of social problems, thought problems, internalizing and externalizing for the majority of tests. In contrast CBCL did not show any significant difference.

Table 5-8 *Statistical Analyses of Correct and Incorrect Answers on ToM Tasks in Terms of TRF (Iran and Sweden)*

	T Score (TS)	Response	$\bar{X}$ (SD)	T/F	Sig	95% confidence interval	
						Lower Limit	Upper Limit
S_A_R	TS Social Problems	No Answer	65.00 (7.216)	1.818	.071	-.332	7.862
		Answer	61.24 (10.631)				
	TS Thought Problems	No Answer	65.47 (8.370)	2.651	.010	1.278	9.048
		Answer	60.30 (12.189)				
S_A_C	TS Social Problems	No Answer	63.71 (11.479)	1.835	.069	-.248	6.619
		Answer	60.52(8.243)				
	TS Thought Problems	No Answer	62.40 (13.182)	.899	.37	-2.184	5.819
		Answer	60.58 (9.866)				
S_A_M	TS Social Problems	No Answer	65.60(7.577)	2.805	.006	1.515	8.764
		Answer	60.46(10.675)				
	TS Thought Problems	No Answer	66.10 (10.603)	3.233	.002	2.628	10.918
		Answer	59.32 (11.481)				
Repr_Q	TS Social Problems	No Answer	64.72(7.854)	2.490	.014	.902	7.,886
		Answer	60.33(10.589)				
	TS Thought Problems	No Answer	65.68(10.393)	3.652	<.001	3.316	11.152
		Answer	58.45(11.162)				
Repr_RD	TS Social Problems	No Answer	64.41 (8.021)	1.734	.085	-.478	7.260
		Answer	61.02 (13.353)				
	TS Thought Problems	No Answer	64.76 (14.468)	2.256	.026	.621	9.460
		Answer	59.72 (9.879)				
Repr_FB	TS Social Problems	No Answer	63.43(10.665)	2.616	.010	1.147	8.265
		Answer	58.72(7.219)				
	TS Thought Problems	No Answer	62.06 (12.252)	1.506	.134	-.995	7.340
		Answer	58.88 (9.147)				
Smart_N	TS Social Problems	No Answer	65.14 (7.185)	1.514	.133	-1.097	8.250
		Answer	61.57 (10.359)				
	TS Thought Problems	No Answer	65.90 (10.931)	2.035	.044	.153	10.825
		Answer	60.42 (11.426)				
Smart_F	TS Social Problems	No Answer	66.16(7.297)	4.511	<.001	3.939	10.091
		Answer	59.14(10.689)				
	TS Thought Problems	No Answer	64.02 (9.191)	2.534	.012	1.047	8.495
		Answer	59.25(12.601)				
Smart_RQ	TS Social Problems	No Answer	64.95 (12.999)	2.082	.039	.196	7.678
		Answer	61.01 (8.337)				
	TS Thought Problems	No Answer	65.05 (14.058)	2.439	.016	.996	9.547
		Answer	59.78 (9.988)				

	T Score (TS)	Response	$\bar{X}$ (SD)	T/F	Sig	95% confidence interval	
						Lower Limit	Upper Limit
S_A_R	Externalizing Problems	No Answer	64.40 (8.190)	2.092	.038	.275	9.819
		Answer	59.35 (12.424)				
	Internalizing Problems	No Answer	61.10 (9.264)	2.156	.035	.341	8.859
		Answer	56.50 (13.138)				
S_A_C	Externalizing Problems	No Answer	61.94 (13.108)	1.389	.167	-1.203	6.871
		Answer	59.10 (10.198)				
	Internalizing Problems	No Answer	58.11 (12.922)	.508	.612	-3.204	5.419
		Answer	57.00 (12.114)				
S_A_M	Externalizing Problems	No Answer	65.26 (10.479)	3.295	.001	2.790	11.178
		Answer	58.28 (11.721)				
	Internalizing Problems	No Answer	61.02 (10.687)	2.220	.028	.554	9.649
		Answer	55.92 (12.976)				
Repr_Q	Externalizing Problems	No Answer	63.47 (9.367)	2.558	.012	1.111	8.720
		Answer	58.55 (12.452)				
	Internalizing Problems	No Answer	60.85 (10.638)	2.638	.009	1.422	9.951
		Answer	55.16 (12.477)				
Repr_RD	Externalizing Problems	No Answer	62.71 (13.334)	1.400	.164	-1.336	7.809
		Answer	59.47 (10.964)				
	Internalizing Problems	No Answer	60.76 (14.200)	2.019	.046	.096	9.536
		Answer	55.95 (11.133)				
Repr_FB	Externalizing Problems	No Answer	61.90 (11.929)	2.300	.023	.685	9.112
		Answer	57.00 (10.436)				
	Internalizing Problems	No Answer	58.24 (12.567)	1.432	.154	-1.225	7.650
		Answer	55.02 (10.982)				
Smart_N	Externalizing Problems	No Answer	63.19 (11.940)	1.159	.249	-2.274	8.708
		Answer	59.97 (11.634)				
	Internalizing Problems	No Answer	61.95 (11.214)	1.847	.067	-.379	11.045
		Answer	56.62 (12.311)				
Smart_F	Externalizing Problems	No Answer	63.32 (8.272)	2.633	.009	1.228	8.650
		Answer	58.38 (13.358)				
	Internalizing Problems	No Answer	61.39 (10.021)	3.439	.001	2.906	10.775
		Answer	54.55 (12.997)				
Smart_RQ	Externalizing Problems	No Answer	62.63 (13.804)	1.345	.181	-1.414	7.427
		Answer	59.63 (10.710)				
	Internalizing Problems	No Answer	61.00 (13.897)	2.134	.035	.361	9.535
		Answer	56.05 (11.323)				

H- 4: We assessed the effect of the country in the ToM results. We hope that this relationship will be related to a specific task but not for the whole construct of ToM (False Belief / Location Change/Unexpected Contents, Representational Change, Assess to Different Orders). Results

show that none of the Sally and Anne tasks have a significant relationship with the country: S_A_R ($\chi^2_{(1)} = 1.550$; P=. 213), S_A_M ($\chi^2_{(1)} = 1.512$; P=. 219), and S_A_C ($\chi^2_{(1)} = .125$; P= .724).

Table 5-9 *The Number and Percentage of Correct and Incorrect Answers on S_A_C Subscales in Each country*

		Iran	**Sweden**	**Total**
S_A_R	Number	19	12	31
Incorrect	% S_A_R	61.3%	38.7 %	100.0%
	% Country	27.1%	18.2%	22.8%
	% Total	14.0%	8.8%	22.8%
Correct	Number	51	54	105
	% S_A_R	48.6%	51.4%	100.0%
	% Country	72.9%	81.8%	77.2%
	% Total	37.5%	39.7%	77.2%
Total	Number	70	66	136
	% S_A_R	51.5%	48.5%	100.0%
	% Country	100.0%	100.0%	100.0%
	% Total	51.5%	48.5%	100.0%

Note. SAR (Sally and Anne-Reality)

Table 5-10

		Iran	**Sweden**	**Total**
S_A_M	Number	26	18	44
Incorrect	% S_A_M	59.1%	40.9%	100.0%
	% Country	37.1%	27.3%	32.4%
	% Total	19.1%	13.2%	32.4%
Correct	Number	44	48	92
	% S_A_M	47.8%	52.2%	100.0%
	% Country	62.9%	72.7%	67.6%
	% Total	32.4%	35.3%	67.6%
Total	Number	70	66	136
	% S_A_M	51.5%	48.5%	100.0%
	% Country	100.0%	100.0%	100.0%
	% Total	51.5%	48.5%	100.0%

Note. SAM (Sally and Anne test-Memory)

Table 5-11

		Iran	Sweden	Total
S_A_C	Number	35	31	66
Incorrect	% S_A_C	50.0%	47.0%	100.0%
	% Country	50.0%	47.0%	48.5%
	% Total	25.7%	22.8%	48.5%
Correct	Number	35	35	70
	% S_A_C	50.0%	50.0%	100.0%
	% Country	50.0%	53.0%	51.5%
	% Total	25.7%	25.7%	51.5%
Total	Number	70	66	136
	% S_A_C	51.5%	48.5%	100.0%
	% Country	100.0%	100.0%	100.0%
	% Total	51.5%	48.5%	100.0%

Note. SAC (Sally and Anne-False Belief)

Table 5-12 The Number and Percentage of Correct and Incorrect Answers on Smarties Subscales in Each Country

		Iran	Sweden	Total
Smart_ FT	Number	38	20	58
	% Smart_ FT	65.5%	34.5 %	100.0%
Incorrect	% Country	53.5%	30.3%	42.3%
	% Total	27.7%	14.6%	42.3%
	Number	33	46	79
Correct	% Smart_ FT	41.8%	58.2%	100.0%
	% Country	46.5%	69.7%	57.7%
	% Total	24.1%	33.6%	57.7%
Total	Number	71	66	137
	% Smart_ FT	51.8%	48.2%	100.0%
	% Country	100.0%	100.0%	100.0%
	% Total	51.8%	48.2%	100.0%

Note. Smart-FT (smarties tube task-False Belief)

Table 5-13

		Iran	Sweden	Total
Smart_ N	Number	14	9	23
	% Smart_ N	60.9%	39.1 %	100.0%
Incorrect	% Country	19.7%	13.6%	16.8%
	% Total	10.2%	6.6%	16.8%
	Number	57	57	114
Correct	% Smart_ N	50.0%	50.0%	100.0%
	% Country	80.3%	86.4%	83.2%
	% Total	41.6%	41.6%	83.2%
Total	Number	71	66	137
	% Smart_ N	51.8%	48.2%	100.0%
	% Country	100.0%	100.0%	100.0%
	% Total	51.8%	48.2%	100.0%

Note. Smart-N (smarties tube task-Naming)

Table 5-14

		Iran	Sweden	Total
Smart_ RQ	Number	34	5	39
	% Smart_ RQ	87.2%	12.8 %	100.0%
Incorrect	% Country	47.9%	7.6%	28.5%
	% Total	24.8%	3.6%	28.5%
	Number	37	61	98
Correct	% Smart_ RQ	37.8%	62.2%	100.0%
	% Country	52.1%	92.4%	71.5%
	% Total	27.0%	44.5%	71.5%
Total	Number	71	66	137
	% Smart_ RQ	51.8%	48.2%	100.0%
	% Country	100.0%	100.0%	100.0%
	% Total	51.8%	48.2%	100.0%

Note. Smart-RQ (smarties tube task-Reality Question)

The scores of False Belief/ Representational Change (Repr_FB) revealed no relationship with countries ($\chi 2_{(1)}$ = .034; P= .853), and the scores of Representational Change- Question

(Repr_ Q) ($\chi 2_{(1)}$ = 7.038; P = .008) and Representational Change- reality (Repr_ RD) ($\chi 2_{(1)}$ = 23.939; P < .001) showed significant relationship with the countries.

Table 5-15 *The Number and Percentage of Correct and Incorrect Answers on Representational Change Subscales in Each Country*

		Iran	**Sweden**	**Total**
Repr_ FB	Number	47	44	91
	% Repr_ FB	51.6%	48.4 %	100.0%
Incorrect	% Country	66.2%	67.7%	66.9%
	% Total	34.6%	32.4%	66.9%
	Number	24	21	45
Correct	% Repr_ FB	53.3%	46.7%	100.0%
	% Country	33.8%	32.3%	33.1%
	% Total	17.6%	15.4%	33.1%
Total	Number	71	65	136
	% Repr_ FB	52.2%	47.8%	100.0%
	% Country	100.0%	100.0%	100.0%
	% Total	52.2%	47.8%	100.0%

Note. Repr_BF (Representational Change Task, False Belief)

Table 5-16

		Iran	**Sweden**	**Total**
Repr_ RD	Number	32	5	37
	% Repr_ RD	86.5%	13.5 %	100.0%
Incorrect	% Country	45.1%	7.7%	27.2%
	% Total	23.5%	3.7%	27.2%
	Number	39	60	99
Correct	% Repr_ RD	39.4%	60.6%	100.0%
	% Country	54.9%	92.3%	72.8%
	% Total	28.7%	44.1%	72.8%
Total	Number	71	65	136
	% Repr_ RD	52.2%	47.8%	100.0%
	% Country	100.0%	100.0%	100.0%
	% Total	52.2%	47.8%	100.0%

Note. Repr_RD (Representational Change Task, Reality Distinction)

Table 5-17

		Iran	Sweden	Total
Repr_ Q	Number	33	16	49
Incorrect	% Repr_ Q	67.3%	32.7 %	100.0%
	% Country	46.5%	24.6%	36.0%
	% Total	24.3%	11.8%	36.0%
	Number	38	49	87
Correct	% Repr_ Q	43.7%	56.3%	100.0%
	% Country	53.5%	75.4%	64.0%
	% Total	27.9%	36.0%	64.0%
Total	Number	71	65	136
	% Repr_ Q	52.2%	47.8%	100.0%
	% Country	100.0%	100.0%	100.0%
	% Total	52.2%	47.8%	100.0%

Note. Repr_Q (representational change task, Question)

The scores of different orders of New Theory of Mind task showed no significant relationship with countries: NTT_1 subscale T= .296; p =. 441, NTT_2 T= .996, p = .743, and NTT_3 ($\chi 2$) = 2.325; p = .508. See *Table 5-18*.

Table 5-19 *Statistical Analyses of Correct and Incorrect Answers on new ToM task in Terms of First and Second Orders*

	Country	$\bar{X}$ and (SD)	(T)	Sig.	95% confidence interval	
					Lower Limit	Upper Limit
NTT_1	Iran (68)	10.43 (4.198)	-.296	.441	-1.723	1.275
	Sweden (63)	10.65 (4.473)			-1.727	1.278
NTT_2	Iran (68)	4.24 (2.666)	-.996	.743	-1.383	.457
	Sweden (63)	4.70 (2.650)			-1.383	.456

Note. NTT1-2 (New ToM test _second-third order)

Table 5-20 *Frequencies and percentages of Correct and Incorrect Answers on new ToM task in Terms of Tired Order*

			Country		
			Iran	Sweden	Total
NTT_3	0	Number	47	36	83
		% NTT_3	56.6%	43.4%	100.0%
		% Country	68.1%	57.1%	62.9%
		% Total	35.6%	27.3%	62.9%
	1	Number	11	16	27
		% NTT_3	40.7%	59.3%	100.0%
		% Country	15.9%	25.4%	20.5%
		% Total	8.3%	12,1%	20.5%
	2	Number	8	7	15
		% NTT_3	53.3%	46.7%	100.0%
		% Country	11.6%	11.1%	11.4%
		% Total	6.1%	5.3%	11.4%
	3	Number	3	4	7
		% NTT_3	42.9%	57.1%	100.0%
		% Country	4.3%	6.3%	5.3%
		% Total	2.3%	3.0%	5.3%
Total		Number	69	63	132
		% NTT_3	52.3%	47.7%	100.0%
		% Country	100.0%	100.0%	100.0%
		% Total	52.3%	47,7%	100.0%

Note. NTT_3 (New ToM test- third order)

The final hypothesis **H-5** hoped that socioeconomic status (SES) may have a significant relation to ToM scores for each group and that children from families with higher levels of SES (in terms of occupation and education) would perform better in ToM tasks. The family background and socioeconomic status was measured by the SES. As shown in Table *5-21* there are not any relationships between SES and any measure of ToM.

Table 5-21 *Descriptive statistics for SES scale in correction with Theory of Mind tasks (In terms of Occupation and Education)*

					Mean ($\bar{X}$), and (SD)	(T)	Sig.	95% confidence interval	
								Lower Limit	Upper Limit
Smart_ FT	No Answer				34.25 (12.04)	.256	.832	-3.587	4.655
	Answer				33.72 (11.12)				
Smart_ N	No Answer				33.64 (11.60)	-.136	.973	-5.838	5.085
	Answer				34.01 (11.51)				
Smart_ RQ	No Answer				32.08 (10.71)	-1.161	.232	-7.115	1.854
	Answer				34.71 (11.75)				
S_A_C	No Answer				35.52 (10.89)	1.364	.504	-1.251	6.801
	Answer				32.75 (11.69)				
S_A_M	No Answer				34.14 (11.04)	.037	.565	-4.229	4.389
	Answer				34.06 (11.57)				
S_A_R	No Answer				34.16 (12.02)	.039	.551	-4.590	4.773
	Answer				34.07 (11.19)				
Repr_ Q	No Answer				33.28 (11.46)	-.392	.873	-5.082	3.401
	Answer				34.13 (11.55)				
Repr_ RD	No Answer				32.64 (10.19)	-.718	.216	-6.174	2.888
	Answer				34.28 (11.96)				
Repr_ FB	No Answer				33.32(11.84)	-.700	.325	-5.829	-2.782
	Answer				34.84 (10.80)				
NTT_ 1	20 Answer						.367		
NTT_ 2	13 Answer						.811		
NTT_ 3	**No Answer**	**1Answer**	**2 Answer**	**3 Answer**					
	34.40 (11.87)	31. 83 (9.049)	35.36 (7.15)	27.54(12.30)			.302		
	Total 33.62 (10.96)							35.5168	31.7406

Note. Mean ($\bar{x}$), Standard Deviation (SD), T-test for equality of means (T), significate (Sig.)
SAA (Sally and Anne test; FB: False Belief, M: Memory, R: Reality), Smart (smarties tube task; FT: false belief, N: Naming, RQ: reality question), Repr_ BF (representational change task, false belief), Repr_Q (representational change task, Question), Repr_ RD (representational change task, Reality Distinction), New ToM test (NTT1-2-3: first-second-third order)

Discussion

6 Discussion and Conclusions

Our first hypothesis was that children with ASD would score significantly lower than children with DS, and children with DS would score significantly lower than normally developed children in all orders of Theory of Mind tests. The results, however, showed that Iranian children with ASD scored better than children with DS and that TD group performed better than both groups of children with ASD and DS in all cases of first order. For Swedish children, the pattern was the same except for the Representational False Belief Task test where we did not find significant differences.

These results are not in line with previous studies (Baron-Cohen, Leslie, et al. 1985, Baron-Cohen 1989, Yirmiya and Shulman 1996) who found that children with ASD performed worse than children with DS.

More in line with our results, we found some evidence that "high-functioning autism" and Asperger Syndrome individuals were competent to pass the ToM tasks (Pennington and Ozonoff 1996). In a key paper, very high functioning adults with autism assessed with the first-order ToM tasks showed the ability to pass even the second-order tasks in their teens with a specific delay. This is usually achieved around 10-11 years old in typically developed children (Baron-Cohen 1989, Happé 1994a, Happé 1994b, Baron-Cohen, Wheelwright et al. 1997, Liddle and Nettle 2006).

For the second-order, the pattern was that typically developing children performed better than clinical groups and there was no significant difference between ASD and DS in both countries.

For the third-order, Iranian TD children performed better than clinical groups and there was no significant difference between ASD and DS; however, in Sweden, children with ASD scored significantly better than children with DS. TD children also performed better than children with DS, but we did not find a significant difference between TD and ASD children. Numerous studies support the fact that some individuals with autism could even pass the second-order more advanced ToM tasks correctly proving the understanding of the mental state in other individuals (Ozonoff, Pennington et al. 1991, Bowler 1992).

Our second hypotheses was that children with higher intelligence quotient would perform better in ToM tasks despite the group that they belong to. We can see that this hypotheses is verified in all cases except for Smart_ RQ and SAR that even not being significant follow the expected pattern.

The present study adds evidence to the existing literature of false belief understating with higher intelligence quotient in the groups of children with autism, Down syndrome, and typical development. There have been numerous reports to the link between ToM and higher IQ scoring in different disorders (Happé 1994b, Yirmiya, Solomonica Levi et al. 1996, Bauminger and Kasari 1999, Pellicano 2007). For instance, Bíró and Russell provided an overview to the possibility that the children with ASD with higher verbal IQ comparatively had better performance on EF and ToM tasks, which was based on using inner speech to regulate executive control over action than children with lower verbal IQ (Bíró and Russell 2001, Pellicano 2007). Much documented evidence points to a positive link between cognitive abilities, verbal IQ, verbal mental age, and first-order attribution performance (Happé 1994b, Yirmiya, Solomonica Levi, et al. 1996).

Furthermore, the previous results supported the current outcomes to the possibility of passing the ToM task by accurate predictions of higher IQ levels through false beliefs attributions in children. For example, it is interesting to note that Bauminger & Kasari (1999) had similar findings. Their sample was the children with high-functioning autism (aged 7 to 14 years) who succeeded to pass the belief questions, and they scored significantly higher in Full and Verbal IQ scores (N=22) than their typical children (N= 19) peers (Bauminger & Kasari, 1999). Such designs could be helpful to clarify the specific features for solving executive function tasks in children with High-functioning (HFA), and low functioning autistic (LFA). Therefore, when HFA children (with IQ score over 70) were compared to LFA group (IQ range below 70) displayed a delay of ToM development. Importantly, the LFA children probably could never reach to false belief ability (Robberts 2008). More studies suggest that higher intelligence, perhaps, has a compensatory effect on the impairment of social cognition (Hur, Byun, et al. 2013).

Our third hypotheses was that behavior, as measured with CBCL and TRF, would be related to ToM scores. This hypothesis is verified when taking into account teachers' scores but not from a parent's point of view. Children with higher scores of internalizing or externalizing scales would perform worse in the ToM tasks. Thought and social problems scales would show stronger correlation to ToM results. In the questionnaire answered by parents (CBCL), we did not find any significant difference. In contrast, when evaluated by teachers (TRF), we found significant differences between subjects that answered correctly and those who did not in the scores of social problems, thought problems, internalizing and externalizing for the majority of

tests. Those differences may be attributed to the perception by teachers of the social situations on a daily basis at school environment, while at home these difficulties might be less visible.

Our fourth hypotheses was that the effect of the culture for the ToM would be related to specific tasks not for the whole construct of ToM. This hypotheses is partially verified because only representational change question, representational change reality, Smarties false belief question and Smarties reality question showed a significant relationship with the countries.

The results highlight the importance that children's ToM function can be as reach and diverse as the cultures in which they develop. Numerous cross-cultural studies have investigated cognitive precursors and false belief understanding, and most of which have looked for an accurate task implementation. For example, in one such cross-cultural study, Iranian children pass tasks of diverse belief understanding at lower rates compared with Western. However, Iranian children demonstrated relatively advanced performance on several knowledge acquisition tasks (Shahaeian, Nielsen et al. 2014). According to relative studies in Swedish culture, Dahlgren, et.la 2010 found ToM was studied in children with cerebral palsy and severe speech impairments. The results were compared to those of the mental age-matched group.

An earlier study by Liu et al (2008) revealed no evidence of using a more cultural version of ToM performance during middle childhood in Hong Kong (Liu, Wellman, et al. 2008).The children attending international schools in Hong Kong were better on executive function than the U.K. children. In addition, children attending local schools in Hong Kong outperformed their British counterparts. In fact, Hong Kong international school pupils were culturally distinct from the U.K. children; they were more likely to be bilingual, a factor that is believed to facilitate ToM

performance through enhanced attention control and inhibition rather than conceptual mental state understanding (Bialystok and Senman 2004). Chinese and Australian children with ASD showed the same developmental sequences of diverse belief and knowledge access but different sequences of content FB and hidden emotion. However, typical Chinese children showed different developmental sequences of diverse belief and knowledge access (Peterson, Wellman et al. 2005, Peterson, Wellman et al. 2012, Zhang, Shao et al. 2016). More studies directly comparing the theory of mind performance in Iranian (Isfahan) children with autism reveals lower scores than children without autism with suitable oral abilities (Heidari, Shamive Isfahani et al. 2011).

However, the evidence in several studies showed that children begin to pass ToM tasks around 4 -5 years old (Wellman, Cross et al. 2001). Also, the smarties standard task used as a well-known task to assess false belief understanding into two groups of children (children with cerebral palsy (CP) and severe speech impairment) in Sweden (Falkman 2005), and typical individuals group in Iran (Yazdi 2008).

To consider how these social and cultural differences could affect the psychological development, some studies suggested that both cognitive profile and behavior of people across different cultures had to be taken into account, and both cultural and linguistic influences were documented (Frank and Temple 2009). This needs to be explored in further studies specially designed to take into account more different cultures because such designs could clarify the specific cultural factors that influence the development of the cognitive function.

Our fifth hypothesis was that socioeconomic status may have a significant relation with ToM scores for each group: children from families with higher levels of SES would perform better in ToM tasks. This hypothesis is not verified in any case.

These results are in line with those of past studies addressing family SES concerning children's ToM development that did not report a clear link (Dunn, Brown et al. 1991, Murray, Woolgar et al. 1999, Pears and Moses 2003). There is a relevancy between fathers' occupational status and as well as mother's education and the children's understanding of emotion in typically developing individuals, although this relevancy was not true about false belief (Dunn, Brown, et al. 1991). On the other hand, the findings from alternative studies have been equivocal, although higher levels of these factors are linked with children's more rapid ToM conceptions (Shatz, Diesendruck, et al. 2003, Weimer and Guajardo 2005, Ruffman, Slade et al. 2006).

Limtations

7 Limitations

The main limitations of this study are the size and representatively of the sample, which has been selected from specific school centers than may not represent all the characteristics of the population.

Another important issue is the selection of instruments; having to choose tests which had been translated and used in Farsi and Swedish has certainly reduced the possibility of using other instruments.

Importance of study

Due to the lack of literature on ToM understanding in Iranian individuals, current study as considerable literature on executive function and ToM skills across different cultures to bridge a stronger discussion about Iranian samples. The most references were far from English language journals (indeed were in Persian).

This research helps to study the relationship between ToM abilities and intelligence for both ASD and Down syndrome, and typically development group. This study could be taking into account as a particular potential study to implications of the Theory of Mind performance in other clinical groups. However, no study to our knowledge has examined a study of the comparison between ASD, DS, and TD through executive function, and ToM. These findings highlight the importance of integrating different cognitive and linguistic processes in order to understand their contribution to ToM at different developmental stages.

8 References

Abbeduto, L., Warren, S. F., & Conners, F. A. (2007). Language development in Down syndrome: From the prelinguistic period to the acquisition of literacy. *Mental retardation and developmental disabilities research reviews*, 13(3), 247-261. https://doi.org/10.1002/mrdd.20158

Abrahams, B. S., & Geschwind, D. H. (2008). Advances in autism genetics: on the threshold of a new neurobiology. *Nature reviews genetics*, 9(5), 341.

Achenbach, T. M. (1991). *Manual for the Teacher's Report Form and 1991 Profile.* Burlington, VT: University of Vermont, Department of Psychiatry.

Achenbach, T. M., & Rescorla, L. (2001). Manual for the ASEBA school-age forms & profiles: An integrated system of multi-informant assessment. Burlington, VT: Aseba.

Achenbach, T. M., & Rescorla, L. A. (2000). *Manual for the ASEBA preschool forms and profiles* (Vol. 30). Burlington, VT: University of Vermont, Research center for children, youth, & families.

Achenbach, T. M., Dumenci, L., & Rescorla, L. A. (2003). DSM-oriented and empirically based approaches to constructing scales from the same item pools. *Journal of clinical child and adolescent psychology*, *32*(3), 328-340. https://doi.org/10.1207/S15374424JCCP3203_02

Ahearn, W. H., Castine, T., Nault, K., & Green, G. (2001). An assessment of food acceptance in children with autism or pervasive developmental disorder-not otherwise specified. *Journal of autism and developmental disorders*, *31*(5), 505-511.

Ahn, S., & Miller, S. A. (2012). Theory of mind and self-concept: A comparison of Korean and American children. *Journal of Cross-Cultural Psychology*, *43*(5), 671-686. https://doi.org/10.1177/0022022112441247

American Psychiatric Association. (2000). *Diagnostic criteria for 299.00 Autistic Disorder*. Diagnostic and Statistical Manuel of Mental Disorders, 4th edition, Washington DC: American Psychiatric Association.

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders (DSM-5®)*: American Psychiatric Pub.

Anderson, K. L. (2013). The Theory of Mind Test (TOM Test). Retrieved from: https://docs.google.com/viewerng/viewer?url=https://vibdoc.com/download/331672.html?reader%3D1

Anto Praveen, R. (2007). *Relationship between Theory of Mind and Intelligence among Children.* Christian Medical College, Vellore.

Asim, A., Kumar, A., Muthuswamy, S., Jain, S., & Agarwal, S. (2015). Down syndrome: an insight of the disease. *Journal of biomedical science, 22*(1), 41. doi: 10.1186/s12929-015-0138-y

Astington, J. W., & Jenkins, J. M. (1999). A longitudinal study of the relation between language and theory-of-mind development. *Developmental Psychology*, *35*(5), 1311-1320. http://dx.doi.org/10.1037/0012-1649.35.5.1311

Avis, J., & Harris, P. L. (1991). Belief-desire reasoning among Baka children: Evidence for a universal conception of mind. *Child development*, *62*(3), 460-467. https://doi.org/10.1111/j.1467-8624.1991.tb01544.x.

Badaruddin, D. H., Andrews, G. L., Bölte, S., Schilmoeller, K. J., Schilmoeller, G., Paul, L. K., & Brown, W. S. (2007). Social and behavioral problems of children with agenesis of the corpus callosum. *Child Psychiatry and Human Development*, *38*(4), 287-302. DOI 10.1007/s10578-007-0065-6

Baddeley, A., & Jarrold, C. (2007). Working memory and Down syndrome. *Journal of Intellectual Disability Research*, *51*(12), 925-931. DOI: 10.1111/j.1365-2788.2007.00979.x

Badenes, L. V., Clemente Estevan, R. A., & García Bacete, F. J. (2000). Theory of mind and peer rejection at school. *Social Development*, *9*(3), 271-283. https://doi.org/10.1111/1467-9507.00125

Baron-Cohen, S. (1989). The autistic child's theory of mind: A case of specific developmental delay. *Journal of child Psychology and Psychiatry*, *30*(2), 285-297. https://doi.org/10.1111/j.1469-7610.1989.tb00241.x

Baron-Cohen, S. (1999). *The evolution of a theory of mind*. Oxford University Press. DOI: 10.1093/acprof:oso/9780192632593.003.0013

Baron-Cohen, S., Leslie, A. M., & Frith, U. (1985). Does the autistic child have a "theory of mind"?. *Cognition*, 21(1), 37-46. https://doi.org/10.1016/0010-0277(85)90022-8

Baron-Cohen, S., Leslie, A. M., & Frith, U. (1986). Mechanical, behavioural and intentional understanding of picture stories in autistic children. *British Journal of developmental psychology*, *4*(2), 113-125. https://doi.org/10.1111/j.2044-835X.1986.tb01003.x

Baron-Cohen, S., Wheelwright, S., & Jolliffe, A. T. (1997). Is there a" language of the eyes"? Evidence from normal adults, and adults with autism or Asperger syndrome. *Visual cognition*, *4*(3), 311-331. https://doi.org/10.1080/713756761

Bauminger, N., & Kasari, C. (1999). Brief report: Theory of mind in high-functioning children with autism. *Journal of autism and developmental disorders*, *29*(1), 81-86.

Begeer, S., Howlin, P., Hoddenbach, E., Clauser, C., Lindauer, R., Clifford, P., ... & Koot, H. M. (2015). Effects and moderators of a short theory of mind intervention for children with autism spectrum disorder: A randomized controlled trial. *Autism Research*, *8*(6), 738-748. https://doi.org/10.1002/aur.1489

Beitchman, J. H., Nair, R., Clegg, M., & Patel, P. G. (1986). Prevalence of speech and language disorders in 5-year-old kindergarten children in the Ottawa-Carleton region. *Journal of Speech and Hearing Disorders*, *51*(2), 98-110.

Belmonte, M. (2009). What's the Story behind'Theory of Mind'and Autism?. *Journal of consciousness studies*, *16*(6-7), 118-139.

Bialystok, E., & Senman, L. (2004). Executive processes in appearance–reality tasks: The role of inhibition of attention and symbolic representation. *Child development*, *75*(2), 562-579. https://doi.org/10.1111/j.1467-8624.2004.00693.x

Bíró, S., & Russell, J. (2001). The execution of arbitrary procedures by children with autism. *Development and Psychopathology*, *13*(1), 97-110. https://doi.org/10.1017/S0954579401001079

Bowler, D. M. (1992). Theory of Mind" in Asperger's Syndrome Dermot M. Bowler. *Journal of Child Psychology and Psychiatry*, *33*(5), 877-893. https://doi.org/10.1111/j.1469-7610.1992.tb01962.x

Brüne, M. (2003). Theory of mind and the role of IQ in chronic disorganized schizophrenia. *Schizophrenia research*, *60*(1), 57-64. https://doi.org/10.1016/S0920-9964(02)00162-7

Brüne, M. (2005). Theory of mind" in schizophrenia: a review of the literature. *Schizophrenia Bulletin* 31(1): 21-42. https://doi.org/10.1093/schbul/sbi002

Buitelaar, J., Van der Wees, M., Swaab-Barneveld, H., & Van der Gaag, R. (1999). Verbal Memory and Performance IQ Predict Theory of Mind and Emotion Recognition Ability in

Children with Autistic Spectrum Disorders and in Psychiatric Control Children. *The Journal of Child Psychology and Psychiatry and Allied Disciplines*, *40*(6), 869-881.

Callaghan, T., Rochat, P., Lillard, A., Claux, M. L., Odden, H., Itakura, S., ... & Singh, S. (2005). Synchrony in the onset of mental-state reasoning: Evidence from five cultures. *Psychological Science*, *16*(5), 378-384. https://doi.org/10.1111/j.0956-7976.2005.01544.x.

Carrey, N. J. (1995). Itard's 1828 memoire on "Mutism caused by a lesion of the intellectual functions": a historical analysis. *Journal of the American Academy of Child & Adolescent Psychiatry*, *34*(12), 1655-1661. https://doi.org/10.1097/00004583-199512000-00016

Carulla, L. S., Reed, G. M., Vaezazizi, L. M., Cooper, S. A., Leal, R. M., Bertelli, M., ... & Girimaji, S. C. (2011). Intellectual developmental disorders: towards a new name, definition and framework for "mental retardation/intellectual disability" in ICD-11. *World Psychiatry*, *10*(3), 175-180. https://doi.org/10.1002/j.2051-5545.2011.tb00045.x

Chapman, R. S., & Hesketh, L. J. (2000). Behavioral phenotype of individuals with Down syndrome. *Mental retardation and developmental disabilities research reviews*, *6*(2), 84-95. https://doi.org/10.1002/1098-2779(2000)6:2<84::AID-MRDD2>3.0.CO;2-P

Christensen, D. L., Braun, K. V. N., Baio, J., Bilder, D., Charles, J., Constantino, J. N., ... & Lee, L. C. (2018). Prevalence and characteristics of autism spectrum disorder among children

aged 8 years—autism and developmental disabilities monitoring network, 11 sites, United States, 2012. *MMWR Surveillance Summaries*, *65*(13), 1. doi: 10.15585/mmwr.ss6513a1

Cirino, P. T., Chin, C. E., Sevcik, R. A., Wolf, M., Lovett, M., & Morris, R. D. (2002). Measuring socioeconomic status: reliability and preliminary validity for different approaches. *Assessment*, *9*(2), 145-155. https://doi.org/10.1177/10791102009002005

Cobos, F. J. M., & Castro, M. C. A. (2010). Theory of Mind in Young People with Down's Syndrome. *International Journal of Psychology and Psychological Therapy*, *10*(3), 363-385.

Cutting, A. L., & Dunn, J. (1999). Theory of mind, emotion understanding, language, and family background: Individual differences and interrelations. *Child development*, *70*(4), 853-865. https://doi.org/10.1111/1467-8624.00061

Cutting, A. L., & Dunn, J. (2002). The cost of understanding other people: Social cognition predicts young children's sensitivity to criticism. *Journal of Child Psychology and Psychiatry*, *43*(7), 849-860. https://doi.org/10.1111/1469-7610.t01-1-00047

Dadsetan, P.R, Bayat,M, Asgari,A. (2010). Effectiveness of child-centered play therapy on children's externalizing problems reduction. *International Journal of Behavioral Sciences* 3(4): 257-264. (In Persian).

Dahlgren, S., Sandberg, A. D., & Larsson, M. (2010). Theory of mind in children with severe speech and physical impairments. *Research in developmental disabilities*, *31*(2), 617-624. https://doi.org/10.1016/j.ridd.2009.12.010

De Giacomo, A., & Fombonne, E. (1998). Parental recognition of developmental abnormalities in autism. *European child & adolescent psychiatry*, *7*(3), 131-136.

Deci, E. L., & Ryan, R. M. (Eds.). (2004). *Handbook of self-determination research*. University Rochester Press.

Denham, S. A. (1986). Social cognition, prosocial behavior, and emotion in preschoolers: Contextual validation. *Child development*, 194-201.

Down, J. L. H. (1867). Observations on an ethnic classification of idiots. *Journal of mental science*, *13*(61), 121-123.

Dunn, J., Brown, J., Slomkowski, C., Tesla, C., & Youngblade, L. (1991). Young children's understanding of other people's feelings and beliefs: Individual differences and their antecedents. *Child development*, *62*(6), 1352-1366. https://doi.org/10.1111/j.1467-8624.1991.tb01610.x

Ebert, S., Peterson, C., Slaughter, V., & Weinert, S. (2017). Links among parents' mental state language, family socioeconomic status, and preschoolers' theory of mind development. *Cognitive Development*, *44*, 32-48. https://doi.org/10.1016/j.cogdev.2017.08.005

Esquirol, É. (1838). *Des maladies mentales considérées sous les rapports médical, hygiénique et médico-légal* (Vol. 1). chez JB Baillière.

Fahie, C. M., & Symons, D. K. (2003). Executive functioning and theory of mind in children clinically referred for attention and behavior problems. *Journal of Applied Developmental Psychology*, *24*(1), 51-73. http://dx.doi.org/10.1016/S0193-3973(03)00024-8

Falkman, K. W. (2005). Communicating your way to a Theory of Mind. The development of mentalizing skills in children with atypical language development.

Farrar, M. J., & Maag, L. (2002). Early language development and the emergence of a theory of mind. *First language*, *22*(2), 197-213. https://doi.org/10.1177/014272370202206504

Flavell, J. H., Flavell, E. R., & Green, F. L. (1983). Development of the appearance-reality distinction. *Cognitive psychology*, *15*(1), 95-120. https://doi.org/10.1016/0010-0285(83)90005-1

Fowler, A. E. (1990). Language abilities in children with Down syndrome: Evidence for a specific syntactic delay. *Children with Down syndrome: A developmental perspective*, *9*, 302-328.

Frank, C. K., & Temple, E. (2009). Cultural effects on the neural basis of theory of mind. *Progress in brain research*, *178*, 213-223. https://doi.org/10.1016/S0079-6123(09)17815-9

Freeman, S. B., Allen, E. G., Oxford-Wright, C. L., Tinker, S. W., Druschel, C., Hobbs, C. A., ... & Sherman, S. L. (2007). The National Down syndrome project: design and

implementation. *Public Health Reports*, *122*(1), 62-72. https://doi.org/10.1177/003335490712200109

Frith, U. (2001). Mind blindness and the brain in autism. *Neuron*, *32*(6), 969-979. https://doi.org/10.1016/S0896-6273(01)00552-9

Frith, U., Morton, J., & Leslie, A. M. (1991). The cognitive basis of a biological disorder: Autism. *Trends in neurosciences*, *14*(10), 433-438. https://doi.org/10.1016/0166-2236(91)90041-R

Gallagher, H. L., & Frith, C. D. (2003). Functional imaging of 'theory of mind'. *Trends in cognitive sciences*, *7*(2), 77-83.https://doi.org/10.1016/S1364-6613(02)00025-6

Ghamarani, A., Alborzi, S., & Khayer, M. (2006). Validity and reliability of the theory of mind test (TOM test) for use in IRAN.

Giaouri, S., Alevriadou, A., & Tsakiridou, E. (2010). Theory of mind abilities in children with Down syndrome and non-specific intellectual disabilities: An empirical study with some educational implications. *Procedia-Social and Behavioral Sciences*, *2*(2), 3883-3887. https://doi.org/10.1016/j.sbspro.2010.03.609

Gibbs, M. V., & Thorpe, J. G. (1983). Personality stereotype of noninstitutionalized Down syndrome children. *American Journal of Mental Deficiency*, *87*(6), 601-605.

Gibbs, V., Aldridge, F., Chandler, F., Witzlsperger, E., & Smith, K. (2012). Brief report: an exploratory study comparing diagnostic outcomes for autism spectrum disorders under DSM-IV-TR with the proposed DSM-5 revision. *Journal of Autism and Developmental Disorders*, *42*(8), 1750-1756. DOI 10.1007/s10803-012-1560-6.

Girli, A., & Tekin, D. (2010). Investigating false belief levels of typically developed children and children with autism. *Procedia-Social and Behavioral Sciences*, *2*(2), 1944-1950. https://doi.org/10.1016/j.sbspro.2010.03.261

Gopnik, A., & Astington, J. W. (1988). Children's understanding of representational change and its relation to the understanding of false belief and the appearance-reality distinction. *Child development*, 26-37.

Graham Jr, J. M., Rosner, B., Dykens, E., & Visootsak, J. (2005). Behavioral features of CHARGE syndrome (Hall–Hittner syndrome) comparison with Down syndrome, Prader–Willi syndrome, and Williams syndrome. *American Journal of Medical Genetics Part A*, *133*(3), 240-247. https://doi.org/10.1002/ajmg.a.30543

Happé, F. G. (1994a). An advanced test of theory of mind: Understanding of story characters' thoughts and feelings by able autistic, mentally handicapped, and normal children and adults. *Journal of autism and Developmental disorders*, *24*(2), 129-154.

Happé, F. G. (1994b). Wechsler IQ profile and theory of mind in autism: A research note. Journal of Child Psychology and Psychiatry, 35(8), 1461-1471. https://doi.org/10.1111/j.1469-7610.1994.tb01287.x

Happé, F. G. (1995). The role of age and verbal ability in the theory of mind task performance of subjects with autism. *Child development*, *66*(3), 843-855. https://doi.org/10.1111/j.1467-8624.1995.tb00909.x

Happé, F., & Frith, U. (1996). The neuropsychology of autism. *Brain*, *119*(4), 1377-1400. https://doi.org/10.1093/brain/119.4.1377

Hare, B., Call, J., & Tomasello, M. (2001). Do chimpanzees know what conspecifics know?. *Animal behaviour*, *61*(1), 139-151. https://doi.org/10.1006/anbe.2000.1518

Hare, B., Call, J., Agnetta, B., & Tomasello, M. (2000). Chimpanzees know what conspecifics do and do not see. *Animal Behaviour*, *59*(4), 771-785. https://doi.org/10.1006/anbe.1999.1377

Harris, P. L., Donnelly, K., Guz, G. R., & Pitt-Watson, R. (1986). Children's understanding of the distinction between real and apparent emotion. *Child development*, 895-909.

Heidari, T., Shamive Isfahani, A., & Faramarzi, S. (2011). The Comparison Theory of Mind Dimension in Autism Children and Normal Children Isfahan City. *Knowledge & Research in Applied Psychology*, *12*(45), 64-70. (in Persian).

Heller, T. (1908). Dementia infantilis Zeitschrift fur die Erforschung und Behandlung des Jugenlichen Schwachsinns. *Journal for Research and Treatment of JuvenileFeeblemindedness, 2*, 141–165.

Hesketh, L. J., & Chapman, R. S. (1998). Verb use by individuals with Down syndrome. *American Journal on Mental Retardation*, *103*(3), 288-304. https://doi.org/10.1352/0895-8017(1998)103<0288:VUBIWD>2.0.CO;2

Hollander, E., Phillips, A. T., & Yeh, C. C. (2003). Targeted treatments for symptom domains in child and adolescent autism. *The Lancet*, *362*(9385), 732-734.

Hollingshead, A. A. (1975). Four-factor index of social status. Unpublished manuscript,. New Haven,CT, Yale University.

Hoogenhout, M., & Malcolm-Smith, S. (2014). Theory of mind in autism spectrum disorder: does DSM classification predict development?. *Research in Autism Spectrum Disorders*, *8*(6), 597-607. https://doi.org/10.1016/j.rasd.2014.02.005

Hughes, C. (1998). Executive function in preschoolers: Links with theory of mind and verbal ability. *British journal of developmental psychology*, *16*(2), 233-253. https://doi.org/10.1111/j.2044-835X.1998.tb00921.x

Hughes, C., & Devine, R. T. (2015). A social perspective on theory of mind. *Handbook of child psychology and developmental science*, 1-46. https://doi.org/10.1002/9781118963418.childpsy314

Hughes, C., Jaffee, S. R., Happé, F., Taylor, A., Caspi, A., & Moffitt, T. E. (2005). Origins of individual differences in theory of mind: From nature to nurture?. *Child development*, *76*(2), 356-370. https://doi.org/10.1111/j.1467-8624.2005.00850_a.x

Hur, J. W., Byun, M. S., Shin, N. Y., Shin, Y. S., Kim, S. N., Jang, J. H., & Kwon, J. S. (2013). General intellectual functioning as a buffer against theory-of-mind deficits in individuals at ultra-high risk for psychosis. *Schizophrenia research*, *149*(1-3), 83-87. https://doi.org/10.1016/j.schres.2013.06.019

Jarrold, C., Baddeley, A. D., & Hewes, A. K. (1999). Genetically dissociated components of working memory: Evidence from Downs and Williams syndrome. *Neuropsychologia*, *37*(6), 637-651. https://doi.org/10.1016/S0028-3932(98)00128-6

Jenkins, J. M., & Astington, J. W. (1996). Cognitive factors and family structure associated with theory of mind development in young children. *Developmental psychology*, *32*(1), 70.

Johnson, C. N., & Wellman, H. M. (1982). Children's developing conceptions of the mind and brain. *Child development*, 222-234.

Joseph, R. M., & Tager–Flusberg, H. (2004). The relationship of theory of mind and executive functions to symptom type and severity in children with autism. *Development and psychopathology*, *16*(1), 137-155. https://doi.org/10.1017/S095457940404444X

Kako Jouybari, AA., Shaghaghi, F., Baradaran, M. (2013). Development of Social Cognition in theory of mind in children. *Social Cognition*.1 (2), 32-39. (in Persian).

Kaland, N., Møller-Nielsen, A., Callesen, K., Mortensen, E. L., Gottlieb, D., & Smith, L. (2002). A newadvanced'test of theory of mind: evidence from children and adolescents with Asperger syndrome. *Journal of child psychology and psychiatry*, *43*(4), 517-528. http://dx.doi.org/10.1111/1469-7610.00042

Kanner, L. (1968). Autistic disturbances of affective context. *Acta paedopsychiatrica*, *35*(4), 100-136.

Kasari, C., Freeman, S. F., & Hughes, M. A. (2001). Emotion recognition by children with Down syndrome. *American Journal on Mental Retardation*, *106*(1), 59-72. https://doi.org/10.1352/0895-8017(2005)110[378:ERBCWD]2.0.CO;2

Katz, G., & Lazcano-Ponce, E. (2008). Intellectual disability: definition, etiological factors, classification, diagnosis, treatment and prognosis. *salud pública de méxico*, *50*, s132-s141.

Kim, Y. S., Fombonne, E., Koh, Y. J., Kim, S. J., Cheon, K. A., & Leventhal, B. L. (2014). A comparison of DSM-IV pervasive developmental disorder and DSM-5 autism spectrum disorder

prevalence in an epidemiologic sample. *Journal of the American Academy of Child & Adolescent Psychiatry*, *53*(5), 500-508. https://doi.org/10.1016/j.jaac.2013.12.021

Kimhi, Y., Shoam-Kugelmas, D., Ben-Artzi, G. A., Ben-Moshe, I., & Bauminger-Zviely, N. (2014). Theory of mind and executive function in preschoolers with typical development versus intellectually able preschoolers with autism spectrum disorder. *Journal of autism and developmental disorders*, *44*(9), 2341-2354.

Klinger, L. G., Dawson, G., Burner, K., & Crisler, M. (2019). Autism spectrum disorder. *Child psychopathology*. (Vol. 12 , pp. 376- 415). The Guilford Press. New York, NY.

Klein, B. P., & Mervis, C. B. (1999). Contrasting patterns of cognitive abilities of 9-and 10-year-olds with Williams syndrome or Down syndrome. *Developmental neuropsychology*, *16*(2), 177-196. http://dx.doi.org/10.1207/S15326942DN1602_3

Kral, T. V., Eriksen, W. T., Souders, M. C., & Pinto-Martin, J. A. (2013). Eating behaviors, diet quality, and gastrointestinal symptoms in children with autism spectrum disorders: a brief review. *Journal of pediatric nursing*, *28*(6), 548-556. https://doi.org/10.1016/j.pedn.2013.01.008

Larsson, B., & Frisk, M. (1999). Social competence and emotional/behaviour problems in 6–16 year-old Swedish school children. *European child & adolescent psychiatry*, *8*(1), 24-33.

Laws, G. (1998). The use of nonword repetition as a test of phonological memory in children with Down syndrome. *The Journal of Child Psychology and Psychiatry and Allied Disciplines*, *39*(8), 1119-1130. https://doi.org/10.1111/1469-7610.00416

Lejeune, J., Turpin, R., & Gautier, M. (1959). Mongolism; a chromosomal disease (trisomy). *Bulletin de l'Academie nationale de medecine, 143*(11-12), 256-265.

Liddle, B., & Nettle, D. (2006). Higher-order theory of mind and social competence in school-age children. *Journal of Cultural and Evolutionary Psychology*, *4*(3-4), 231-244.

Lindblad, I. (2013). *Mild intellectual disability: Diagnostic and outcome aspects*.

Liu, D., Wellman, H. M., Tardif, T., & Sabbagh, M. A. (2008). Theory of mind development in Chinese children: a meta-analysis of false-belief understanding across cultures and languages. *Developmental psychology*, *44*(2), 523. http://dx.doi.org/10.1037/0012-1649.44.2.523

Loukusa, S., Mäkinen, L., Kuusikko-Gauffin, S., Ebeling, H., & Moilanen, I. (2014). Theory of mind and emotion recognition skills in children with specific language impairment, autism spectrum disorder and typical development: Group differences and connection to knowledge of grammatical morphology, word-finding abilities and verbal working memory. *International journal of language & communication disorders*, *49*(4), 498-507. https://doi.org/10.1111/1460-6984.12091

Lydon, S., Healy, O., O'Callaghan, O., Mulhern, T., & Holloway, J. (2015). A systematic review of the treatment of fears and phobias among children with autism spectrum disorders. *Review Journal of Autism and Developmental Disorders*, *2*(2), 141-154.

Mandy, W. P., Charman, T., & Skuse, D. H. (2012). Testing the construct validity of proposed criteria for DSM-5 autism spectrum disorder. *Journal of the American Academy of Child & Adolescent Psychiatry, 51*(1), 41-50. https://doi.org/10.1016/j.jaac.2011.10.013

Maulik, P. K., Mascarenhas, M. N., Mathers, C. D., Dua, T., & Saxena, S. (2011). Prevalence of intellectual disability: a meta-analysis of population-based studies. *Research in developmental disabilities*, *32*(2), 419-436. https://doi.org/10.1016/j.ridd.2010.12.018

Mazza, M., Mariano, M., Peretti, S., Masedu, F., Pino, M. C., & Valenti, M. (2017). The role of theory of mind on social information processing in children with autism spectrum disorders: A mediation analysis. *Journal of autism and developmental disorders*, *47*(5), 1369-1379.

Milligan, K., Astington, J. W., & Dack, L. A. (2007). Language and theory of mind: Meta-analysis of the relation between language ability and false-belief understanding. *Child development, 78*(2), 622-646. https://doi.org/10.1111/j.1467-8624.2007.01018.x

Minaei, A. (2005). "Manual of ASEBA school-age forms for Iranian children. *Tehran, Iran: Research Institute for Exceptional Children.* (in Persian).

Mo, S., Su, Y., Chan, R. C. K., & Liu, J. (2008). Comprehension of metaphor and irony in schizophrenia during remission: The role of theory of mind and IQ. *Psychiatry research, 157*(1), 21-29. https://doi.org/10.1016/j.psychres.2006.04.002

Molzhon, A. (2016). Exploring the Influence of Socioeconomic Status on the Executive Function and Theory of Mind Skills of Preschoolers.

Muris, P., Steerneman, P., Meesters, C., Merckelbach, H., Horselenberg, R., van den Hogen, T., & van Dongen, L. (1999). The TOM test: A new instrument for assessing theory of mind in normal children and children with pervasive developmental disorders. *Journal of Autism and Developmental Disorders, 29*(1), 67-80.

Murray, L., Woolgar, M., Briers, S., & Hipwell, A. (1999). Children's social representations in dolls' house play and theory of mind tasks, and their relation to family adversity and child disturbance. *Social Development, 8*(2), 179-200. https://doi.org/10.1111/1467-9507.00090

Mustard, A., & Gulabivala, K. (2014). 15 - The medical–endo interface and patients with special needs. In *Endodontics (Fourth Edition)* (pp. 361-368): Mosby.

National Academies of Sciences, E., & Medicine. (2015). *Mental disorders and disabilities among low-income children*: National Academies Press.

Nemerimana, M., Chege, M. N., & Odhiambo, E. A. (2018). Risk Factors Associated with Severity of Nongenetic Intellectual Disability (Mental Retardation) among Children Aged 2–18 Years Attending Kenyatta National Hospital. *Neurology research international, 2018*. https://doi.org/10.1155/2018/6956703

Sabbagh, M. A., Xu, F., Carlson, S. M., Moses, L. J., & Lee, K. (2006). The development of executive functioning and theory of mind: A comparison of Chinese and US preschoolers. *Psychological science, 17*(1), 74-81. https://doi.org/10.1111/j.1467-9280.2005.01667.x

Sanchez, M. M., Heyn, S. N., Das, D., Moghadam, S., Martin, K. J., & Salehi, A. (2012). Neurobiological elements of cognitive dysfunction in down syndrome: exploring the role of APP. *Biological psychiatry*, *71*(5), 403-409. https://doi.org/10.1016/j.biopsych.2011.08.016

Sanz-Cervera, P., Pastor-Cerezuela, G., Fernández-Andrés, M. I., & Tárraga-Mínguez, R. (2015). Sensory processing in children with autism spectrum disorder: relationship with non-verbal IQ, autism severity and attention deficit/hyperactivity disorder symptomatology. *Research in Developmental Disabilities*, *45*, 188-201. https://doi.org/10.1016/j.ridd.2015.07.031

Satcher, D. (2001). Mental health: Culture, race, and ethnicity—A supplement to mental health: A report of the surgeon general. *US Department of Health and Human Services.*

Sattler, J. M., & Hoge, R. D. (2006). Assessment of children: Behavioral, social, and clinical foundations. *Look inside this issue for the*, *123*.

Saxe, R. (2009). Theory of mind (neural basis). *Encyclopedia of consciousness*, *2*, 401-410. https://doi.org/10.1016/B978-012373873-8.00078-5

Schalock, R. L., Borthwick-Duffy, S. A., Bradley, V. J., Buntinx, W. H., Coulter, D. L., Craig, E. M., ... & Shogren, K. A. (2010). *Intellectual disability: Definition, classification, and systems of supports*. American Association on Intellectual and Developmental Disabilities. 444 North Capitol Street NW Suite 846, Washington, DC 20001.

Scheeren, A. M., de Rosnay, M., Koot, H. M., & Begeer, S. (2013). Rethinking theory of mind in high-functioning autism spectrum disorder. *Journal of Child Psychology and Psychiatry*, *54*(6), 628-635. https://doi.org/10.1111/jcpp.12007

Schick, B., De Villiers, P., De Villiers, J., & Hoffmeister, R. (2007). Language and theory of mind: A study of deaf children. *Child development*, *78*(2), 376-396. https://doi.org/10.1111/j.1467-8624.2007.01004.x

Shiri E, Nejati V, Pouretemad HR, Chimeh N. (2014). Evaluation of effectiveness of cognitive rehabilitation on remediation of social cognitive abilities in children with high function autism. J Res Behave Sci 2014; 11(5): 320-331. (in Persian).

Statistical Centre of Iran. (2011). Retrieved from website: *https://www.amar.org.ir/english/Iran-at-a-glance/Iran*

Sundqvist, A. A. (2010). *Knowing me, knowing you: Mentalization abilities of children who use augmentative and alternative communication* (Doctoral dissertation, Linköping University Electronic Press).

Shahaeian, A., Nielsen, M., Peterson, C. C., & Slaughter, V. (2014). Cultural and family influences on children's theory of mind development: A comparison of Australian and Iranian school-age children. *Journal of Cross-Cultural Psychology*, *45*(4), 555-568. https://doi.org/10.1177/0022022113513921

Shahaeian, A., Nielsen, M., Peterson, C. C., Aboutalebi, M., & Slaughter, V. (2014). Knowledge and belief understanding among Iranian and Australian preschool children. *Journal of Cross-Cultural Psychology*, *45*(10), 1643-1654. https://doi.org/10.1177/0022022114548484

Shaked, M., & Yirmiya, N. (2004). Matching procedures in autism research: Evidence from meta-analytic studies. *Journal of Autism and Developmental Disorders*, *34*(1), 35-40.

Shatz, M., Diesendruck, G., Martinez-Beck, I., & Akar, D. (2003). The influence of language and socioeconomic status on children's understanding of false belief. *Developmental Psychology*, *39*(4), 717. http://dx.doi.org/10.1037/0012-1649.39.4.717

Sigman, M., Ruskin, E., Arbelle, S., Corona, R., Dissanayake, C., Espinosa, M., ... & Robinson, B. F. (1999). Continuity and change in the social competence of children with autism, Down syndrome, and developmental delays. *Monographs of the society for research in child development*, i-139.

Sinet, P. M., Theophile, D., Rahmani, Z., Chettouh, Z., Blouin, J. L., Prieur, M., ... & Delabar, J. M. (1994). Mapping of the Down syndrome phenotype on chromosome 21 at the molecular level. *Biomedicine & pharmacotherapy*, *48*(5-6), 247-252.

https://doi.org/10.1016/0753-3322(94)90140-6

Sivasankari,V. (2018). The Relationship between Working Memory Capacity and Fluid Intelligence. *Proceedings of WRFER International Conference.*

Symons, D. K. (2004). Mental state discourse, theory of mind, and the internalization of self–other understanding. *Developmental Review*, *24*(2), 159-188. https://doi.org/10.1016/j.dr.2004.03.001

Oh, S., & Lewis, C. (2008). Korean preschoolers' advanced inhibitory control and its relation to other executive skills and mental state understanding. *Child Development*, *79*(1), 80-99. https://doi.org/10.1111/j.1467-8624.2007.01112.x

O'Nions, E., Sebastian, C. L., McCrory, E., Chantiluke, K., Happe, F., & Viding, E. (2014). Neural bases of Theory of Mind in children with autism spectrum disorders and children with conduct problems and callous-unemotional traits. *Developmental science*, *17*(5), 786-796. https://doi.org/10.1111/desc.12167

Ozonoff, S., & McEvoy, R. E. (1994). A longitudinal study of executive function and theory of mind development in autism. *Development and psychopathology*, *6*(3), 415-431. https://doi.org/10.1017/S0954579400006027

Ozonoff, S., Pennington, B. F., & Rogers, S. J. (1991). Executive function deficits in high-functioning autistic individuals: relationship to theory of mind. *Journal of child Psychology and Psychiatry*, *32*(7), 1081-1105. https://doi.org/10.1111/j.1469-7610.1991.tb00351.x

Partridge, L. (2007). *Stress, Theory of Mind and emotional and behavioural difficulties in children* (Doctoral dissertation, University of London).

Pears, K. C., & Moses, L. J. (2003). Demographics, parenting, and theory of mind in preschool children. *Social Development*, *12*(1), 1-20. https://doi.org/10.1111/1467-9507.00219

Pellicano, E. (2007). Links between theory of mind and executive function in young children with autism: clues to developmental primacy. *Developmental psychology*, *43*(4), 974.

Pennington, B. F., & Ozonoff, S. (1996). Executive functions and developmental psychopathology. *Journal of child psychology and psychiatry*, *37*(1), 51-87. https://doi.org/10.1111/j.1469-7610.1996.tb01380.x

Perkins, A. (2017). The lowdown on Down syndrome. *Nursing made Incredibly Easy*, *15*(2), 40-46. doi: 10.1097/01.NME.0000511841.85763.77

Perner, J. (1991). *Learning, development, and conceptual change. Understanding the representational mind.* Cambridge, MA, US: The MIT Press.

Perner, J., & Wimmer, H. (1985). "John thinks that Mary thinks that…" attribution of second-order beliefs by 5-to 10-year-old children. *Journal of experimental child psychology*, *39*(3), 437-471. https://doi.org/10.1016/0022-0965(85)90051-7

Perner, J., Frith, U., Leslie, A. M., & Leekam, S. R. (1989). Exploration of the autistic child's theory of mind: Knowledge, belief, and communication. *Child development*, 689-700. doi: 10.2307/1130734

Perner, J., Leekam, S. R., & Wimmer, H. (1987). Three-year-olds' difficulty with false belief: The case for a conceptual deficit. *British journal of developmental psychology*, *5*(2), 125-137. https://doi.org/10.1111/j.2044-835X.1987.tb01048.x

Peterson, C. (2014). Theory of mind understanding and empathic behavior in children with autism spectrum disorders. *International Journal of Developmental Neuroscience*, *39,* 16-21. https://doi.org/10.1016/j.ijdevneu.2014.05.002

Peterson, C. C., Wellman, H. M., & Liu, D. (2005). Steps in theory-of-mind development for children with deafness or autism. *Child development*, *76*(2), 502-517. https://doi.org/10.1111/j.1467-8624.2005.00859.x

Peterson, C. C., Wellman, H. M., & Slaughter, V. (2012). The mind behind the message: Advancing theory-of-mind scales for typically developing children, and those with deafness, autism, or Asperger syndrome. *Child development*, *83*(2), 469-485. https://doi.org/10.1111/j.1467-8624.2011.01728.x

Peterson, C., Slaughter, V., Moore, C., & Wellman, H. M. (2016). Peer social skills and theory of mind in children with autism, deafness, or typical development. *Developmental psychology*, *52*(1), 46. http://dx.doi.org/10.1037/a0039833

Pinel, P. (1800). *Analectes sur le Traite´ Me´dico-Philosophique sur l'Alie´nation Mentale ou la ManieRichard.* (Vol. 11, an ix.). Paris: Caille et Ravier Librairies.

Premack, D., & Woodruff, G. (1978). Does the chimpanzee have a theory of mind?. *Behavioral and brain sciences*, *1*(4), 515-526. https://doi.org/10.1017/S0140525X00076512

Pueschel, S. M., & Pueschel, J. K. (1994). Biomedical Concerns in Persons with Down Syndrome. *Pediatric Physical Therapy*, *6*(4), 222.

Rajabi, G. R. (2008). "Standardization of the Raven's Progressive Matrices test in school children in Ahwaz." *Contemporary Psychology* 3(1): 23-32. (in Persian).

Raven, J. C. (1936). Mental tests used in genetic studies: The performance of related individuals on tests mainly educative and mainly reproductive. Unpublished master's thesis, University of London.

Raven, J. C., Court, J. H. & Raven, J. (1986). Manual for Raven's progressive matrices and vocabulary scales (section 2)- Coloured Progressive Matrices (1986) edition, with U.S: norms). London:Lewis.

Raven, J. C., Court, J. H. & Raven, J. (2002). Raven's Colored Progressive Matrices. Dr. G. Schuhfried Ges M. B. H. Austria.

Raven, J., Raven, J. C., & Court, J. H. (1998). Standard progressive matrices,1998edition. Oxford, England: *Oxford Psychological Press*.

Rhodes, M., & Brandone, A. C. (2014). Three-year-olds' theories of mind in actions and words. *Frontiers in psychology*, *5*, 263. https://doi.org/10.3389/fpsyg.2014.00263

Rice, C. (2009). Prevalence of autism spectrum disorders-Autism and developmental disabilities monitoring network, United States, 2006.

Rieffe, C., Terwogt, M. M., & Cowan, R. (2005). Children's understanding of mental states as causes of emotions. *Infant and Child Development: An International Journal of Research and Practice*, *14*(3), 259-272. https://doi.org/10.1002/icd.391

Rieffe, C., Terwogt, M. M., Koops, W., Stegge, H., & Oomen, A. (2001). Preschoolers' appreciation of uncommon desires and subsequent emotions. *British Journal of Developmental Psychology*, *19*(2), 259-274. https://doi.org/10.1348/026151001166065

Robberts, M. (2008). Theory of mind development: A comparison of children with autism spectrum disorders and typically developing South African children. *Unpublished honours thesis, University of Cape Town, South Africa*.

Robinson, J., Roberts, T., & Sherman, P. (2019). Chronic Dislocation of Radiocarpal Joint in two patients with Down Syndrome.

Rodgers, C. (1987). Maternal support for the Down's syndrome stereotype: The effect of direct experience of the condition. *Journal of Intellectual Disability Research*, *31*(3), 271-278. https://doi.org/10.1111/j.1365-2788.1987.tb01370.x

Roper, R. J., & Reeves, R. H. (2006). Understanding the basis for Down syndrome phenotypes. *PLoS genetics*, *2*(3), e50.

Ruffman, T., Slade, L., Devitt, K., & Crowe, E. (2006). What mothers say and what they do: The relation between parenting, theory of mind, language and conflict/cooperation. *British Journal of Developmental Psychology*, *24*(1), 105-124. https://doi.org/10.1348/026151005X82848

Tomblin, J. B., Records, N. L., Buckwalter, P., Zhang, X., Smith, E., & O'Brien, M. (1997). Prevalence of specific language impairment in kindergarten children. *Journal of speech, language, and hearing research*, *40*(6), 1245-1260. https://doi.org/10.1044/jslhr.4006.1245.

Tylor, E. B. (1871). *Primitive culture: researches into the development of mythology, philosophy, religion, art, and custom* (Vol. 2). J. Murray.

Vivanti, G., Hudry, K., Trembath, D., Barbaro, J., Richdale, A., & Dissanayake, C. (2013). Towards the DSM-5 criteria for autism: clinical, cultural, and research implications. *Australian Psychologist*, *48*(4), 258-261. https://doi.org/10.1111/ap.12008

Wang, Z., Devine, R. T., Wong, K. K., & Hughes, C. (2016). Theory of mind and executive function during middle childhood across cultures. *Journal of Experimental Child Psychology*, *149*, 6-22. https://doi.org/10.1016/j.jecp.2015.09.028

Weimer, A. A., & Guajardo, N. R. (2005). False belief, emotion understanding, and social skills among Head Start and non-Head Start children. *Early Education and Development*, *16*(3), 341-366. https://doi.org/10.1207/s15566935eed1603_3

Weiss, B., & Landrigan, P. J. (2000). The developing brain and the environment: an introduction. *Environmental health perspectives*, *108*(suppl 3), 373-374. https://doi.org/10.1289/ehp.00108s3373

Wellman, H. M. (1992). *The MIT Press series in learning, development, and conceptual change. The child's theory of mind.* Cambridge, MA, US: The MIT Press.

Wellman, H. M., & Estes, D. (1986). Early understanding of mental entities: A reexamination of childhood realism. *Child development*, 910-923. doi: 10.2307/1130367

Wellman, H. M., Cross, D., & Watson, J. (2001). Meta-analysis of theory-of-mind development: The truth about false belief. *Child development*, *72*(3), 655-684. https://doi.org/10.1111/1467-8624.00304

Wilcox, J., & Reid Duffy, P. (2015). The syndrome of catatonia. *Behavioral Sciences*, *5*(4), 576-588. https://doi.org/10.3390/bs5040576

Wimmer, H., & Perner, J. (1983). Beliefs about beliefs: Representation and constraining function of wrong beliefs in young children's understanding of deception. *Cognition*, *13*(1), 103-128. https://doi.org/10.1016/0010-0277(83)90004-5

Wishart, J. G., & Johnston, F. H. (1990). The effects of experience on attribution of a stereotyped personality to children with Down's syndrome. *Journal of Intellectual Disability Research*, *34*(5), 409-420. https://doi.org/10.1111/j.1365-2788.1990.tb01551.x

World Health Organization. (1992). *The ICD-10 classification of mental and behavioural disorders: clinical descriptions and diagnostic guidelines* (Vol. 1): World Health Organization.

World Health Organization. (2013). Global tuberculosis report 2013. World Health Organization.

Yazdi, A. (2008). Social Cognition and Language. *Journal of Mashhad Faculty of Letters and Human Sciences* (159). (In Persian).

Yirmiya, N., & Shulman, C. (1996). Seriation, conservation, and theory of mind abilities in individuals with autism, individuals with mental retardation, and normally developing children. *Child Development, 67*(5), 2045-2059. https://doi.org/10.1111/j.1467-8624.1996.tb01842.x

Yirmiya, N., Erel, O., Shaked, M., & Solomonica-Levi, D. (1998). Meta-analyses comparing theory of mind abilities of individuals with autism, individuals with mental retardation, and normally developing individuals. *Psychological bulletin*, *124*(3), 283. http://dx.doi.org/10.1037/0033-2909.124.3.283

Yirmiya, N., Solomonica-Levi, D., Shulman, C., & Pilowsky, T. (1996). Theory of mind abilities in individuals with autism, Down syndrome, and mental retardation of unknown etiology: The role of age and intelligence. *Journal of Child Psychology and Psychiatry, 37*(8), 1003-1014. https://doi.org/10.1111/j.1469-7610.1996.tb01497.x

Zelazo, P. D., Burack, J. A., Benedetto, E., & Frye, D. (1996). Theory of mind and rule use in individuals with Down's syndrome: A test of the uniqueness and specificity claims. *Journal of*

Child Psychology and Psychiatry, *37*(4), 479-484. https://doi.org/10.1111/j.1469-7610.1996.tb01429.x

Zhang, T., Shao, Z., & Zhang, Y. (2016). Developmental steps in theory of mind of typical Chinese children and Chinese children with autism spectrum disorder. *Research in Autism Spectrum Disorders*, *23*, 210-220. https://doi.org/10.1016/j.rasd.2015.10.005

Appendix

9 Appendix

Signiant and non-Signiant Correction in Each Tasks and Country

	Iran			Sweden		
	TD	**DS**	**ASD**	**TD**	**DS**	**ASD**
NTT1	>	=		>	=	
NTT2	>	=		>	=	
NTT3	=	=	Sig TD	>	<	
SAC_FB	>	<		Smart >	<	
Rrp_ FT	>	<		Rep_Q >	<	

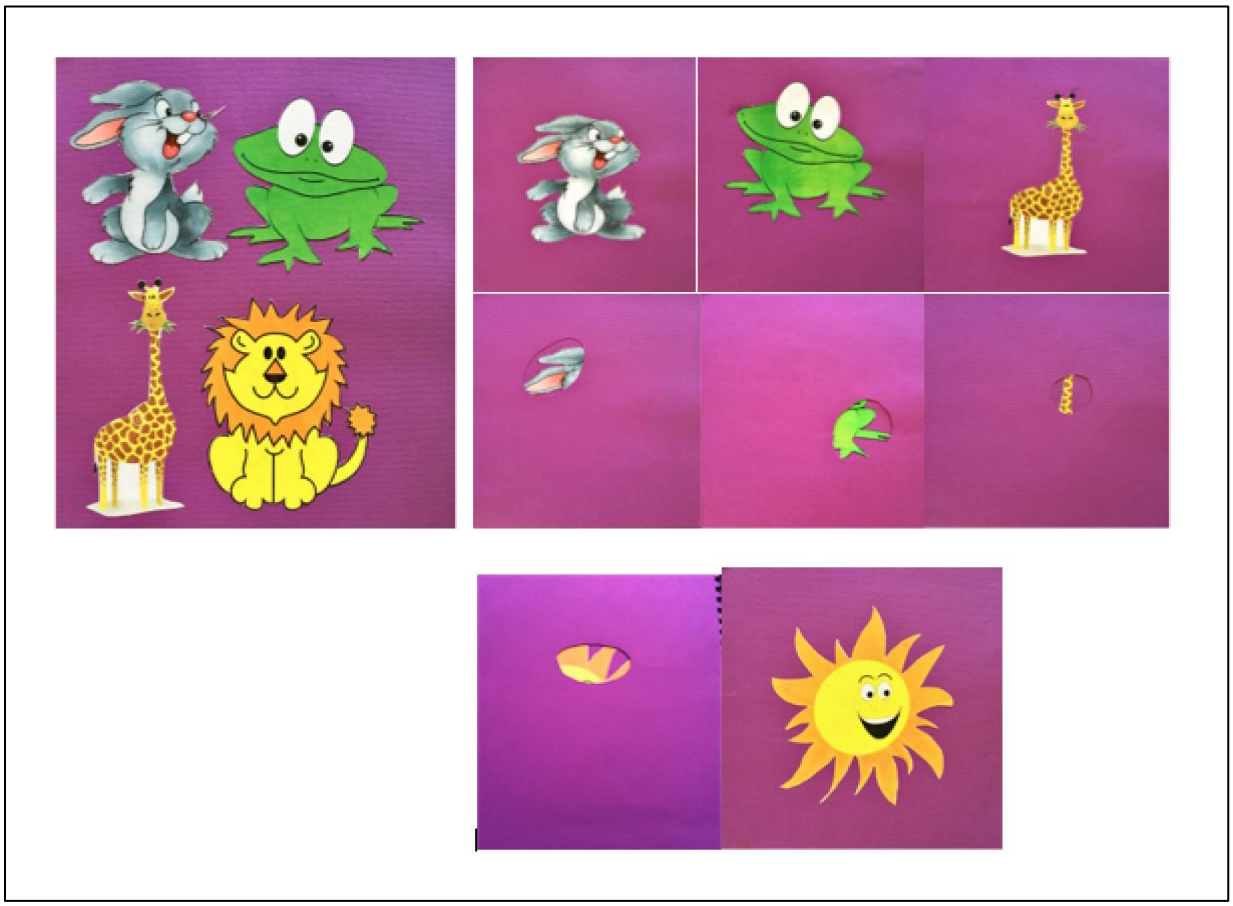
Definition of three orders of Theory of Mind (ToM)

ToM orders	**Definition**
First order (ToM 1)	The first order tasks refer to different people might have diverse understanding in the same situation. We call first order task because it infers one person's mental state. A typical child often can keep track of how different people might think concerning different things about the world by 3- 4 years old (Wimmer and Perner 1983).
Second order (ToM 2)	The second order task refers to recognize whom mind is separate from and differs from the physical world or even the mind could represent objects and events accurately or inaccurately. A person able to think about an object even though the object is not physically present. It could be represented by false with respect to a real object or event, in the behavior it could be false with respect to a mental state, and also by believe that two person's perceptual views could be different, this pursuer often is completed around 6 - 8 years old (Muris, Steerneman et al. 1999).
Third order (ToM 3)	The third order as more advanced aspect of ToM refers to children (10-11 years old) able to understand the mind actively mediates the interpretation of reality. It could be defended that pervious experiences often have affect on the current mental states such as; emotions and social inferences (Muris, Steerneman et al. 1999)

Description of Each Theory of Mind Task

False Belief / Location Change	A girl doll comes to room, puts her ball in a basket, and then she left. While she was away a boy (doll) transferred the marble into the box. When girl returned to the room, experimenter asked; Where does girl (doll) think her marble is?" After that, "Where is the marble?" (Reality question), and "Where was the marble in the beginning?" (Memory Question) were asked.
False Belief /Unexpected Contents	A child is presented a tube of Smarties who contains pen rather than the expected smarties, and ask two control by What is this?" and "What is in it?" then asked; what other people, will think is in there before it is opened (who has not seen inside the tube) (Belief Question).
Representational Change	In this task, first presented a picture of animals who their bodies hidden except to one part (The objects were similar to versions that children had seen before, except the last picture). Then examiner asked three questions: what a child think the object is at the begging? (Representational change), when another child comes in (who has not seen the last object), what will he/she think the object is (false belief)? Moreover, what is the object look like and really? (Appearance-reality distinction).
Assess to Different Orders	The current task, nine stories, contains 38 items, drawing and/or read story item show to a child *with* three subscales: 1) Precursors of ToM (first order), 2) First Manifestations of a Real ToM (second order) and 3) more advanced aspects of ToM (third order), total all questions should be answered correctly for individuals with typically development.
Intelligence Cognitive Functioning	This IQ task as a nonverbal group test is known Raven's Progressive Matrices, and a child must be identifying the missing element to complete. There are three versions of current test: SPM, CPM, and APM who used to assess to intelligence and perceptual capacity, reasoning or observation ability, problem solving or thinking skills in children and adults.

Representational Change Test in the Current Study



Representational Change Test Definition

First Show to the Children deceptive objects.

Question 1: what is the names of objects? (Representational change). Answers are:

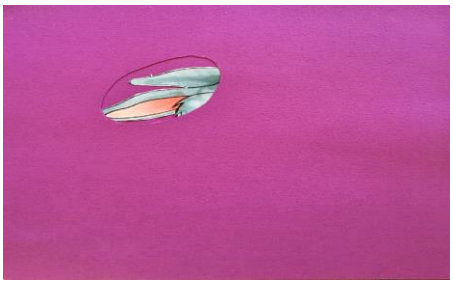
Rabbit

Frog

Graff

Lion

Than shows the pictures which one part of them is hidden and again ask about the names:

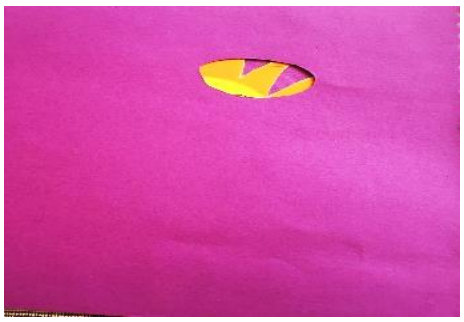
1: 

In the next page show the picture completely to the child. We continue until to picture number three.

2.  

3.  

The last object is diffident with other objects which a child seen at begging, indeed, the child seen a picture of lion, now we show a picture of sun to her/him

Question 2: What do you think is it? What is the object look like and really (reality distinction)

- Answer: lion or sun

Question 3: What is your mom would think the object (false belief)

- Answer: sun or lion

AD HOC QUESTIONNAIRE

Child's Full Name	First Middle Last			
Child's Gender	☐ Boy ☐ Girl			
Data of Birth (DoB): Mo____ Day____ Year____	Child's Age:	Today's date: Mo. ____ Day ____ Year _____		
Grad in School:				
Your Gender: ☐ Female ☐ Male	Your Relation to the Child:			
Diagnosis:				
When diagnosed (In which age he (s) was):	By whom (doctor, psychologist, Psychiatrist, etc.):			
How (describe briefly):	Test (type of test)	Clinical Diagnosis	DSM	Other Reference
Parent's Age				
PARENTS' USUAL GRADE OF EDUCATION, even if , no studies *(Please be specific — for example, standard college or university graduation, Bachelor's degree, diplomas, Incomplete University or college, high school graduate, Incomplete Higher Secondary School, under High School, Completed Primary Studies, and Primary, no studies)*				
Education	Father's Education	Mother's Education		
PARENTS' USUAL TYPE OF WORK, even if not working now *(Please be specific — for example, auto mechanic, high school teacher, homemaker, laborer, lathe operator, shoe salesman, army sergeant)*				
Occupation	Father's type of Work:	Mother's type of Work:		

The Hollingshead Four Factor Index of Socioeconomic Status (SES)

Full name:	Age:
Father age:	father Job:
Mather age:	Mather age:
Number of family members:	where was he/she stand in your family?

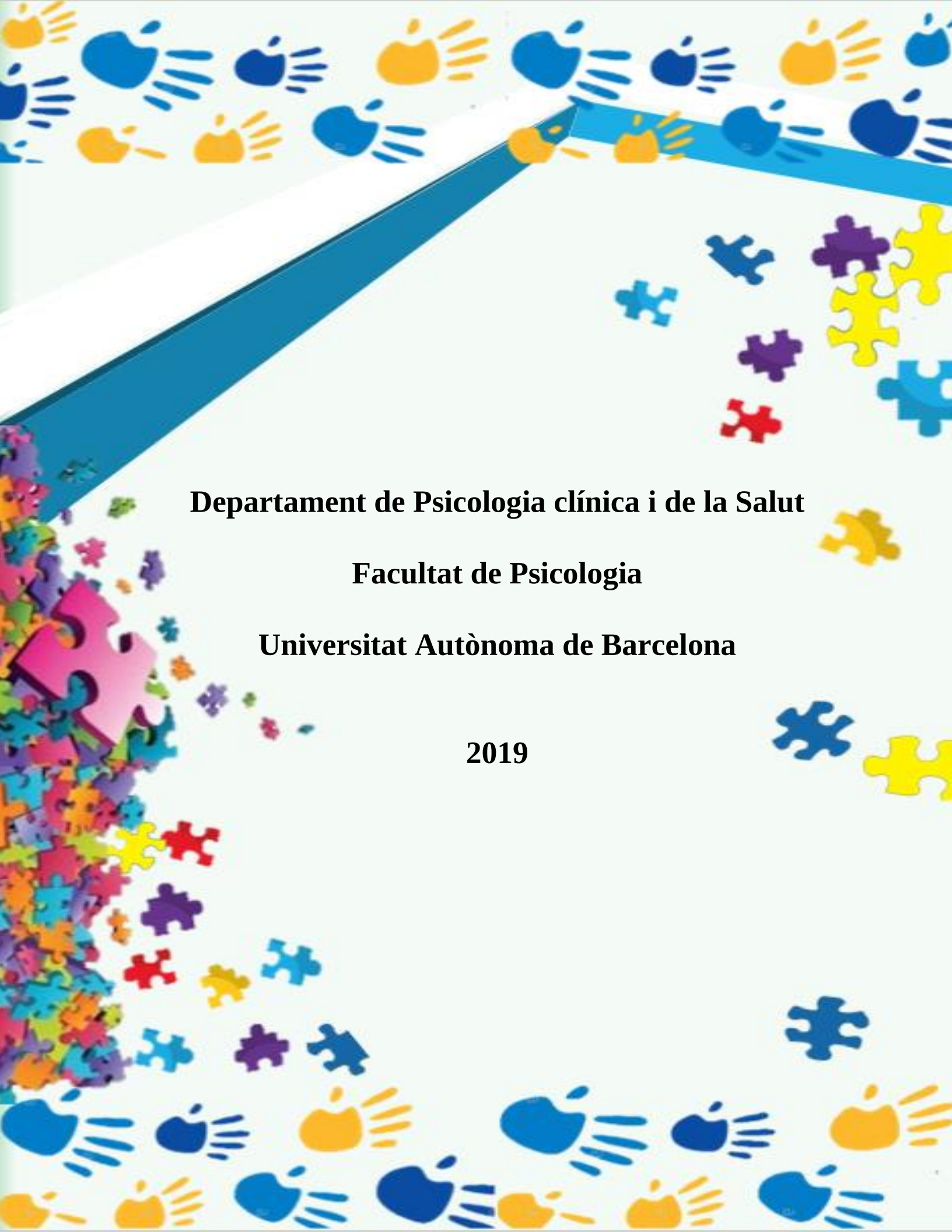
Father education

1. Illiterate 2 .Primary 3.under high school 4. High school 5. Diploma
6. Degree 7. License 8.Massachusetts 9.doctor 10. Postdoctoral

Mother education

1. Illiterate 2.Primary 3.under high school 4. High school 5. Diploma
6. Degree 7. License 8.Massachusetts 9.doctor 10. Postdoctoral

Job category		Mother	Father
9	Higher executive proprietor of large businesses, major professional		
8	Administrators, lesser professionals, proprietor of medium-sized business		
7	Smaller business owners, farm owners, managers, minor professionals		
6	Technicians, semi-professionals, small business owners		
5	Clerical and sales workers, small farm and business owners		
4	Smaller business owners, skilled manual labourers', craftsmen, tenant farmers		
3	Machine operators and semi-skilled workers		
2	unskilled workers		
1	Farm labourers, menial service workers, students, housewives, (dependent on welfare, no regular occupation)		
0	Not applicable or unknown An SES score is then calculated for a total parental SES score		



Departament de Psicologia clínica i de la Salut

Facultat de Psicologia

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