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Development of Narrative Skills in Greek-speaking Children with ASD and ADHD

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Krystallenia Fiorentzi

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Krystallenia Fiorentzi

University of Crete

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Abstract

Narrative development has been linked to children's social skills and academic achievement. Narratives are part of children's everyday life. This has led researchers to utilize narratives for assessment purposes in developmental disorders. In the present thesis we were concerned with children with Autism Spectrum Disorders (ASD) and children with Attention Deficit Hyperactivity Disorder (ADHD). Both groups present difficulties in macro- (e.g. overall organization, temporal and causal connections, theory of mind) and micro-structural (e.g. syntactic and grammatical aspects of language) levels of narration, although research data has produced inconsistent findings. The present study employed data from a larger study utilizing the assessment battery of Logometro (Mouzaki, Ralli, Antoniou, Diamanti & Papaioannou, 2017). More specifically, a retelling and a free-narration task were administered to children with ASD and ADHD and analyses were carried out based (a) on the protocol of Logometro, (b) on the model of causal networks and (c) based on linguistic features of children's narratives. The analyses aimed at detecting differences among children with ASD and children with ADHD in relation to typically developing (TD) children. Results showed significant differences between ADHD and matched TD children in both the retelling and the free narration task. In the retelling task, the parameters of sequencing, reference to the problem as well as vocabulary quality were found to differ significantly between children with ADHD and TD children. Children with ASD and TD children differed significantly in the quality of the vocabulary. In the free-narration task reference to the problem approached significance between children with ADHD and TD children. As for the model of causal networks, it was applied in free narration data and goal-attempt-outcome units and use of subordinate goals found differed between children with ADHD and TD children. In addition, children with ADHD and ASD differed significantly in the amount of events the produced. Finally, the linguistic feature analysis showed differences among the three groups in aspects like temporal, causal and goals terms, theory of mind, conjunction and subordination. In some areas TD children exhibited a higher performance while in other parameters, ADHD children performed higher than the other two groups.

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Table of Contents

Abstract 2
Acknowledgements 3
Introduction 7
1. Developmental Disorders 10
1.1. Prominent neurodevelopmental disorders 10
1.2. Autism Spectrum Disorder (ASD) 14
1.2.1. Epidemiology and characteristics. 14
1.2.2. Etiology and neurophysiological evidence. 18
1.2.3. Diagnosis and Comorbidity. 20
1.3. Attention Deficit Hyperactivity Disorder (ADHD) 23
1.3.1. Epidemiology and characteristics. 23
1.3.2. Etiology and neurophysiological evidence. 26
1.3.3. Diagnosis and comorbidity. 29
1.4. ADHD and ASD: Neurophysiological deficits and interpretive models 31
1.5. Language and communication in children with ASD and ADHD 37
1.5.1. Language and communication in children with ASD. 37
1.5.2. Language and communication in children with ADHD. 42
2. Narrative skills in children 46
2.1. Development of narrative skills in children 46
2.2. Importance of narratives in the diagnosis of Developmental Disorders 48
2.3. Narrative assessment 52
2.4. Narrative skills in children with ASD and ADHD 55
3. Method 62
3.1. Study Aims 62
3.2. Participants 62
3.3. Measures 64
3.4. Procedures 64
3.5. Data coding 65
4. Analyses 69
4.1. Results 69
4.2. Structural evaluation 69
4.3. Causal networks 73
4.4. Linguistic features analysis results 75

5. Discussion.....80
5.1. Limitations - Suggestions.....91
5.2. Conclusions.....92
References.....94

List of Tables

Table 1: Information about participants: Total number of participants, number of participants according to gender, age with standard deviation (SD) and details about the area children lived (rural, semi-urban, urban). 63

Table 2: Total number of words (TW) and different words (DW) in retelling (R) and free narration (Fr) 69

Table 3: Mean score and standard deviation (SD) for structural dimensions of the retelling task of TD children, children with ADHD and ASD. Coh. stands for coherence, seq. for sequencing, introd. For introduction, char. for character development, prob. for reference to the problem, out. for outcome, faith. for faithfulness tso the original narration and voc. to the quality of the vocabulary used. 70

Table 4: Mean score and standard deviation (SD) for structural dimensions of the free-narration task of TD children, children with ADHD and ASD. Coh. stands for coherence, seq. for sequencing, introd. For introduction, char. for character development, prob. for reference to the problem, out. for outcome and voc. for the quality of the vocabulary used. 70

Table 5: Mean score, standard deviation (SD) and significance level (P) in the non-parametric Mann-Whitney test for the retelling and the free-narration task for the following pairs of participants: TD-ADHD and TD-ASD children.....72

Table 6: Mean score and standard deviation (SD) for the parameters of causal networks. IR stands for internal responses, G1 for the main goal, O1 for the superordinate outcome, G2+ for the subordinate goals and O2+ for the subordinate outcomes. 73

Table 7: Complete and incomplete units that include goal, attempt and outcome (GAO) for the three groups of participants. 73

List of Figures

Figure 1: Mean scores of the performance of the TD, ADHD and ASD children in the retelling and free-narration task. 72

Figure 2: Mean scores and standard deviations for the temporal (TDt., ADHDt., ASDt.), causal (TDc., ADHDc., ASDc.) and goal terms (TDg., ADHDg., ASDg.) used by each group in the narratives. 76

Figure 3: Mean score and standard deviation for the total number of conjunctions (TDc., ADHDc., ASDc.), the "and" conjunction (TDand, ADHDand, ASDand), the number of subordinate clauses (TDs., ADHDs., ASDs.) and the number of utterances in direct speech (TDdrs., ADHDdrs., ASDdrs.) for our three groups of participants. 77

Figure 4: Picture from the free narration task showing the child's and the guests' happiness at the end of the party. 78

Figure 5: Picture from the free narration task showing the sadness of the clown due to the youngest child's crying. 78

Figure 6: Mean score and standard deviation of ToM terms for the TD, ADHD and ASD group. 79

Figure 7: Total number of ToM terms for the TD, ADHD and ASD group. The ToM terms are divided into emotional terms and terms indicating mental states/thoughts. 79

Introduction

ASD and ADHD are two developmental disorders characterized by limitations in communication and language skills. For both disorders there are indications of deficient verbal and nonverbal communication and social interaction, including facial recognition and emotion understanding (Ellison & Semrud-Clikeman, 2007; Klin, McPartland & Volkmar, 2005; Lord & Spence, 2006; Loth, Gómez & Happé, 2008; Tsatsanis, 2005; Tye et al., 2013; Yuill & Lyon, 2007). As for ASD, it covers a broad spectrum of individuals with variable abilities, but even in high-functioning individuals deficits can be encountered in functional use of language, in connotations or else in pragmatic aspects of language (Diehl, Bennetto & Young, 2006; Karogiannaki & Michaletou, 2005; Loth et al., 2008). Individuals with ADHD tend to display better receptive than expressive language skills and they may show deficient pragmatic skills and difficulties in other features in the socio-emotional domain (Kim & Kaiser, 2000; Miranda et al., 2013).

Due to common impairments in both disorders, research has tried to identify differences in language production between ASD and ADHD from a very young age. Narratives have been used in research, as they are a more sensitive means of detecting language difficulties in relation to standardized tests in developmental disorders (Banney, Harper-Hill & Arnott, 2015). Narratives can unravel difficulties in both macro- and micro-structure and performance in storytelling has been linked both to oral language development and later academic achievement (Botting, 2002; Diehl et al., 2006; Heilmann, Miller, Nockerts & Dunaway, 2010; Stadler & Ward, 2005). In addition, narratives can exert an important influence in conceptual development and in the development of higher-order skills related to the production of coherent discourse (Heilmann et al., 2010; Stadler & Ward, 2005).

This study aimed at examining narrative skills in children with ASD and in children with ADHD in relation to TD children. Since different narrative tasks require different use of cognitive and linguistic resources, we included both tasks form Logometro (a retelling and a free narration task) (Mouzaki, Ralli, Antoniou, Diamanti & Papaioannou, 2017). The Logometro assessment battery is a standardized screening tool examining language production in children aged between 3 and 7 years of age. Evaluation of narratives was carried out based on structural elements examined by the protocol of Logometro. Additional analyses were carried out, one according to the model of causal networks and another analysis regarding linguistic features in children's stories. Through these analyses the aim

was to identify linguistic areas that are problematic for children with ADHD and ASD in relation to TD participants and to find any linguistic features that are sensitive enough to differentiate the three groups of participants early in their development.

Research has provided mixed results, with a number of studies indicating that TD children tend to produce longer narratives, something that was not evident in our data from the number of total and different words (no significant differences were found) (Diehl et al., 2006; Flory et al., 2006; Kuijper, Hartman, Bogaerds-Hazenberg & Hendriks, 2017). Results showed that TD children performed better than the other groups of participants in the retelling task, while in free narration children with ADHD and children with ASD performed better than their matched TD peers. Children with ASD were older than TD children due to matching that was based on language skills. This age difference may correlate with more experiences of children with ASD in storytelling. As for the difference between TD children and children with ADHD, a possible explanation could be that free narration does not have the same demands as retelling. According to Diehl et al. (2006) and Flory et al. (2006), retelling has a bigger cognitive load as it requires understanding the story, holding it for some time in memory and then retrieving the necessary information in order to convey the story to a listener in an appropriate manner.

The vast majority of children identified effectively the broader goal of the free narration. However, in the free narration task children with ADHD performed significantly lower than TD peers in the number of subordinate goals produced and children with ASD performed significantly lower in the number of events produced in relation to ADHD children. This pattern, along with problems in both children with ASD and ADHD in establishing causal and temporal links may show a relatively intact ability of children with ASD to process information at a global level, although there may be problems in understanding – identifying causal links in stories, leading to coherence problems (Loth et al., 2008). In children with ADHD there have been reports for deficient sustained attention and working memory, leading to children identifying links between more immediate events at the expense of broader links governing the story, influencing coherence of the narrative (Derefinko et al., 2014; Flory et al., 2006; Lorch et al., 1999).

A last area of interest was theory of mind due to the problems children with ASD and children with ADHD have in emotion recognition. Although children with ADHD did not differ from TD peers, children with ASD performed very low in emotion and thought terms. Thought terms were nearly absent from children's narratives in relation to emotion terms,

something that in research has been linked to development of children, as thought terms arise much later than terms showing emotions (Ensink & Mayes, 2010).

In conclusion, all the analyses carried out in this study attested to the importance of narratives in the identification of early indications of developmental disorders and the need for careful choice of the narrative task necessary in each clinical context. The findings of the present study corroborated part of already existing research and showed the importance of both quantitative and qualitative data in research dealing with developmental disorders.

1. Developmental Disorders

1.1. Prominent neurodevelopmental disorders

"Developmental Disorders" is an umbrella term which hosts a number of different but sometimes comorbid disorders, which have different etiologies (Dittrich & Tutt, 2008). In general, those disorders impact on the development throughout childhood and are considered to have a biological basis. In keeping with Dittrich and Tutt (2008), there are subgroups of developmental disorders and those subgroups can be formed according to the following parameters: 1) whether a gene has been identified for the disorder (e.g. Down Syndrome), 2) whether disorders are attributed to environmental factors (e.g. Foetal Alcohol Syndrome), 3) whether the origin of the disorder is unknown, 4) and whether there are neurological abnormalities whose nature needs to be further investigated (also known as neurodevelopmental disorders).

Taking into account the aforementioned definition of developmental disorders, we are going to discuss certain developmental disorders and how they influence linguistic skills. The developmental disorders under study are Attention Deficit Hyperactivity Disorder (ADHD) and Autism Spectrum Disorder (ASD) since comorbidity could often be observed between them.

ASD is characterized by deficits in three domains which are communication, social interaction, and interests (Thurm, Lord, Lee & Newschaffer, 2007). People with ASD tend to exhibit repetitive and restricted patterns of interest. It has also been underlined that language delay/impairment is a core feature of ASD, since it is the most common indication in order to initiate referral to an expert. Linguistic skills vary greatly among individuals with ASD, ranging from fluent individuals with advanced skills in vocabulary and grammar to individuals with severe difficulties in language production and in comprehension (Boucher, 2012; Thurm et al., 2007).

Boucher (2003) indicated that there are individuals with ASD who do not produce oral language in which case there is, most of the times, comorbidity with intellectual disability. Moreover it has been supported that in ASD there are frequent sensory-perceptual and motor difficulties and language use takes place when people with ASD want something and not in favor of social purposes. Language content has been described as repetitive and egocentric, and conversation as not mutual/reciprocal (i.e. one-sided), as ASD children face difficulties in initiating, maintaining and managing a conversation (Boucher, 2003; Helland, Biringer, Helland & Heimann, 2012). Individuals with ASD have pronounced deficits in

pragmatics, in comprehension and in use of non-verbal cues. Thus, problems have been found in understanding and using facial expressions, gestures and vocal prosody in order to convey meaning, even in individuals with high-functioning autism (Boucher, 2003; Helland et al., 2012). According to Rice, Warren and Betz (2005), differential diagnosis between ASD and language impairment and the previously described combination of characteristics that resembles the linguistic profile of SLI, is of particular interest.

The core feature that defines SLI is language impairment despite typical cognitive and sensory skills. Speech delay in SLI is not so frequent and it has been reported in less than 2% of the SLI population (Shriberg et al., 1999 in Rice et al., 2005). As for vocabulary, SLI children exhibit a delayed lexical system as they show lower scores in relation to typically developing children and generally appear to perform like younger children. In morphology, they have difficulties in grammaticality judgment tests and more specifically, in finiteness morphemes, which tend to be omitted for a longer period of time than their typical peers. For this reason, it is proposed that finiteness morphemes can serve as diagnostic markers for SLI. In pragmatics, children with SLI do not have marked deficits and their performance in syntax and semantics is lower than in social communication, suggesting possibly that pragmatic deficits are secondary to semantic and syntactic ones. In general, as Rice et al. (2005) indicated, in SLI we can observe more of a delayed linguistic growth with only some aspects of deviant growth.

Dyslexia is another developmental disorder which more recent studies have found to be separate from and truly comorbid with LI, although in the past, the possibility of the two disorders falling in the category of spurious comorbidity was examined. In more detail, according to Redmond, Ash and Hogan (2015), dyslexia has been considered as a manifestation of LI, mostly due to frequent reports of dyslexic children who had language delays and impairment during their preschool years. Two other developmental disorders which have been found to have interactive comorbidity are intellectual disability and Specific Language Impairment (SLI). Specifically, borderline mental retardation or else called nonspecific language impairment (NLI), differs from SLI, as lower non-verbal IQ appears to interact with LIs and result in lower performance of children with NLI in relation to children with SLI (Rice et al., 2005).

On the other hand, Fragile X Syndrome is a genetic cause of ASD and individuals with this syndrome are usually characterized by severe intellectual disability. This disorder differs from the aforementioned ones, as the language delay observed is in line with the limitations in nonverbal IQ. According to Rice et al. (2005), children with Fragile X are

relatively better in verbal rather than visuo-spatial cognitive tasks. Speech problems in Fragile X include harsh vocal quality, rapid and variable speech rate and deficits in articulation. High levels of anxiety along with hypotonia of muscles and cognitive delays impact speech and language skills of individuals with Fragile X Syndrome. Individuals with Fragile X Syndrome seem to perform lower than mentally-matched peers in pragmatic abilities and research findings for ToM are not consistent, with some indications pointing that ToM is delayed but with other findings suggesting that people with Fragile X Syndrome present similar performance to that of mentally-matched children (Rice et al., 2005).

Williams Syndrome is another genetic disorder which is accompanied by mild to moderate intellectual disability and a delay in language development. Research findings show that the errors those children make are developmental, indicating a delayed language growth. On the other hand, as Rice et al. (2005) stated, some researchers suggest that children with Williams Syndrome follow a deviant development, as they rely solely on auditory memory for language production and not on grammatical skills. As adults, moreover, individuals with Williams Syndrome persist on making errors in grammar. In Williams Syndrome there is discrepancy between nonverbal and language skills similar to SLI but reverse (nonverbal skills exceed linguistic skills). More specifically, vocabulary and all other language skills exceed nonverbal ones, something that differentiates this condition form other developmental language disorders (Philofsky, Fidler & Hepburn, 2007; Rice et al., 2005). A differentiating characteristic between Williams Syndrome and ASD and SLI is morphosyntax, with children with Williams Syndrome showing a delayed onset of acquisition for grammatical morphology proceeding with a normal rate of acquisition despite the cognitive delays. As for pragmatics, there is not much information, but it is argued that children with Williams Syndrome do not appear to have problems in social communication, while there are also reports for hypersociability and some maladaptive behaviors (Philofsky et al., 2007; Rice et al., 2005).

Individuals with Williams Syndrome make many errors during speech production and those errors increase as the environment becomes more demanding and errors are attributed partly to the anxiety which operates additively to difficulties in articulation due to low muscle tone. Phonological deficits moreover are claimed to influence errors during speech production and all the aforementioned factors result finally in speech intelligibility problems in more demanding contexts, although individuals with Williams Syndrome speak clearly when producing short/simple sentences (Andriola, 2015).

Children with Down Syndrome on the other hand, seem to have a slower rate of acquisition of grammar. There is a disparity between nonverbal cognition and grammatical skills, while no discrepancy is found between vocabulary skills and nonverbal cognition (Rice et al., 2005). Additional problems are encountered in speech, as intelligibility is affected by articulatory and hearing deficits on top of cognitive and language delays. As for pragmatics, there are strengths but more weaknesses and as far as theory of mind is concerned, studies have found poorer performance than controls (Rice et al., 2005). In individuals with Down Syndrome there are difficulties in phonological awareness (Roch & Jarrold, 2008), while cognitive abilities range between moderate and severe intellectual disability. Comprehension appears stronger than production from the 18th month of life and there are problems in verbal STM (Laws & Gunn, 2004; Vicari, 2006). Burgoyne et al. (2012) indicate that phonological awareness is impaired and recognition skills are better than productive ones. Hearing loss ranges from mild to moderate conductive hearing loss and is caused by frequent middle ear infections (Laws & Gunn, 2004). Finally, in expressive language there are pronounced deficits in syntactic and morphological measures, including MLU and number of both total and different words in conversational and narrative contexts (Finestack & Abbeduto, 2010).

The last developmental disorder discussed is ADHD where more than half of the population exhibit some kind of language difficulties (Väisänen, Loukusa, Moilanen & Yliherva, 2014). Those difficulties however, may go unnoticed if there is not a systematic evaluation of linguistic skills. ADHD is the most common psychiatric disorder which is diagnosed in childhood and is accompanied by difficulties in verbal skills, auditory-linguistic processing, language comprehension, reading, writing and social skills. There are also cases where slower processing speed has been found for children with ADHD, something that has been considered as an indication of overlap between linguistic difficulties in ADHD and SLI (Väisänen et al., 2014). Children with ADHD exhibit problems in pragmatics as well, problems namely with the use of language in a social context. While fluency, articulation and other aspects of expressive language may not be affected, difficulties may be evident in understanding implied meaning and there is also the possibility of stereotyped language (Väisänen et al., 2014). Children with ADHD, as well as children with Conduct Disorder, have been found to use private speech for a longer period of time in relation to typically developing children. There are also problems in executive functions, which are crucial for social and cognitive development, a parameter that relates to the weakness in pragmatics (Väisänen et al., 2014).

1.2. Autism Spectrum Disorder (ASD)

1.2.1. Epidemiology and characteristics.

It has been supported that ASD is a broad term that manifests itself differently among individuals and is comprised by smaller categories which are Asperger Syndrome (AS), autistic disorder and pervasive developmental disorder-not otherwise specified (PDD-NOS) (Boucher, 2003; Klin et al., 2005; Lord & Spence, 2006; Rice et al., 2005). ASD seems to affect males more frequently than females with a rate of 3 or 4 to 1, with some studies showing even greater difference between male and female children (Lord & Spence, 2006). Besides, when only retarded children are taken into account the ratio approaches 1 to 1. Intellectual disability can co-occur with ASD and can sometimes be linked to the severity of ASD symptoms, with research indicating that the population of children with nonverbal IQ under 70 is less than 50% (Lord & Spence, 2006). According to the Center for Disease Control (CDC) (2009) cited in Gargaro, Rinehart, Bradshaw, Tongue and Sheppard (2011), the prevalence rate of ASD in the USA is 0.9% and males seem to be more affected than females (ratio: 4-5 to 1 according to American Psychiatric Association, 2000). The age of onset has to be before 3 years.

ASD was first described by Eugen Bleuler in 1912 in an article during his effort to describe different forms of schizophrenia and then the first definition of ASD was given by Kanner (1943) (Syriopoulou-Delli, 2016). In 1944 Asperger described more functional individuals with ASD that differed from the previous descriptions of autistic individuals (Syriopoulou-Delli, 2016). The first to use the term Asperger's Syndrome was Lorna Wing in a research published in 1981 (Karogiannaki & Michaletou, 2005). This was due to the fact that she described a group of autistic people that matched the profile described by Hans Asperger, who referred to four boys with an unfamiliar profile of linguistic, social and cognitive skills and used the term "autistic psychopathology". Both Asperger and Kanner dealt with autistic children, who were characterized by limited social interactions, deficits in communication and stereotypical interests. Kanner worked with more severe forms of autism, while Asperger with more functional cases. Although the diagnostic criteria for ASD are closer to what Kanner described, Wing realized that there were cases of autistic people with the typical autistic characteristics although in a milder form, who developed their linguistic

skills and the eagerness for communication like typically developing (TD) people. Those people with autism showed impairments only later in more elevated forms of communication that are based on conversational skills (Karogiannaki & Michaletou, 2005).

Individuals with ASD have repetitive plans and activities and they want to preserve sameness. They are characterized by stereotyped/repetitive behavior and they exhibit great problems when their routine changes (Christakou et al., 2013; Lord & Spence, 2006; Loth et al., 2008; Peeters, 2001). ASD children also exhibit fixation with particular objects and their stereotypical interests appear to begin at a certain point and end at another point; during this period, those interests dominate in their free time and their conversations (Ellison & Semrud-Clikeman, 2007).

Children with ASD may display either increased or decreased responsiveness to sensory stimuli too (e.g. children may not want to touch certain surfaces, may want their clothes be made from certain fabrics etc.). Other features of ASD children include head banging, body spinning, body rocking, body cycling, adherence to certain routines and others (Muma & Cloud, 2013). Additionally, according to Peeters (2001) there are accounts of self-injury, wandering without purpose, screaming, spitting and stereotyped behavior in ASD. Stereotyped behavior is usually self-directed and characteristic examples are observation of somebody's own fingers, waving somebody's arms or swaying the body back and forth (Peeters, 2001, p. 89). People with ASD do not like going beyond the literal, they do not have flexible thought and they cannot thus share conversations and the social intercourse of TD individuals.

Echolalia is another characteristic of ASD along with problems in figurative expressions. Not using the typically established meaning of the words can be very confusing at times (Peeters, 2001). However, we need to mention that visual and visuo-spatial abilities seem to be of relative strength in ASD in relation to verbal abilities (Tsatsanis, 2005).

In general, ASD is characterized by limitations in social interaction and communication (verbal and mon-verbal), play, imagination, cognition and processing of social and emotional cues (Ellison & Semrud-Clikeman, 2007; Klin et al., 2005; Lord & Spence, 2006; Loth et al., 2008; Tsatsanis, 2005; Tye et al., 2013). ASD appears then to affect primarily social development, communication (verbal and non-verbal) and is characterized by a restricted range of behaviors and behavioral problems (Tsatsanis, 2005). People with ASD do not understand the emotions, intentions and thoughts of other people. Children with ASD are characterized by ‘‘mindblindess’’ which restrains their ability to understand/predict what people are about to do, they are not able to relate to people or

situations and infer other people's motivations, something that impacts interpersonal relations (Loth et al., 2008; Peeters, 2001). This could result in children with ASD being often characterized as anti-social, as they do not think about or understand non-literal aspects of language or else the connotations/pragmatics of the language and simply say what they think (Karogiannaki & Michaletou, 2005; Loth et al., 2008).

Overall social and communication deficits were found to derive form one and only underlying deficient social communication factor including both non-verbal communication and reciprocal conversation (Lord & Spence, 2006). According to Peeters (2001), ASD individuals perceive information typically but they process it differently, while they also differ in the development of communication, social behavior and imagination.

From a developmental point of view, and with regards to social reciprocity, it is evident autistic infants from birth to have responsiveness issues when they are held, as they do not also engage in social smiling (Ellison & Semrud-Clikeman, 2007). In the first months of life children with ASD display decreased visual attention to other people, they seek other people less frequently and they show decreased number of efforts to participate in social interactions through smiling and vocalizing (Chawarska & Volkmar, 2005). Other signs include absence of differential response to various verbal stimuli and to their name as TD infants do. Young children with ASD appear to have difficulties imitating body movements and movements involving objects (Carter, Davis, Klin & Volkmar, 2005). Other characteristics of autistic children include "deficient mother-child reciprocity, regression/arrested social interactions and ritualistic or else stereotypic behaviors" (Ellison & Semrud-Clikeman, 2007, p. 115). Deficits in joint attention skills, body movement imitation and imaginative play have been linked to deficits later in language development in children with ASD (Toth, Munson, Meltzoff & Dawson, 2006).

Children with high functioning autism (HFA) often exhibit strong long-term memory and long period of concentration in case they are interested in a specific subject and they also use innovative problem-solving skills (Karogiannaki & Michaletou, 2005). On the other hand, those children may show a lack of motive and attention for things that would be interesting for other children in class and may present a profile similar to learning disabilities when they are assessed. In the social field, teachers and parents may witness children with HFA being vulnerable to the teasing of other children and it is possible that children with HFA are alone during breaks (Karogiannaki & Michaletou, 2005).

People with AS were mentioned as a link between TD population and autism with regards to social functioning, since people with AS exhibit higher cognitive and linguistic

abilities and are eager to engage in social interactions, despite few problems (Klin et al., 2005; Loth et al., 2008). As it has been previously mentioned, AS and ASD are distinguished in ICD-10 and DSM-4 in terms of the age of onset criteria. Ellison and Semrud-Clikeman (2007) argued that individuals with AS display chronic and important deficits in social interaction and repetitive patterns of behavior. Another distinctive characteristic of individuals with AS, is that this population is not linguistically impaired. The linguistic and cognitive development of AS individuals may even resemble the respective development in TD children. While individuals with AS may not differ from TD peers to a great extent, this is not the case with individuals with ASD, who face many difficulties (Semrud-Clikeman, 2007).

Since AS has been described as a scaffold between TD children and children with ASD in many skills, among which is ToM (Loth et al., 2008). More specifically, by the end of childhood it has been suggested that children with AS and HFA improve their ToM skills at least in structured and situations which are verbally mediated. It has been argued that ToM skills influence or are the basis of social competence. It would be expected that since children with HFA/AS exhibit at some point good ToM skills, they would consequently manage to handle social demands. According to Loth et al. (2008), this not the case though, as recent studies have found substantial deficits in social adaptive behavior.

In sum, deficits displayed in AS concern the following areas (Ellison & Semrud-Clikeman, 2007; Klin et al., 2005; Karogiannaki & Michaletou, 2005):

- Absence or poor empathy, intellectualization of feelings and flat affect,
- Immature, inappropriate, one-sided social interaction, withdrawal, difficulties with facial expressions,
- Little or no ability of founding new social relationships,
- Dull, monotonous, stereotypical, repetitive speech, long-winded and incoherent utterances which fail to deliver a message effectively,
- Poor, non-verbal communication,
- Fixation with certain topics, resistance to change, obsessive/compulsive rituals,
- Clumsy, uncoordinated movements and idiosyncratic body postures, poor body awareness,
- Aggressiveness, noncompliance and other conduct problems,
- Egocentric preoccupations,
- Good rote memory.

In more detail, children with AS think in an ego-centric manner but they are not selfish, they like dominating in a group game and they are not generally fond of group games (Karogiannaki & Michaletou, 2005). They tend to follow their own interests and not the ones of a team or of other children. Moreover, they tend to prefer the company of older people rather than that of their peers. Children with Asperger also tend to ignore unwritten rules that govern people's relationships and they can become rude and/or make inappropriate comments to people they talk with. Interestingly, there are some problems that seem to be more intense in certain periods of time (e.g. stereotypic behaviors and gaze avoidance) and other that are evident throughout life (communication and interaction patterns) (Karogiannaki & Michaletou, 2005). This last remark concerns more severe forms of ASD as well.

Concluding, the incidence of Asperger's Syndrome has been estimated to approximately 0.26% of the total population with higher incidence being found for individuals between 7 and 16 years and higher incidence being evident for males. The specific syndrome manifests itself before the 4th year of life (Ellison & Semrud-Clikeman, 2007).

1.2.2. Etiology and neurophysiological evidence.

Although there is not conclusive evidence as to the exact etiology of ASD, it is widely accepted that the particular disorder is of genetic origin (Banora, Lamb, Barnby, Bailey & Monaco, 2006; Ellison & Semrud-Clikeman, 2007). According to Ellison & Semrud-Clikeman (2007) ASD is a hereditary disorder and there are various observations testifying to this claim. First, there is an increased incidence of ASD among siblings (it is 50 times more likely that a sibling of an individual with ASD has the same disorder in comparison with TD individuals). Second, ASD has an increased incidence in monozygotic rather than in dizygotic twins. ASD occurs especially in monozygotic twins and was claimed to be "one of the most heritable neuropsychiatric disorders" (Banora et al., 2006, p. 51).

Besides the previous evidence, relatives of ASD children exhibit characteristics of ASD more often than relatives of children with other neuropsychiatric disorders, suggesting the existence of a broader ASD phenotype with genetic etiology (Banora et al., 2006). There has been a lot of discussion around the possible candidates for ASD among which are genes on chromosome 5, 7 and 15 (Banora et al., 2006).

It is worth noting that apart from the aforementioned genetic factors, Ellison and Semrud-Clikeman (2007) argued for increased prenatal and perinatal complications at birth in relation to births of TD children. The most frequent complications include meconium in the amniotic fluid, bleeding during pregnancy as well as use of hormones prescribed by a doctor (Ellison & Semrud-Clikeman, 2007). Ellison and Semrud-Clikeman (2007) also indicated that ASD has been linked to other genetic disorders such as Fragile X syndrome and untreated phenylketonuria.

As for neurological evidence for ASD, there is research evidence suggesting EEG abnormalities, hippocampal abnormalities, ventricular enlargement, cortical atrophy, right-left asymmetry abnormalities, reticular activating system dysfunctions, limbic system involvement and cerebellum abnormalities (Ellison & Semrud-Clikeman, 2007). Ellison and Semrud-Clikeman (2007) suggested that children with ASD may not show the pattern of hemisphere specialization we encounter in the typical population. Problems have been traced in executive control and frontal lobe function, with children having lower performance than TD children. Additionally, higher levels of serotonin and higher levels of dopamine have been linked to children with ASD. In general, higher serotonin has been linked to cognitively retarded people and higher dopamine has been linked to symptom severity in ASD and has been traced in psychotic children too.

Evidence from neuroimaging, as it is mentioned in Gargaro et al. (2011), does not indicate to an established marker for ASD, but research in this field has found structural abnormalities in the frontal lobes, the limbic system, the cerebellum and amygdala, the medial temporal lobe, the inferior parietal lobe and the tempo-parietal junction (Gargaro et al., 2011, p. 1082). Nevertheless, it needs to be mentioned that these findings are not consistent, with the only exception being the increase in early brain growth and size, both of grey and white matter (Gargaro et al., 2011, p. 1082). From a developmental point of view, the enlargements mentioned are evident before the age of four but they normalize as children grow older.

With regards to fMRI findings, deficits have been found in the specialization of different cortical networks which do not develop fully. Other reviews suggest that there is disorganization in cortical networks and disturbance of functional connectivity and synchronization while other study findings suggest alternations in the activation of frontostriatal networks and enhanced activity in parieto-occipital networks (Gargaro et al., 2011). In addition to the aforementioned difficulties, striatal regions present hypofunctionality and as for the temporal lobes there is evidence of localized hypoperfusion

in both hemispheres of the brain. These deficits are linked to difficulties encountered in social skills like the perception of face, voice and social stimuli, as well as social cognition (Gargaro et al., 2011).

Di Martino et al. (2013) have discussed the presence of dysconnectivity in larger networks and especially in the default network and in fronto-parietal-striatal circuitry, in the case of both ASD and ADHD. Research using the technique of voxel-based morphology has moreover gray matter reductions in medial temporal and left inferior parietal cortex for both of the groups mentioned before. In addition, reductions in supramarginal gyrus have been found for ASD. Further evidence, using fMRI has found for ASD and ADHD hyperactivation in the precuneus, and hypoactivation in areas like superior parietal cortex and striatum, areas namely involved in attentional control. For ASD furthermore, there are indications for cerebellar hyperactivation and for ADHD there is evidence for hypoactivation of dorsolateral prefrontal cortex, which are specific for each of the two conditions (Di Martino et al., 2013).

According to Johnson et al. (2007), anatomical and physiological differences in fronto-striatal and fronto-parietal networks have been found for ASD as well. In more detail, there is evidence for large frontal lobe volumes, reduced grey matter in fronto-striatal and parietal networks. Dysfunctions, such as regional cerebral blood flow in the left prefrontal cortices have been reported in ASD. Additional evidence suggests increased activation of the frontal and parietal cortices in the context of response inhibition tasks, increased left hemisphere activity in the inferior and orbitofrontal cortices. It was after all noted that alternations in fronto-striatal and fronto-parietal circuits may relate to executive function problems in both ASD and ADHD (Johnson et al., 2007). In accordance with Brieber (2007), alternations in the case of ASD have been found in the hippocampus-amygdala complex as well as the occipital cortex.

1.2.3. Diagnosis and Comorbidity.

Peeters (2001) argued that the inclusion of ASD in pervasive developmental disorders means that this disorder affects somebody deeply for his/her whole life. It was highlighted by Syriopoulou-Delli (2016) that even though there has been a lot of effort to examine the genetic, neurological and hereditary nature of ASD, the evidence is still inconclusive. Furthermore there has been a lot of effort to describe the characteristics of ASD and form

some categories in this spectrum and this has been proven very difficult. Based on these difficulties there is not one generally accepted definition for ASD.

It was noted that due to the difficulty in establishing certain objective diagnostic criteria for ASD, it is of high importance to carry out a differential diagnosis (Karogiannaki & Michaletou, 2005). Volkmar and Klin (2005) agreed upon the need for differential diagnosis in order to distinguish ASD among other disorders with similar symptoms. In order to exclude other syndromes or disorders with similar characteristics, various experts (psychologists, child psychiatrists, pediatricians, occupational therapists, physiotherapists etc.) ought to cooperate. In order for a child to be diagnosed with ASD there are precise criteria set by certain institutions and other criteria set by experts in the field (Karogiannaki & Michaletou, 2005).

In more detail, there are two sets of diagnostic criteria established by two institutions that are particularly restraining and these are determined by the World Health Organization (that has formed the 10th edition of the International Classification of Diseases) and the American Psychiatric Association (that has published the 4th edition of the Diagnostic and Statistical Manual of Mental Disorders, DSM-4) (Volkmar & Klin, 2005; Karogiannaki & Michaletou, 2005). In the new DSM-5, however, there are 7 criteria devided in 2 categories and changes in the wording, while in the previous edition of DSM there were 12 criteria divided in 3 categories (Syriopoulou-Delli, 2016).

In sum, for a child to be diagnosed with ASD, he/she has to fulfill all 3 criteria in the first group of symptoms regarding deficits in social communication and interaction across different contexts. From the second group of symptoms the child has to fulfill 2 of the 4 criteria regarding restrained repetitive behaviors, interests or activities, while DSM-5 requires all symptoms to be present from early childhood and to restrain and hinder child's functioning in everyday life.

Nowadays, Asperger's Syndrome is considered a part of the broader ASD, it has its own diagnostic criteria and is more frequent than other more severe forms of autism (Karogiannaki & Michaletou, 2005). The diagnosis of Asperger has been described as a two-stage procedure. First, a questionnaire or a scale is administered to parents and teachers and the second stage involves the formal assessment by experts who are well-aware of the behavior and skills of children with developmental disorders based on reliable criteria that give an accurate picture of the syndrome. Karogiannaki & Michaletou (2005) described two psychometrically sensitive scales that can efficiently identify children with Asperger's Syndrome. The first scale is the Australian Scale for Asperger's Syndrome (ASAS) and has

been designed for school-aged children. Each question or statement can be rated in a Likert type scale consisting of six points, with the sixth point indicating that a behavior or characteristic is observed extremely often. The second scale is Autism Spectrum Screening Questionnaire (ASSQ), which is a 27-item checklist that can be completed by lay informants in order to assess a child or an adolescent for Asperger's syndrome and other high-functioning autism spectrum disorders (Karogiannaki & Michaletou, 2005).

Gillberg and Gillberg (1989), as described in Karogiannaki and Michaletou (2005), have formed two criteria for Asperger's Syndrome diagnosis. According to the first criterion, the child has to have two of the following characteristics: 1) inability to interact with peers, 2) absence of eagerness to interact with peers, 3) no understanding of social norms/codes, 4) inappropriate social and emotional behavior. The second criterion refers to non-verbal communication and includes the following parameters: 1) limited use of gestures, 2) clumsy/inappropriate movements, 3) limited use of face expressions, 4) inappropriate expressions, 5) weird, cold face. Szatmari, Brenner and Nagy (1989) cited in Karogiannaki and Michaletou (2005), specify the diagnostic criteria for Asperger's Syndrome in emotional detachment from other people/hardship to understand feelings of other people, no eye contact while talking to other people, and sitting too close to other people while having a conversation with them.

It needs to be mentioned that there is a linguistic disorder, the Semantic/ Pragmatic Language Disorder, which is very close to ASD or even overlaps with ASD at some points (Karogiannaki & Michaletou, 2005). Common characteristics with ASD include echolalia, reduced ability of the child to respond to the change of faces during a conversation, differences in prosody, hardship in understanding other people's perspective. Although their syntax seems to be good, but the content/ what they try to say, is not clear. So even if the two disorders resemble on another, they are distinct.

ASD has been finally found to co-occur with intellectual disability very often (Peeters, 2001). However, it was noted that ASD itself is not a mental illness. More specifically, Ellison and Semrud-Clikeman (2007) claimed that children with autism may have comorbid epilepsy (25%), cognitive retardation (70%), attention problems, and aggressive/impulsive disorders. Epilepsy has also been reported in children with ASD with its prevalence ranging between 5 and 44% (Lord & Spence, 2006). Behavioral problems, self-injury, hyperactivity to various stimuli (e.g. touch, odors, sounds), sleep disturbances as well as mood/affect disorders (e.g. inappropriate or no emotional response) have also been reported to co-occur with ASD (Ellison & Semrud-Clikeman, 2007). Lord and Spence (2006)

mentioned that psychosis, ADHD, depression in higher functioning individuals, anxiety, obsessive-compulsive symptoms, Tourette Syndrome and schizophrenia have been claimed to co-occur with ASD to a bigger or lesser extent. It has also been claimed that approximately 30% of people with ASD have comorbid ADHD and manifest as a result age-inappropriate inattention, impulsiveness and hyperactivity (Christakou et al., 2013).

1.3. Attention Deficit Hyperactivity Disorder (ADHD)

1.3.1. Epidemiology and characteristics.

ADHD and ASD are among the most frequently diagnosed psychiatric disorders. ADHD is the most common psychiatric disorder diagnosed in children, affecting 3-7% of children at school (Ellison & Semrud-Clikeman, 2007). It is a heterogeneous disorder which is estimated to affect 3-5% of school-aged children and is present throughout life. Individuals with this disorder are at risk of psychopathology later in life (Ellison & Semrud-Clikeman, 2007). Prevalence rates range between 3% and 7% in schoolchildren, according to Gargaro et al. (2011) and between 5% and 7%, according to Redmond et al. (2015). Sobanski et al. (2010) estimated prevalence of ADHD at 5% in school children.

Prevalence rates in ADHD suggest that ADHD is more frequent in comparison to ASD and it appears to be the second most frequent comorbid disorder in people with ASD in the last years (Gargaro et al., 2011). It was noted by Miranda, Baixauli, and Colomer (2013) that from the population of children with ADHD, a certain percentage continues to show important indications of the disorder in adolescence and in adulthood; this percentage is approximately 3% of the general population. Additional information from other studies, as cited in Miranda et al. (2013), estimates that approximately 15% of the children diagnosed with ADHD continue to meet the criteria for the disorder at age 25. Sobanski et al. (2010) argued that 65% of the individuals diagnosed with ADHD continue to exhibit the impairing symptoms to young adulthood.

Children with ADHD is characterized by impulsivity, hyperactivity and inattention which do not conform to their developmental stage and an increased number of children with ADHD are at risk of displaying comorbid language impairment (Gargaro et al., 2011; Renz et al., 2003). This neurodevelopmental disorder seems to manifest itself differently in each sex,

with females being more likely to be diagnosed with the inattentive type (Gargaro et al., 2011). This distinction influences the ratio between males and females which is 6.4:1. In general, Redmond (2004) indicated that ADHD manifests itself in different ways among children, resulting in a heterogeneous population.

Ellison and Semrud-Clikeman (2007) mentioned that people with ADHD display deficits in attention span, self-regulation and impulsive control and shows motoric over-activity. Although ADHD embodies the element of inattention, it is not a primarily disorder of attention (Westby & Watson, 2003). The researchers gave some examples in favor of this statement which include among others not doing a lot of effort for a task, poor emotional self-regulation and compliance to teachers'/parents' commands, poor working memory and deficient verbal fluency.

Anastasopoulos and Shelton (2001) indicated that impulsivity, hyperactivity and inattention are primary attributes of ADHD but they do not constitute sufficient features for the diagnosis of the disorder, something that has made the diagnosis of ADHD unclear. Additional characteristics that have been linked mainly to the severity of the core symptoms are irritability, hot temper, low frustration tolerance, and sudden unpredictable shifts towards negative emotions (e.g. anger, dysphoria and sadness) (Sobanski et al., 2010).

As for the core symptoms, inattentiveness manifests itself differently across lifespan and early signs of it can be traced during infancy. Toddlers for instance may not be able to watch a TV program of their interest for more than a few minutes and preschoolers may not seem to be listening during story time (Anastasopoulos & Shelton, 2001). Entering kindergarten poses new challenges upon the child in terms of self-regulation. Weakness in this ability, implies that it is easier for the child to get distracted, which can result in the child not finishing all of the tasks the teacher has assigned to him/her or making mistakes lack of adhering to teacher's instructions or due to day dreaming (Anastasopoulos & Shelton, 2001).

Impulsivity is another characteristic of ADHD which can manifest itself in different ways across lifespan. For example it is possible for somebody to take risks that are not necessary or say something instantly without first having thought that what she/he says may be insulting. For preschoolers some indications of impulsivity are taking another child's toy (because the child with ADHD cannot wait), or trying to reach objects of their interest without thinking about the obstacles in space, resulting in the ADHD child bumping into tables or chairs. For school-age children indices of ADHD may be that a child with ADHD cuts in front of the line made by classmates, makes inappropriate comments or mistakes due to preference towards speed (Anastasopoulos & Shelton, 2001).

Hyperactivity is the third characteristic of ADHD that can also vary throughout development but it mainly includes physical elements, like constant motion, inability to stay still or moving back and forth. During preschool years a child with ADHD may be unable to sit with other children in the circle for some time, or may not be able to lay down on a carpet for rest time. In elementary school, children with ADHD may not be able to stand in a row or when seated they may tap their fingers on the desk or they may jump from one piece of furniture to another (Anastasopoulos & Shelton, 2001).

Ellison and Semrud-Clikeman (2007) argued that individuals with ADHD have problems in inhibitory control and they cannot thus suppress their response to environmental stimuli. There are different subtypes embedded in this disorder. There are for instance symptoms related to motor hyperactivity, where individuals cannot inhibit their movement, something that is linked to frontal and prefrontal regions of the brain. The second type of the disorder is related to inattention, and relates to interference sensitivity, problems in filtering external stimuli, and is embedded in sustained and divided attention. It was noted that attention is a complex construct that has multiple components that interact with cognitive, motor and social aspects of human development. As a result, if there is a problem in any of the components of attention, all other components will also be affected, since attention is one part of the construct. Individuals with ADHD have been found to have problems in selective and sustained attention but not in orienting or reactive attention (Ellison & Semrud-Clikeman, 2007).

Attentional deficits may be secondary deficits; ADHD has been presented as a disorder that is primarily about behavioral inhibition and regulation (Ellison & Semrud-Clikeman, 2007). For instance, a child may not be more prone to distraction but it may refuse to engage in activities which are not of their interest and which do not lead to obvious/immediate results. Ellison and Semrud-Clikeman (2007, p. 122) stated that "[the] child with ADHD is capable of orienting to specific stimuli but unable to resist or disinhibit responses to completing stimuli that appear more interesting and reinforcing".

Inattention, hyperactivity and impulsivity, which exceed developmentally appropriate levels, have been linked to substantial difficulties in various social contexts like school. Children with ADHD display a strong tendency towards school failure and grade retention (Freer, Hayden, Lorch & Milich, 2011; Lorch, Milich, Flake, Ohlendorf & Little, 2009). At school, children with ADHD are characterized by difficulties in study skills, disorganized work habits, and inappropriate behaviors inside the classroom (Renz et al., 2003).

Children with ADHD have additional problems while interacting with their peers and family members (Ellison and Semrud-Clikeman. 2007; Yuill & Lyon, 2007). It is worth noting that about 50 % to 60% of the children face difficulties during social interaction with peers, although such difficulties are not part of the diagnostic criteria (Gentschel & McLaughlin, 2000; Yuill & Lyon, 2007). There are reports that link different subtypes of the disorder with differences in the social field (Ellison and Semrud-Clikeman, 2007). Children that are not hyperactive tend to have difficulties with social isolation and nonverbal reasoning, while children with the combined type tend to be more prone to social rejection and oppositional/defiant disorder or conduct disorder. Children with the combined type are at high risk of learning problems and problems with information processing as well as aggressive behaviors. ADHD children that are not hyperactive, are less impulsive, aggressive and they do not have so intense behavior problems. However, children with the inattentive subtype are more daydreaming, confused and lost in thought (Ellison & Semrud-Clikeman, 2007).

There is also research suggesting that children and adolescents with ADHD exhibit problems in in facial recognition of emotions (which is part of social skills), even though not consistently (Yuill & Lyon, 2007). However, it was mentioned that it is not clear whether the reported difficulties in the recognition of facial expressions derive from a primary deficit in social recognition or whether they are a consequence of inattention/impulsion. There is evidence though suggesting that deficits in face recognition coincide with broader deficits in emotion understanding depending on contextual information (Da Fonseca, Seguier, Santos, Poinso & Deruelle, 2009). Other deficits include cognitive deficits as in the area of executive functions (there is a more general cognitive dysfunction in this case) (Yuill & Lyon, 2007). In their study, Yuill and Lyon (2007) found that ADHD children may have performed low in facial recognition but they also could not inhibit their responses and answered quickly in a task that was relevant to recognition of non-emotional aspects of the faces.

1.3.2. Etiology and neurophysiological evidence.

There are speculations as to which could be the causes of ADHD but, as in ASD, there is not a definite conclusion for this question. Ellison and Semrud-Clikeman (2007) noted that first-degree relatives of individuals with ADHD are likely to have ADHD and it is

also highly probable that children with ADHD have relatives with antisocial or mood disorders. Even though there are reports of ADHD running in families, it has also been noted that there is not enough evidence to conclude whether the familial characteristic of ADHD is based on genetic or psychological factors or even on both of them (Ellison & Semrud-Clikeman, 2007).

Genetic etiologies have been supported by studies revealing that ADHD is evident in immediate and extended biological relatives of ADHD individuals (Anastasopoulos & Shelton, 2001). Interestingly, it was argued that high incidence of ADHD has been traced for siblings, even higher incidence has been found for twins, with the monozygotic twins having the highest probability of exhibiting ADHD. Research in the field of neurochemistry has also found some chemical imbalances with regard to dopamine, norepinephrine and serotonin (Anastasopoulos & Shelton, 2001). It was suggested that a dopamine transporter gene on chromosome 5, a dopamine D4 receptor gene on chromosome 11 as well as the HLA site on chromosome 6 may be responsible for the disorder (Anastasopoulos & Shelton, 2001). In addition, it was stated that ADHD and its different subtypes may emerge from multiple genes, with the subtypes deriving from different combinations of various genes. Miranda et al. (2013) mentioned that ADHD is a hereditary neurodevelopmental disorder, which manifests itself in childhood and it is attributed among others to “decreased dopaminergic brain functioning” (p.1938).

It may be the case that apart from the aforementioned parameters, prenatal complications influence the manifestation of ADHD. Alcohol abuse or substantial consumption of nicotine from the mother, can interact with genetic factors and lead to an offspring having ADHD. It has also been found that a mother may not have ADHD in her genes but the aforementioned environmental risk factors can affect the child (Anastasopoulos & Shelton, 2001).

A transactional model for ADHD is presented by Ellison and Semrud-Clikeman (2007) where an environmental factor may affect the disorder but not its causes. The neuropsychological dysfunction is attributed mainly to genetic factors and/or temperamental variations. More specifically, it was mentioned that deficits in prefrontal regions in the frontal lobes may be responsible for some of the symptoms in ADHD, since the aforementioned brain regions entail networks with the reticular formation and diencephalic structures.

Moreover, according to Anastasopoulos and Shelton (2001) there is evidence in favor of anatomical differences in brain structure. Coaxial tomographic scans and higher resolution magnetic resonance imaging are usually employed in search for structural differences in

ADHD. Cerebral blood flow (CBF) and positron-emission tomography (PET) have been utilized to examine brain function and have found differentiation in prefrontal brain regions and in networks connecting these regions to the limbic system among others. Moreover, in active states there are findings showing hypoconnectivity in fronto-striato-parieto-cerebellar networks, front-parietal networks and fronto-cerebellar ones. Alternations in fronto-striatal regions in ADHD can justify the cognitive deficits and the loss of inhibition (Gargaro et al., 2011).

Sustained attention tasks involve the following regions: the fronto-parietal circuit, the right dorsolateral prefrontal cortex and the right inferior parietal cortex (Di Martino et al., 2013). Brieber (2007) claimed that middle occipital gyrus and post-central areas of the brain have been found to differ in ADHD and the severity of attention deficits have been linked to reductions of grey matter in the left middle/premotor gyrus. Moreover, in keeping with Di Martino et al. (2013) individuals with ADHD present deficits in the fronto-parietal and fronto-striatal networks and there are also reports for bilateral reductions in prefrontal volume, reduced white matter in the parietal–occipital regions and increased grey matter in the inferior parietal cortices, reduced anatomical volume of the caudate nucleus, putamen and cerebellum. Stoodley (2014) has argued that "the cerebellum mediates attention-related circuity that is relevant to the etiology of ADHD" (p. 11). Moving on, dysfunctions have been traced in the dorsal anterior cingulate, fronto-striatal circuit and prefrontal cortices, with recent research suggesting dysfunctions in the parietal lobe and especially of the right hemisphere (Di Martino et al., 2013).

In ADHD deficits are described in prefrontal brain regions in the frontal lobes, where there are networks with the reticular formation and dienchephalc structures, as it was mentioned before. All these are linked to the regulation of arousal and suppression of responses to irrelevant stimuli. Ellison and Semrud-Clikeman (2007) argued that although this model can explain the differentiation of symptoms across different ages, it cannot sufficiently explain other parameters like the persistence of secondary symptoms in adolescence that can cause many difficulties for individuals of that age.

With regards to social cognition, research has found deficits in certain brain areas linked to complex social cognition. In more detail, Uekermann et al. (2010) referred to study findings that used magnetic resonance imaging in ADHD individuals and have found that areas that interweave with social cognition and are affected are the following: the orbitofrontal cortex, the caudate nucleus, the ventral striatum and the cerebellum (Uekermann et al., 2010).

1.3.3. Diagnosis and comorbidity.

DSM-IV-TR includes 9 characteristics for inattention and 9 characteristics for hyperactivity/impulsivity. In order for a child to be diagnosed with ADHD he/she has to fulfill at least 6 out of the 18 characteristics and the symptoms must be present for at least 6 months and they must have been evident before the age of seven (Westby & Watson, 2013). Depending on the majority of symptoms (inattentiveness, hyperactivity/impulsivity or both), the diagnosis can be predominantly inattentive (ADHD-PI), predominantly hyperactive-impulsive (ADHD-PHI) or combined type (ADHD-C). Accordingly, Anastasopoulos and Shelton (2001) define the disorder as: "a chronic and pervasive condition characterized by developmentally inappropriate levels of inattention, hyperactivity-impulsivity or both" (p. 58). It has also been indicated that ADHD is more often in boys rather than girls and may co-occur with other secondary conditions that may add more burden on the child, something which can affect the psychosocial impairment.

It is worth mentioning that ADHD does not usually exist on its own but is comorbid with other disorders, internalizing and externalizing ones, like oppositional defiant disorder, conduct disorder, anxiety/depression, language learning disabilities and dyslexia. In addition there have been reports for pragmatic deficits in ADHD which are described in DSM-IV like not awaiting for their turn, interrupting others, talking excessively and other. Due to their problem in self-regulation and rule-governed behavior, they face difficulties in their social relations with parents, teachers and peers (Sobanski et al., 2010; Westby & Watson, 2013).

Furthermore, individuals with ADHD have been found to be susceptible to behavioral and emotional problems with anxiety and depression reported by relevant studies (Anastasopoulos & Shelton, 2001; Kim & Kaiser, 2000; Sobanski et al., 2010). However, there is also contradictory evidence by reports that do not find emotional problems among ADHD individuals. Whether or not an individual with ADHD exhibits such difficulties depends on the way he/she will deal with the challenges that are present in each developmental stage. Potential comorbid diagnoses are conduct disorder, defiant-oppositional disorder, anti-social personality disorder, anxiety, major depression, substance abuse (drug and alcohol abuse), fetal alcohol syndrome, language learning difficulties and dyslexia, while it is important that we note the high rates of comorbidity of ADHD in adulthood with psychiatric disorders such as anxiety disorders, mood disorders, substance abuse, and others (Anastasopoulos & Shelton, 2001; Gentschel & McLaughlin, 2000; Miranda et al., 2013; Westby & Watson, 2013). It is worth noting that peer acceptance is crucial for children with

ADHD, since this acceptance/support can act as a buffer against stress as well as psychological and psychiatric problems (Gentschel & McLaughlin, 2000).

Finally, ADHD has been linked to speech and language delays and problems along with mental and behavioral problems (Westby & Watson, 2013). The presence of language problems in ADHD, although not included as a diagnostic criterion, has led to the argument that ADHD is highly comorbid with language impairment (Kin & Kaiser, 2000; Redmond, 2004). Evidence attesting to the reports about comorbid language impairments includes among others the presence of a delay in the onset toddlers with ADHD start talking, although this finding has not been corroborated by all studies (Westby & Watson, 2013). Additional evidence is derived from the observation that children with language disorders have been diagnosed many times with comorbid ADHD. For example, Tirosh and Cohen (1998) cited in Westby and Watson (2013) reported 45% comorbidity between ADHD and language disorders; this finding derived from a study with 3.208 participants aged between 6 and 11 years old.

It needs to be mentioned that ADHD is highly comorbid with ASD. According to Kuijper et al. (2017) both ASD and ADHD are included in the most frequently diagnosed psychiatric disorders in children and while they may have the same picture on the surface but there are qualitative differences and different reasons behind what we actually see (Karogiannaki & Michaletou, 2005). For instance, if a child is impulsive he/she may throw objects away, disrupt the flow of the game or destroy things. That is why children with ADHD may not play with other children during the recess. Children with ASD may also be alone during team games at recess as their interests are usually idiosyncratic and may want to be lonely, whereas children with ADHD are characterized by typical interests of their age. There are of course children who exhibit both disorders and feel safer with routines, they are sensitive with their sensory systems and they have problems in motor coordination. As far as attention is concerned, children with ADHD cannot remain concentrated for a long period of time, something that may change according to motives and the circumstances in each case. Generally however, children with ADHD display a limited attention capacity, whereas children with ASD may show limited concentration when participating in group activities and larger attention span when an activity is related to something they are interested in (Karogiannaki & Michaletou, 2005).

There are similarities in social and cognitive functioning between ASD and ADHD as well as in language (Kuijper et al., 2017). According to Kuijper et al. (2017), DSM-5 includes pragmatic and social difficulties along with language impairments as core criteria for ASD.

On the other hand, although language impairment may not be included in the diagnostic criteria of DSM for ADHD, language problems are included as criteria for the particular condition. In addition, individuals with ADHD may be characterized by deficits in pragmatics, semantics and syntax (Kuijper et al., 2017). In the social field children with ASD avoid social interaction or are withdrawn, they do not share their feelings with other people, they feel great anxiety when being with other people (Syriopoulou-Delli, 2016).

1.4. ADHD and ASD: Neurophysiological deficits and interpretive models

ASD and ADHD bare both similarities and differences. According to Brieber et al. (2007), ASD population bears ADHD characteristics and vice versa. For instance, ASD people exhibit attention deficits, impulsivity or hyperactivity and ADHD people exhibit problems in social skills but to a smaller extent than ASD people. As for executive functions, deficits are encountered in both disorders.

Gargaro et al. (2011) argued the evidence is not consistent regarding neurophysiological evidence in ASD. In structural neuroimaging, despite the contradictions that exist, more regular findings seem to be the reduced brain volume in the right prefrontal cortex, the basal ganglia, the cerebellum and the corpus callosum; alternations have also been traced in the medial temporal lobe and the inferior parietal lobe. Alternations in the last two brain areas have been reported both for ASD and ADHD. Functional neuroimaging techniques have come up with mixed results, since there are findings suggesting functional hyperconnectivity in the default mode network of the brain, while there is also evidence of hypoconnectivity in the particular network. Gargaro et al. (2011) concluded that albeit the differentiation among the findings of research in neuroimaging, there is evidence showing that in both ADHD and ASD, frontostriatal areas of the brain are affected and there is an increase in the size of the brain in ASD as opposed to ADHD, where it seems that the early brain size is decreased. The last parameter that seems to be common between the two disorders is that the functionality of brain networks seems to be affected.

Johnson et al. (2007) also agreed that both ASD and ADHD display alternations in fronto-striatal and fronto-parietal circuses something which is linked to executive function differences in the particular disorders. Deficits in executive functioning have been proposed to exert great influence on language and mathematic skills and, despite the fact that there may

be an improvement as the years pass, the deficit in the executive functioning is significant if ADHD population is compared to the typically developing population (Wu & Gau, 2013).

In a study by Johnson et al. (2007) participated 23 children with ADHD, 21 children with high-functioning autism and 18 typically developing children and the age range was between 8 and 15 years took part. The tool used to assess sustained attention was the Fixed and Random versions of the Sustained Attention to Response Task (Robertson et al., 1997) presented on a laptop computer. The ADHD group showed problems in response inhibition and sustained attention, as well as in the arousal levels. With regards to children with HFA, they seemed to have intact sustained attention but deficient response inhibition.

Another study of Christakou et al (2013) included one group with children with ASD another with children with ADHD and a third control group that included typically developing children. Each group consisted of 20 children and the age range was between 11 and 17 years old. The fMRI task examined sustained attention. The study showed both similarities and differences between ASD and ADHD. As for similarities, both experimental groups displayed hyperactivation in the precuneus. In addition to that, when the load of sustained attention increased, the activation of the precuneus increased, while the opposite was found for the controls. Differences among others included activation in the cerebellum for ASD participants, indicating a dysregulation of a fronto-striato-cerebellar network which is specific to ASD.

Stoodley (2014) carried out an anatomic likelihood estimate meta-analysis (ALE) for whole-brain, voxel-based morphology imaging studies regarding developmental dyslexia, ASD and ADHD in relation to typically developing, age-matched participants. In ASD and ADHD different areas are affected in the cerebrum and the cerebellum and the distinctive cerebro-cerebellar circuits that are influenced in each disorder give rise to a distinctive profile. These findings along with additional evidence from other research reports were taken into account by Stoodley (2014), who ultimately concluded that “the cerebellum mediates attention-related circuitry that is relevant to the etiology of ADHD” (p. 11).

In a study by Brieber et al. (2007) between ASD and ADHD groups there was a common decrease in the volume in the left hippocampus-amygdala complex and increase in the left inferior parietal gyrus/postcentral gyrus. According to Brieber et al. (2007) the parietal cortex is of paramount importance for tasks that relate to attention, suggesting that impairment in the parietal and frontal cortex lead to deficits in an attentional network. For ADHD it was found that there are abnormalities in fronto-striatal regions as opposed to ASD, where alternations were traced in fronto-temporo-limbic regions. Abnormalities in the

hippocampus-amygdala complex and the occipital cortex have been linked to the pathophysiology of ASD along with social cognition. In the same study the alternations in the right supramarginal gyrus that were traced near the temporoparietal conjunction, may be linked to deficits in cognitive functions including mentalising, imitation and Theory of Mind (ToM) (Brieber et al., 2007).

Based on neurophysiological evidence for both ADHD and ASD, it could be suggested that some areas of the brain are affected in both disorders. Accordingly, in order to explain similar symptoms in both conditions, similar neuropsychological theories have been used. Uekerman et al. (2010) indicated the dependence of efficient social interaction on social cognition, the ability namely of people to understand the mind of others. In other words, social cognition stands for the encoding, representation and interpretation of incoming social stimuli, and it includes cues from faces and prosody for the perception of emotions, theory of mind (ToM), empathy and humor processing.

According to Sjöwall, Roth, Lindqvist & Thorell (2013), ToM is defined as the capacity to think logically about other people's mental states. This term also includes the ability to predict as well as understand other people's behavior on the basis of their mental states. Another relevant term that was mentioned is "mentalising" which denotes the process by which mental states are represented. ToM includes an affective element, named empathy, which refers to the ability of a person to be aware of/understand other peoples' emotional states and feelings (Sjöwall et al., 2013). Neurological studies have linked ToM abilities in children with ASD to narrative performance (Siller, Swanson, Serlin & Teachworth, 2014).

In ASD difficulties in social interaction are evident early on, when children do not engage so much in social smiling or vocalizing to the caregiver. The absence or deviance in early signs of social interaction can be linked to deficits in joint attention (Chawarska & Volkmar, 2005; Lord & Spence, 2006). According to Carter et al. (2005), this impairment in early interaction interferes with joint attention which evolves around the 6^{th} or 8^{th} month of life and regards a "preverbal social communicative skill that involves sharing with another person the experience of a third object or event" (p. 319). A characteristic example in Carter et al. (2005) was that a TD infant can show towards a toy he/she finds interesting, look at it and look at the caregiver as well, something that is impoverished in ASD infants.

Except then for problems in recognizing other people's mental states, there are difficulties in executive functions for ASD. According to Gargaro et al. (2011) there is evidence from relevant research that albeit the deficits in ToM, problems in executive functions are more universally apparent and that problems in executive function tasks can

predict problems in ToM. Interestingly, people with ADHD as well, face deficits in executive functions, although there is a differentiation in how those deficits manifest themselves in ASD (stereotypical behaviors) and in ADHD (inattention/hyperactivity). In turn, the difference in the manifestation of executive function deficits in the two disorders can be explained by a differentiation in the deficits of the frontostriatal circuitry. It was noted that tasks aiming at assessing ToM, are affected by executive function processes and low performance may be caused not by mental state understanding but from executive function problems (e.g. shifting of sets).

Theory of Mind and later language ability have been linked to social – communicative behaviors of infants like joint attention behaviors, pretend play and imitation (Charman et al., 2000). ToM has been firmly linked to language development. These three parameters of social behaviors interweave with the deficits traced later in ToM skills of individuals with ASD, which also co-occurs with important difficulties in language pragmatics (Charman et al., 2000). Although it is not easy to determine whether social aspects of infant behavior are precursors of ToM skills and language, it was found by Charman et al. (2000) that particularly joint attention is linked to language and ToM skills.

Neurocognitive functions that relate to joint attention could play then an essential role to social cognition and language development. Simultaneous processing of information that have to do with an individual him-/herself, with other individuals and with objects or events is closely related to a processing network which includes across distal frontal, temporal and parietal cortical systems (Mundy & Jarrold, 2010). As an individual grows older and becomes more experienced, the effort to coordinate attention to all kinds of stimuli becomes more internalized and takes a form of cognitive operations that regard mental attention to common representations. The final outcome is the internalization of joint attention which is the basis of social cognition, symbolic thought, and self-awareness (Mundy & Jarrold, 2010, p. 986).

Joint attention has further been divided into responding joint attention (RJA) and initiating joint attention (IJA), with the first being simply a respond to stimuli and the second displaying an effort of an individual to generate a gesture or a gaze to guide somebody else's attention. IJA to a greater extent and RJA to a lesser extent have been found to be deficient in ASD from preschool (Mundy & Jarrold, 2010). The two types of joint attention also appear to vary according to age and be related to executive function and language development, although research has indicated that IJA is crucial in the difficulties in social and emotional aspects of development in ASD. The particular type of joint attention is linked to parietal and

temporal cortical processes (Mundy & Jarrold, 2010). In these areas deficits have been reported for ASD.

There are various tasks assessing ToM, like false believe tasks that examine the ability of understanding that an individual may have false beliefs, which has been confirmed by findings in relevant studies. Research in ADHD however, suggests that impairments appear in more advanced social cognition abilities. For instance, there is evidence from social problem-solving tasks that suggests problems in encoding and generation of responses compared to typically developing populations. Deficits have also been noticed in social information processing, in tasks with a high demands in inhibitory control as well as in empathy. According to Sjöwall et al. (2013), there is a body of research that has also found difficulties for ADHD children and adolescents in assigning a label to the emotions displayed by protagonists of stories have. They also face challenges when trying to identify their own feelings.

ToM appears to be a challenge for people with ASD, who seem to have particular difficulties in negative expressions. Tye et al. (2013) argued that ASD and ADHD appear to be highly comorbid and apart from the core symptoms, people with ADHD can encounter deficits in emotions as well. There is limited data in this field indicating that recognition of emotions, along with their contextual interpretation and the expressions that accompany them is problematic in general. Research evidence coming from labelling and matching of emotions tasks, suggests that both ASD and ADHD individuals perform similarly, even though other studies have showed poorer performance for people with ASD (Tye et al., 2013).

Processing of emotional stimuli has also been found to be deficient in ADHD, but there is a lot of discussion around the possible roots of those deficits. There are for example indications of sustained attention and inhibitory control problems and it has thus been suggested that inattention, apart from executive functions might as well contribute to deficient emotional processing. An interesting issue raised by Uekermann et al., (2010) involved whether inattention and as such perception deficits are secondary to executive function deficits or not. From a neuropsychological point of view, problems in working-memory, set shifting and inhibition have been linked to dorsolateral prefrontal and medial prefrontal cortex dysfunction, and deficits in affect perception and social cognition have been linked to medial prefrontal cortex.

Tye et al. (2013) carried out a study using an emotional recognition task and argued for differentiation between ASD and ADHD in emotion face processing. As for the

participants with both ASD and ADHD, there were indications of an additive effect. Specifically, it was found that differences shown in N170 amplitude in expressions of fear for the ASD group were related to lower levels of motivation, or else, with avoidance in the case of negative emotional stimuli. With regards to the ADHD group, there was reduced differentiation between happy and neutral faces and between fearful and neutral faces.

According to evidence from the previously mentioned study, Tye et al. (2013) identified temporal, functional and structural elements that differentiated ASD from ADHD and they are indicative of the consequent problems people with ASD and ADHD face during social functioning. Interestingly, the group with comorbid ASD and ADHD seemed to have deficits from both disorders but they also showed some distinct characteristics like different N170 latency and longer N400 latency in comparison to ASD.

Neuroimaging research has consistently linked alternations in fronto-striatal-cerebellar and frontoparietal circuits to ADHD in cognitive tasks but there is not much evidence for face expressions. For ASD, research findings have shown alternations in the activation of regions embedded in social cognition. More specifically, the regions that seem to be affected in the course of facial expression processing are the frontal gyrus, superior temporal gyrus, inferior parietal lobe and fusiform gyrus (Tye et al., 2013).

Gargaro et al. (2011) claimed that the frontostriatal model of Bradshaw (2001) may allow us to understand the executive dysfunction theory, which argues that deficits in frontostriatal circuitry are responsible for ASD and ADHD. Specifically, it was argued that children with ASD and children with ADHD exhibit deficient executive functions, although each disorder is characterized by a unique profile of difficulties (different clinical manifestation of difficulties) in executive functions. Children with ASD have difficulties in ToM, whose precursors are deficits in executive functions. The different symptoms of ASD and ADHD were claimed to result from a differential disruption in the frontostriatal circuit (Gargaro et al., 2011). According to the model of Bradshaw, frontal lobes develop very slowly, resulting in them being vulnerable to neurodevelopmental regions more than other brain regions do (Gargaro et al., 2011). It was suggested that the areas that seem to be particularly susceptible are the frontal lobes, basal ganglia and neurotransmitters that are embedded in the particular regions, leading to cognitive, emotional and motor impairments. It was consequently suggested that ASD is characterized by a primary affective impairment and ADHD is characterized by a primary deficit in attention and inhibition (Gargaro et al., 2011).

In sum, chemical imbalances and structural deficits in the frontal lobes seem to account for cognition, emotions and motor control, which are evident in both ASD and

ADHD (Gargaro et al., 2011). In both conditions, the aspects involved are the limbic/affective aspect, a frontal cognitive one and a striatal/behavioral-inhibition aspect. It is however worth noting that ASD and ADHD differ in the possible combinations that can take place among the aforementioned aspects; ASD and ADHD are different in the kind of motor and cognitive dysfunction they involve and the deficits in the executive functions. Based on the three areas we mentioned before, ASD seems to be deficient primarily in the affective component, while ADHD is characterized by primarily attentional and inhibitory deficits (Gargaro et al., 2011).

In conclusion, theory of mind, central coherence and executive functions are interpretation models that have been utilized in order to explain impairments of ASD individuals (Tsatsanis, 2005). Taking the aforementioned models into account, we observed that these theories adhere to ADHD as well and they can explain many symptoms in ADHD. Although there may be many similarities between the two conditions, we need to be careful while discussing them, because there are also parameters that differentiate ASD and ADHD.

1.5. Language and communication in children with ASD and ADHD

1.5.1. Language and communication in children with ASD.

As it has been previously mentioned, ASD presents problems in reciprocal social interaction along with restrictive/repetitive behaviors as well as interests. According to Banney et al. (2015) both verbal and non-verbal communication is deficient in individuals with ASD. However, since ASD is a spectrum disorder it covers different language profiles, with approximately 20% of the population being nonverbal (Walenski, Tager-Flusberg & Ullman, 2006). Deficits have been reported in the areas of pragmatics, speech acts, non-verbal communicative gestures, conversational discourse, prosody, nonliteral language, grammar, lexicon and phonology (Walenski et al., 2006). Due to all the aforementioned difficulties in structural and pragmatic aspects of language, ASD has been claimed to resemble SLI and pragmatic impairment (PI) as we will see below (Loukusa et al., 2007).

Standardized measures of linguistic evaluation may not be sufficient and may not always give an accurate description of language abilities in ASD (Banney et al., 2015). Additionally, there is a discrepancy among the findings of different studies, something that may partially derive from methodological differences in matching (whether participants have

been matched on chronological age, the general linguistic abilities of children or verbal IQ or how functional children with ASD are) (Banney et al., 2015).

Even in cases where individuals have good language skills, expressive language can be stereotypical/formulaic, because phrases are stored as chunks and there is additionally use of specific grammatical patterns. This has been interpreted as no indication of true generation of language; comprehension then is more impaired in relation to production (Boucher, 2003). Grammatical development appears not to be affected, phonological, morphological and syntactic development seems to be delayed but intact while there are substantial difficulties in functional language use (Diehl et al., 2006). Delays are also reported in articulation and linguistic areas such as vocabulary, syntax, phonology and morphology, although more prevalent are the difficulties in pragmatics (Guerts & Embrechts, 2008; Manolitsi & Botting, 2011). Other features of autism include, tendency to be preoccupied with certain topics, echolalia, speech delay, idiosyncratic speech, difficulties with vocabulary, grammar and comprehension, as well as tone, rate, pitch, use of prosody to disambiguate meaning, characteristics that point to language and communication difficulties along with problems in object permanence and spatial relations (Diehl, Bennetto, Watson, Gunlogson & McDonough, 2008; Ellison & Semrud-Clikeman, 2007; White, Keonig & Scahill, 2006).

On the other hand, there are children with ASD who are nonverbal, using up to 5 words per day, while other children may be competent and use language to participate in a conversation (Rice et al., 2005). Even if children with ASD may be able to take part in a conversation, they find it difficult to use language in an appropriate way based on contextual demands so that the listener understands speaker's intentions and preferences (Philofsky et al., 2007). The first group (nonverbal children) is defined in terms of a deviant language system and the second group (children able to produce language) is described as having a delayed language system (Rice et al., 2005). It is important to note here that variability is not evident only in the quantity but also in the quality of language produced. This variability can be traced in structural language (Manolitsi & Botting, 2011; Whitehouse, Barry & Bishop, 2008). Boucher (2003) described that there are individuals with ASD with sufficient social and language skills, but there are also people who do not speak and in this last case most of the times there is comorbidity with intellectual disability. A number of children with ASD may show a regression - they may produce certain early words, but they may lose this vocabulary and after some time they may gain it back; the outcome is similar to the autistic children who display a delay in the onset of first words (Rice et al., 2005).

From a developmental perspective, Muma and Cloud (2013) mentioned that ASD infants show diminished attempts of babbling in the first year. Children with ASD display delayed language development and some children exhibit echolalia. There is also evidence suggesting stereotypical utterances and deficits in pragmatics (e.g. greetings, topic initiation/ sharing/ development, deictic expressions, types of anaphora etc.) (Muma & Cloud, 2013).

Early language skills and other cognitive skills act as predictors for future linguistic attainments. The severity of autistic symptomatology from 2 to 5 years of life, adaptive behaviors exhibited, certainty of diagnosis and other parameters, have been linked to language skills (Thurm et al., 2007, p. 1721). At age 5 the level of expressive language abilities can act not only as a crucial predictor of eventual functioning, but it can moreover indicate directions for school placements, access to social opportunities, acquisition of academic skills and ease of communication for children with ASD or other developmental delays (Thurm et al., 2007, p. 1722). One of the main indices of ASD is the delayed language early in life. According to Diehl et al. (2006) though, there are better chances for positive outcomes in case language is functional by the age of 5.

A longitudinal study examining the link between initial state and final outcome in children's development was carried out by Thurm et al. (2007) involving 118 children. Data were collected at 2, 3 and between 4 and 5 years of age. The tests administered were developmentally appropriate. Results from both parent reports and children's assessments) showed that cognitive ability was a significant predictor of expressive language and receptive language outcomes at age 5. As for age 3, socialization, but not nonverbal cognitive ability, was a marginally significant factor for children's language competence.

Pragmatic deficits, and more specifically communication deficits, seem to be present in most individuals with ASD (Guerts & Embrechts, 2008; Loukusa et al., 2007; Philofsky et al. 2007). The vast majority of children with ASD have linguistic difficulties and even in high functioning autistic individuals, where most aspects of language develop according to age, semantics and pragmatics exhibit some problems (Guerts & Embrechts, 2008). Pragmatic difficulties are traced in both comprehension and production skills and especially when individuals have to employ information coming from various sources (Loukusa et al., 2007). Children with ASD speak in a literal manner only and they have a stereotypical and repetitive speech (Syriopoulou-Delli, 2016). In more detail, communicative intentions, presupposition, social discourse/discourse management as well as the use of prepositions, connectives and pronouns seem to be deficient in ASD (Guerts & Embrechts, 2008; Syriopoulou-Delli, 2016). Children with ASD are in other words over-literal, they have poor conversation skills and

they face difficulties with inferencing. Pragmatics, apart from the knowledge of social rules and socio-cognitive understanding (e.g. ability to interpret listener's perspective), involve for instance the ability to link coherently language in discourse and narratives (Boucher, 2003; Rice et al., 2005).

Difficulties in pragmatics are related to difficulties in semantics and more specifically in areas like metaphor, irony and word play (Boucher, 2003). Non-literal/allusive language is then an important obstacle for individuals with ASD. Since children with ASD have problems with metaphor, understanding, for instance, a joke is very difficult or nearly impossible for these children (Karogiannaki & Michaletou, 2005). The latter appear to use short phrases and have difficulties with abstract terms, like deictic ones (i.e. terms that change their meaning according to time, place, or speaker, e.g. 'now', 'there', 'I') (Boucher, 2003, p. 5161). Difficulties have also been found in the area of pronouns relative to reflexives and possessives (Perovic, Modvanova & Wexler, 2013). Specific impairments in the acquisition of terms referring to states of mind or emotions have also been noted in some studies. In general, people with ASD face challenges with both linguistic and non-linguistic pragmatic indices (Boucher, 2003).

Regarding to structural aspects of the language, there are many commonalities between ASD and language impairment (Manolitsi & Botting, 2011). In SLI and language impairment (LI) expression is primarily impaired, without excluding problems in receptive language. It has been underlined though that the difference in children's performance may be influenced by the nature of the tests administered to the participants. It is highly important that we mention the distinction between standardized tests and contexts of everyday language use, as it seems that ASD children may be relatively good in standardized measures, while they perform worse in semantics, in pragmatics and in the use of complex morphosyntax in naturalistic setting such as in a spontaneous play paradigm (Manolitsi & Botting, 2011).

Studies have examined morphosyntactic abilities in children with ASD and have found that only those children with additional language impairment resemble children with SLI, as both of these groups tend to have problems with finiteness marking. SLI nevertheless differs from ASD, in that pragmatic deficits in ASD are primary and present in all children. Pragmatic deficits include limitations in speech acts, in conversation and in narration and in the ability to adopt the interlocutor's perspective (Rice et al., 2005).

From a developmental point of view, Guerts and Embrechts (2008) aimed at preschoolers aged between 4 and 7 years old with ASD, SLI and typically developing preschoolers. After comparing the three groups, the results indicated that language problems

for preschoolers with ASD were more profound than the ones for school-aged children with ASD and these deficits were better explained when impulsivity was considered as a covariate. Guerts and Embrechts (2008) argued that language deficits are more profound in preschoolers, while for school-aged children pragmatics seem to be more problematic, with impulsivity affecting language structure and pragmatic skills.

It has also been proposed by Whitehouse et al. (2008) that ASD may be divided into subtypes, with the one of them having core linguistic deficits similarly to SLI. In this study researchers formed two groups of children, with one having 34 children with ASD (7-15 years old) and the other 34 children with SLI (6-14 years old). The group of ASD was further divided into having additional SLI (18 children) and 16 children who had appropriated language skills. Assessment carried, involved for receptive and expressive language, verbal STM, oromotor ability and social communication ability including measures, some of which were given to participants and other to parents.

Participants with SLI and those with ASD and deficient language skills were similar in measures of receptive and expressive language, while participants with SLI performed significantly worse in measures of speech-motor skills and verbal STM in relation to ASD participants with linguistic deficits who performed within the normal range in these measures. In addition, the SLI group made more errors in longer words (four syllables) in non-word-repetition which is considered as a psycholinguistic marker for SLI. Consequently, it was supported that despite some similarities in the nonword repetition task, the two groups are not similar. The difficulties for ASD participants with language impairment in this task could not be explained by problems in planning speech movements because in the oromotor task both groups with ASD performed similarly. Another hypothesis of the study held that nonword repetition difficulties stem from the intensity of the symptoms of ASD. More specifically, it was found that participants facing difficulties in more than one of the three autistic domains were more likely to display structural language difficulties. This finding was assumed to betray only an association between the severity of the symptomatology and in structural language problems but not any causal relationship (Whitehouse et al., 2008).

As far as memory is concerned, most children have very strong memory but even in more functional cases that have speech, information is stored in fragments/episodes without linking all episodes in order to form a coherent whole and understand the world. Children with ASD may be able to solve a problem but they find it extremely difficult to transfer their knowledge to other contexts (Syriopoulou-Delli, 2016). Sensory and motor difficulties may also be evident in some children with ASD and make the situation more difficult. However, it

has been previously mentioned that the way various difficulties interweave with each other give rise to the wide range of children's strengths and weaknesses we witness in ASD.

1.5.2. Language and communication in children with ADHD.

In ADHD linguistic difficulties are not part of the diagnostic criteria (Bellani, Moretti, Perlini & Brambilla, 2011; Guerts & Embrechts, 2008). In addition, there is no evidence of major language delays in ADHD (Westby & Watson, 2013). Nevertheless, ADHD is highly comorbid with communication disorders and especially with pragmatic and expressive disorders as well as discourse organization deficits (Kim & Kaiser, 2000; Westby & Watson, 2013). In general, it has been claimed that expressive language skills are more deficient than receptive language skills (Kim & Kaiser, 2000).

One particular skill that seems to be challenging for people with ADHD is writing, since it involves different executive skills like planning, organization and monitoring (Bellani, Moretti, Perlini & Brambilla, 2011; Guerts & Embrechts, 2008). Research evidence has suggested that children with ADHD are characterized in writing by an increased number of grammatical and spelling errors, limitations in vocabulary, smaller number of sentences, subordinate clauses and functional words (Bellani et al., 2011; Guerts & Embrechts, 2008). Additional aspects that seem to be affected are coherence, pragmatics and other features of the socio-emotional domain (Miranda et al., 2013). Consequently, deficits noted concern higher-order language skills. Difficulties in this particular area have been related to deficits in executive functions (Westby & Watson, 2013).

Children with ADHD display poor performance in school, dysfunction in social skills and delinquent behaviors (Wu & Gau, 2013). For preschoolers with ADHD, Guerts and Embrechts (2008) mention that deficits in pragmatics are the most dominant, with further problems being encountered in the form, content and use of language. It has also been supported that the type of linguistic problems is linked to the manifestation of various difficulties later in life. Difficulties in expressive language are linked to deficits in attention - while the combination of both expressive and receptive language difficulties lead to social problems (Guerts & Embrechts, 2008). In fact, problems in pragmatics during social interaction include more stereotyped conversations, conversational rapport problems and problems in social relationships, as they display inappropriate and impulsive behaviors (Bellani et al., 2011; Guerts and Embrechts, 2008).

Moreover, language problems in ADHD are evident in articulation, language-processing, pragmatics, narratives, comprehension, verbal short-term memory, spelling and punctuation and there are also problems with the connection of different pieces of information (Bellani et al., 2011). Other signs of language impairment may be delay in the onset of first words and word combinations, low achievement in standardized tests about vocabulary, syntax, fluency in reading and short-term memory and in narrative production (Redmond, 2004).

In the family context during different tasks and the conversation between children and parents joint attention is of great necessity (as ADHD manifests itself in everyday life and affects language use) (Väisänen et al., 2014). Children with ADHD have been found to have problems in conversational skills and in retaining the topic of conversation. Additional difficulties include increased mazes (false starts, repetitions, revisions etc), avoidance of eye contact, excessive talk and other. This example suggests that one possible explanation for the cause of language problems in ADHD is that attention limitations in ADHD interfere with the need for joint attention in various aspects of everyday life (Väisänen et al., 2014). On the other hand, Väisänen et al. (2014) pointed out that there is not agreement in the relation between ADHD and language and the direction of the influence.

According to Redmond (2004), who tried to delve into the etiology of linguistic deficits in ADHD, language, attention and cognitive abilities seem to be closely related from an early stage in human development. Evidence in favor of this argument derives from research findings which have shown attention and motor problems among others in children with language impairment (Tallal, Dukette & Curtiss, 1989 in Redmond, 2004). Since both cognitive and language problems are common features of children with either ADHD or LI, it is interesting to examine the comorbid condition (Cohen et al., 2000). Although there are indications such as the low performance in working memory task. However, there is a variance in the achievement of both ADHD and LI and it seems that bigger problems are present when both conditions arise in an individual (Cohen et al., 2000). It was moreover claimed that language deficits of children with ADHD are in fact a consequence of inattention, impulsivity and hyperactivity. A third possibility is that developmental disorders as ASD, SLI and ADHD which are accompanied by linguistic limitations, "might represent a continuum of 'defective time parcing mechanisms" (Redmond, 2004, p. 109). With the aid of these mechanisms, segmentation and analysis of both linguistic and non-linguistic information are divided and analyzed successfully.

Research regarding linguistic skills in children with ADHD has examined the particular group in relation to both ASD and SLI, due to common characteristics among the three disorders in the linguistic performance. Guerts and Embrechts (2008) in order to examine the linguistic profile of preschoolers and school-age children with ASD and ADHD used a questionnaire (CCC-2) administered to parents and examines language structure skills and pragmatic skills. CCC-2 includes 70 items divided equally in 10 scales which are speech, syntax, semantics, coherence, inappropriate initiation, stereotyped language, use of context, nonverbal communication, social relationships and interests. The results for the participants of 7-14 years old suggest that children with ASD have a different profile than preschoolers. For the latter group problems were traced both in pragmatics and in structural language, such as syntax. In more detail, both ASD and ADHD groups showed problems in the scale regarding context, inappropriate initiation and interests differed from the typically developing children. The ASD group differed moreover from the ADHD group, in that the former had more difficulties in the scales concerning nonverbal communication. In the scale about stereotyped language the ASD group had more problems than the typically developing children.

In another study, Väisänen et al. (2014) administered CCC-2 to 38 families of children aged between 5 and 12 years old and children were divided equally in ADHD and typically developing children. Result showed significant difficulties for children with ADHD in all subscales: speech, syntax, semantics, coherence, inappropriate initiation, stereotyped language and others. Children with ADHD appeared to face many pragmatic limitations such as inappropriate initiation, repetitive talk about their interests, no attention to conversational overtures, not look at the interlocutor and there were also cases where parents of children with ADHD reported that their children repeated answers or took things too literally. Authors argued that deficits in executive functions (which refer to planning and monitoring somebody's behavior), lead to pragmatic deficits. Another possibility considered in the study was that children with ADHD may have complex difficulties leading to the possibility of having more than one diagnosis. It is also probable that ASD, ADHD and other disorders lie on a continuum and are not distinct. So, it was concluded that study children may not have been diagnosed with ASD but they may have had many autistic traits due to the comorbidity of the two developmental disorders.

Finally, Redmond et al. (2015) examined 3 groups of children with 19 children each group, aged from 7 to 9.9 years of age. The participants were divided in the following groups: SLI, ADHD+LI and typically developing children. The measures used were: a nonword

repetition task, a sentence recall task and tense probes for tense marking. The results indicated that the severity of the symptoms of ADHD did not act additively to the LI, but rather had little impact on the results. Moreover, the group with ADHD had similar performance to the SLI group. It was argued that ADHD could have acted as a subtractive/protective factor, since children whose parents reported more intense behavioral problems had better results in the language measures in comparison with children with ADHD who had been reported with fewer symptoms.

2. Narrative skills in children

2.1. Development of narrative skills in children

The development of narrative skills starts early in life, from birth, when children begin to participate in interactions with older language users (Stadler & Ward, 2005). "Narrative stories surround children from their earliest language experiences" (Paris & Paris, 2003, p. 39). Conversation with other users offers children valuable information about different aspects of language like structure, meaning and use of the language.

Parents and other caregivers narrate experiences regarding family members and they later use illustrated storybooks for joint reading, something that aids the development of narrative skills in children. Furthermore, caregivers usually ask children questions providing scaffolding for narratives (Gormann, Fiestas, Peña & Clark, 2011; Paris & Paris, 2003). Chang (2004) and Rathmann, Mann & Morgan (2007) mentioned that caregivers offer help to children in relation to both the content and the structure of their narratives.

In the beginning, children's narratives are short, simple and fragmented. According to Paris and Paris (2003), a rich repertoire of knowledge about narratives starts to develop from the age of 2 or 3. This was believed to derive from young children's need to cater for their well-being, to narrate for example their needs, their desires and their frustration and also to respond to other speakers. In other words, there is a goal-directed knowledge from this early age (Paris & Paris, 2003).

Storytelling starts in the form of retelling personal experience and so narratives begin when children play, when children retell stories and finally they create their own fictional stories. Chang (2004) in turn, argued that children from the age of 2 start narrating stories of personal experience and fictional stories before entering school. Rathmann et al. (2007) agreed that at age 2 narratives of personal experience emerge. According to Stadler and Ward (2005) storytelling emerges at the age of 3 or 4 and it plays a vital role in language development, in the transition to literacy and in later academic success. Narratives by the age of 3 or 4 start to include structural element of narratives such as setting, complications and outcomes (Rathmann et al., 2007). For English-speaking children, it was mentioned that the variable "and then" as well as the variable of coherence and the variable of cohesion are problematic, as there is not a link among events that is temporal. Instead, it was claimed that children mention what is interesting for them. Considering narratives as a system of networks based on goals, attempts to reach a goal and outcomes, children at the age of 3 or 4 are not able to identify such relations but name what they see in pictures (Renz et al, 2003).

Children between 4 and 8 years old improve their ability to integrate meaning among pictures progressively (Paris & Paris, 2003). Improvement is also noted in children's ability to make sense of the picture sequences in a more flexible manner. Children also become steadily more competent in making inferences about pictures. More specifically, at about the age of 5 children are able to represent events from the angle of Goal-Attempt-Outcome units and show a steadily decreasing inclusion of events that are not part of these networks and stories become more and more coherent as children base their narration on goals (Renz et al., 2003). Paris and Paris (2003) noticed that from preschool years until they finish elementary school, children manage to identify both explicit and implicit relations in the picture stories and are able to integrate the meaning that derives from the pictures.

Rathmann et al. (2007) mentioned that children between 5 and 7 years old display indications that they can understand basic emotions and intentions and include information about the time, place and the heroes of the story. Preschoolers can link events in linear order and at about 5 years old children start using complex syntax in order to build temporal and causal connections (Capps, Losh & Thurber, 2000). Additional elements that characterize children's narratives at that stage are goal, logical progression, sub-plots and understanding of time frames (Rathmann et al., 2007). Preschoolers were also claimed to acquire understandings of the mental states of the characters of the story (Paris & Paris, 2003). Young children acquire thinking skills that are embedded in narratives like "perspective taking" and other skills that help children understand what features are external or internal to the stories (Paris & Paris, 2003).

Then, at age 8 to 10 children's narratives have reached a higher level, where they use correctly most structural elements and they show they understand how to tell a story to another listener. Moreover, they indicate understanding of more difficult emotions like jealousy but they still have some problems with reference to events and characters (anaphora). After the age of 9 or 10, children's narratives are more complex, they include more details and they are more coherent, reaching an adult-like form (Manolitsi & Botting, 2011; Renz et al., 2003). Children try to capture listener's attention, differentiate their narration according to the audience and they use a range of different linking words/phrases like "so", "and", "when" (Rathmann et al., 2007). All in all, it could be argued that children in elementary school are capable of constructing a narrative with a beginning, a middle and an end. As time passes, people tend not to be concerned with the details and the exact replication of the story, but they rather use the gist (Diehl et al., 2006).

Even though narratives have universal attributes, Gormann et al. (2011) underlined the differences in storytelling across cultures in terms of content, structural organization, and functions. Content is a term used for the goals, themes and ideas expressed in a narrative and is acquired by the child through social interaction and repeated experiences. Children also learn how to combine their knowledge in socially accepted ways. As a result, content is affected by culture due to the fact that children learn ideas and perspectives that are important for each culture through narratives. For example, Gormann et al. (2011) found that narratives of Chinese children have more themes related to social engagement, morals and authority in comparison to American children.

The second parameter that may be affected by the culture is structural organization. This concerns the flow, construction and elements of macrostructure in narratives and is often influenced by culture and context as well. Gormann et al. (2011) found children to be less restrained when narrate their personal experiences in relation to fictional narratives which have a certain topic and should include certain structural elements. Moreover, research has shown that Central American mothers tended to give more emphasis on providing their preschool children with scaffolding during personal narratives facilitating conversation. European American mothers on the other hand, were found to encourage accurate sequential organization in their children's personal narratives.

Function is the third parameter of narratives influenced by culture and it refers to the purpose of the narrative as narratives could serve as text or as performance. Accordingly, emphasis is given on the coherence and order of the narrative text or on making the narrative engaging for the listener. Gormann et al. (2011) indicated that both these elements are not found in one narrative but they are interrelated up to a certain degree. Nichol (1989), as cited in Gorman et al. (2011), had found for instance, that upper elementary African American children exhibited more elements of narrative as performance, since they included quotations of the characters of the story and an important interactional component between the listener and the narrator. Despite the fact that narratives differ across cultures, we should bear in mind that they differ according to the genre too (personal versus fictional narratives).

2.2. Importance of narratives in the diagnosis of Developmental Disorders

Narrative cognition has been argued to be a vital means through which people come to understand the world (O'Neil, Pearce & Pick, 2004). More specifically, people assign meaning to experience and relationships through narratives and make individual events a coherent whole, as the narrator views events from his/her perspective and puts the events in a

temporal sequence (Caps et al., 2000; Losh & Capps, 2003). In other words, narratives are a means of extracting valuable information about various aspects of cognitive functioning (Lorch et al., 1999).

> These aspects include the strategic allocation of attention; the selection, encoding, and interpretation of important information; the use of story structure; the retrieval of relevant background information; the generation of inferences that allow interpretation of the presented information; the monitoring of comprehension; and the use of retrieval skills. (Lorch et al., 1999, p. 273)

From very early (third/fourth year) in children's life we can notice the emergence of storytelling, a form of language that is important for oral language development, but also for the transition to literacy and for the prediction of later academic achievements (Botting, 2002; Diehl et al., 2006; Heilmann et al., 2010; Stadler & Ward, 2005). Narrative skills have been linked not only to reading competence but also to mathematic skills (O'Neil, Pearce & Pick, 2004). Furthermore, it has been supported that narratives influence conceptual development, grammar and vocabulary skills, as well as macro-structural skills. Deficient macro-structural skills may impact discourse-level skills as the ability to produce coherent discourse that is also age- appropriate (Heilmann et al., 2010; Stadler & Ward, 2005). It is even more important that the ability to comprehend and produce narratives is linked to positive social communication (Diehl et al., 2006).

Stadler and Ward (2005) examined the role of narratives in the development of oral language in children, since narratives call for more sophisticated language in relation to everyday communication. With regards to the skills required to produce a sufficient narrative, the storyteller needs to bear in mind that the listener does not have the necessary knowledge about the event being described. As a result, the narrator needs to employ explicit vocabulary, use effectively the pronouns and use efficiently temporal connectives. Last but not least, narratives are beneficial for young children since they aid children develop their language abilities before they undertake reading. (Stadler & Ward, 2005).

It is worth noting that production of stories is tightly knit to comprehension. Unless children understand potential relations among the characters of a story, identify causal and goal relations, story coherence will be negatively affected (Renz et al., 2003). Narratives are employed to assess pragmatic abilities and they allow us to delve into language comprehension and production that exceeds the level of the sentence (Diehl et al., 2006).

> According to Diehl et al. (2006), "[t]he process of retelling a story involves understanding the story, holding the story in memory, and constructing the retelling in

> a manner that is understandable by the listener. […] In general, people use the largest, most general frame to organize their narrative, and put stories into schemas with settings, plots, and episodes" (p. 88).

In narratives, it is of great importance to be able to establish thoughts and emotions within a greater framework of causality (Capps et al., 2000). A skilled narrator can establish temporal and causal links among the events (Losh & Capps, 2003). In order to do so, it is important for the narrator to have the ability to recognize and attribute emotions, thoughts, actions and intentions and explain them in accordance with the normative expectations (Losh & Capps, 2003). The interest revolves around the causes and consequences of different psychological states and actions (Capps et al., 2000). Complex syntax and morphology could prove an important tool while trying to establish temporal and causal relations in a narrative (Capps et al., 2000; Losh & Capps, 2003). What we need to bear in mind is that narratives can be analyzed in order to serve multiple purposes. According to Manolitsi and Botting (2011), narratives can be analyzed from two different angles: the first concerns macro-structure and refers to coherent structure of the story (story grammar/story structure) and the second angle refers to micro-structure that involves structural analysis at the sentence level.

Both levels of analysis offer the researchers crucial information. The first level of analysis is macrostructure and delves into higher-order hierarchical organization of the narrative (Miranda et al., 2013). Macrostructure interweaves with the aspects examined in story grammar and is concerned with the complexity of the structure in each episode. The second level of narrative analysis is microstructure and is linked to lower-level aspects of the narrative, to internal linguistic structures namely, like grammatical units and lexical diversity. Total number of words, the number of different words and the type-token ratio corrected are indicators used often for the evaluation of microstructure (Miranda et al., 2013). The third component is calculated by finding the total number of content words (tokens) and dividing them into the number of different content words (types). According to Miranda et al. (2013) content words are those who have lexical meaning such as main verbs, nouns, adjectives and adverbs.

Narratives have been presented by Banney et al. (2015) also as a useful means of extracting information about the linguistic abilities of people with ASD. There is a lot of discussion concerning standardized tests, as a number of researchers claim that standardized tests may not be sensitive enough to trace the linguistic difficulties in the case of people with ASD. Narratives can be examined both at a macro-level and a micro-level, with the latter regarding words, sentences etc. (Banney et al., 2015). Findings using narratives as a source of

assessment however, are conflicting, with part of the research indicating reduced syntactic complexity and decreased use of evaluative devices in ASD individuals. On the other hand, other research has reported no differences in the previous domains between ASD individuals and typically developing population. Evaluative devices are linked to the use of internal state language and show how the narrator interprets various events, while the type of narrative task can have an impact on the results of the study. For example, Novogrodsky (2013), as cited in Banney et al. (2015), examined pronominal referencing in individuals with ASD and found difficulties in the story generation task, while in story re-tell no problems were reported. Difficulties in linking events with causal relations have also been reported to be problematic in ASD.

Conversational samples are also proposed as a particularly important source of information about language disorders in children. This kind of samples shows the ability of children to use various language forms and in various functional contexts (Redmond, 2004). Redmond (2004) argued that conversational-based measures can prove very helpful, since they allow researchers to assess multiple levels of linguistic proficiency. Speaking rate, utterance formulation, lexical diversity, mean length of utterance (MLU), as well as morphosyntax, are all examples of conversational sample areas that are examined by researchers for differentiating various impairments and in order to aid differential diagnosis.

Another important asset of conversational indices of language impairment is the higher ecological validity in relation to other standardized tests. This is because through conversational sample analysis we can access and evaluate areas that respond better to typologies that are generated by clinicians and those areas are: delayed language development, deficits in word-finding, utterance formulation and rate of message-transference problems (Redmond, 2004, p. 111). Via these narratives somebody can observe the narrative difficulties that contribute to the social-communicative deficits observed in ASD (Losh & Capps, 2003).

Narratives are part of expressive language skills but they also provide a window to the overall communication skills of children (Botting, 2002; Capps et al., 2000). Narratives can unravel subtle differences among children, something that standardized tests cannot achieve since they are not as sensitive tools (Manolitsi & Botting, 2011). Another advantage of narratives is the fact that can be used when normative data are not available and in cases where standardized tests cannot could not have been administered. Narratives are also of particular value in research due to the fact that they enable researchers to delve not only into linguistic but also cognitive and social aspects of human development (Capps et al., 2000).

Narratives are valid means of evaluation and can be used to access children that show atypical development. For the cases where similar communication profiles are evident, narratives can clarify qualitative differences that distinguish different disorders (Botting, 2002; Capps et al., 2000). It has been shown that this type of assessment can be of particular use especially in ASD, where there are various social-communicative deficits (Capps et al., 2000). More specifically, the diagnosis of high functioning autism can be assisted via narratives, as the latter call for pragmatic skills and the understanding of mental states in order to interpret human behavior (Capps et al., 2000).

Finally, parental questionnaires have also been used in order to extract information regarding the communicative competence of younger children. Kuijer et al. (2017) reported that the questionnaires are not as informative as narratives, as the latter is a direct measure of communicative abilities. Providing additional advantages such as the documentation of structural components (lexical diversity, syntactic complexity), the length of the sentences along with more pragmatic areas like the way sentences are linked and referential components (Kuijper et al., 2017, p. 64).

2.3. Narrative assessment

According to Paris and Paris (2003) pictorial stories is the most dominant type of narrative assessment due to being familiar to children and pleasing to their eyes. These picture books constitute a bridge to the next stage which has text along with illustrations and they are also something children encounter at home. Most of the times, caregivers use at some point books with pictures to narrate stories to children and later schools also employ picture books. Paris and Paris (2003) underlined the fact that pictorial narratives are challenging since they require integration of information, inferential skills, knowledge about the main elements of the story as well as understanding of both temporal and causal sequences (p.40). Storybook narratives rather than narratives of personal experience (they mirror everyday experience) appear to be highly structured (Losh & Capps, 2003).

Capps et al. (2000) citing Loveland et al. (1990), argued that narrative skills can be effectively assessed through tasks involving asking children to narrate a puppet show or a video sketch they have seen. A frequently used tool for narrative assessment is *Frog, Where Are You* (Mayer, 1969), a wordless picture book (Tager-Flusberg, 1995 in Caps et al., 2000).

Tager-Flusberg and Sullivan (1995), as reported in Capps et al. (2000) used the picture book *Frog on His Own* (Mayer, 1973) to examine use of causal attributions, mental state language and theory of mind by utilizing questions regarding characters' emotions after the narration.

Manolitsi and Botting (2011) used the 11-page colored storybook *Peter and the cat* (Leitao and Allan, 2003). The researchers did not take away the book during the phase of retelling. They assessed macro-skills and they coded story structure/story grammar (level of structure) and story content (appropriate content) assigning scores ranging among 0, 1, 2 and 3. As far as micro-skills are concerned, they employed assessment of linguistic devices (semantics and syntax) scoring them from 0 till 3 depending on competence in the use of the devices.

According to Diehl et al. (2006) if the storybook is in front of the participant while he/she retells the story, there is a decrease in the cognitive demands of the task and this in turn leads to the production of longer and more complex narratives. On the other hand, there is the possibility of heaving the child to listen to the story and at the same time look at the storybook; if you take away the storybook during the next phase of narration, the task increases in difficulty both in the sense of recalling and reproducing the story. According to Diehl et al. (2006), the second choice is better in the sense that increasing the difficulty of the task may unravel underlying deficits in memory and organization.

Moonsamy, Jordaan and Greenop (2009) in order to assess narrative skills of children with ADHD, used a structured narrative task with a picture sequence, where children generated a story by using picture sequence cards taken from the "Papa Moll" picture stories (Schubi Lehrmittel, 1988). Interestingly, researchers used a story before the two narrative tasks in order to reduce anxiety, a strategy that has been found to improve the performance of participating children. The narratives were evaluated on the basis of cohesion and coherence, following Fey's (2001) framework; macrostructure/coherence features included: setting (0-3), characters (0-3), Plot (0-6), Ending (0-3), assigning a total score of 15. Micro-structure features assessed were: Reference (0-6), Conjunctions (0-4), Ellipsis (0-1), Substitution (0-1), Adverbs (0-3) (Total score =15). For successful use of cohesive devices, someone needs to be able to use his/her knowledge either in grammar or vocabulary, or it is also possible that some cohesive devices like conjunction call for the use of both grammar and lexical knowledge. In order to measure cognitive processing, and more specifically, planning, attention, simultaneous processing and successive processing the Cognitive assessment System (CAS) (Naglieri & Das, 1997) is also used.

Finally, Diehl et al. (2006) in order to elicit and assess narratives used the Strong Narrative Assessment Procedure (SNAP; Strong, 1998). They used an audiotaped verbal version of *Frog, Where Are You?* (Mayer, 1969) and children were asked to listen to the story while they looked at the pictures of the wordless book. The participants left the room for a few minutes and when they returned, they narrated the story without having the book in front of them. After they finished their narration, examiners asked children questions, factual and inferential, parameters asessed with SNAP were story length, syntactic complexity, referential cohesion and finally story grammar. The system that was used for the coding in the transcription was Child Language Data Exchange System (CHILDES; MacWhinney, 2000).

Data analyses included researchers identifying causal connections (causal relationship between two events) and causal chains (the term refers to the sequence of events that form the gist of the story and not peripheral events) for both the story and the narrative produced by participants. The researchers also examined certain elements (e.g. characters and objects) that participants recalled and the intrusions, namely references that were not included in the initial story children heard. Coherence of the narrative children told, was assessed by calculating the number of causal connections divided by the number of c-units (communication units: Verb + Arguments) (Diehl et al., 2006).

The aforementioned studies examined elements of macro-structure, of micro-structures or even both categories. It is plausible then to examine narratives based on two main axes: coherence (macro-structure) and cohesion (micro-structure) which continue to develop throughout children's development (Hickman, 2004). It has been argued that the examination of either the one or the other facet of narrative organization is not recommended. Both levels of analysis interweave with each other throughout development and the examination of one of the two levels offers an incomplete picture of the development of children's narratives.

There two main ways to encode coherence: *scripts* and *story grammars* (Hickman, 2004). Scripts were defined as a form of higher-order organized knowledge that refer to certain sequences of actions which unfold in certain spatial and temporal context (Loth et al., 2008). Scripts involve certain goals and subgoals like "dining at a restaurant" and there are different levels of abstraction regarding scripts (Loth, Gómez & Happé et al., 2008). Narrative scripts are the first, primitive constructions of story schemas that concern knowledge structures regarding events and sequences that are familiar to children such as birthday parties (Paris & Paris, 2003). Narrative scripts become narrative schemas later on;

the latter hold information about main events of the stories along with temporal and causal sequencing of events (Paris & Paris, 2003).

On the other hand, it appears that a more frequently cited account is that of story grammars, according to which a narrative is constituted by a *setting,* a *complication,* a *resolution,* and an *evaluation* (attitude of the narrator towards the story). However, Hickman (2004) noted the existence of other elements proposed in the broader framework of story grammars, and those elements constitute additional fine distinctions that are based on the elements described before. For instance, *Setting* is followed by an *Episode.* An episode is comprised by an *Initiating Event* which triggers an *Internal Response.* Then there is also an *Attempt*on the part of the protagonist to achieve a goal which then leads to some *Consequence* resulting in a *Reaction* on the part of the protagonist (Hickman, 2004). Other accounts have used the following elements: *Setting, Beginning, Reaction, Attempt, Outcome, Ending* (Hickman, 2004).

2.4. Narrative skills in children with ASD and ADHD

Although research regarding narrative skills in ASD has found common characteristics among children with ASD, there are also indications about differentiation of narrative skills in the particular group (Norbury & Bishop, 2003). It has been suggested that individuals with ASD face challenges at nearly all levels of narrative skills. Global skills, like organization and coherence, appear to be more deficient in ASD in comparison to local skills (Diehl et al., 2006; Norbury & Bishop, 2003).

Kuijper et al. (2017) claimed that generally there are not wide differences in the performance of ASD and typically developing children as far as verbal productivity and syntactic complexity are concerned. However, research findings suggest that syntactic complexity is affected in children with ASD (Kuijper et al., 2017). Losh and Capps (2003) also did not find major differences between TD children and children with ASD, as both groups of participants produced stories of comparable length and displayed a tendency of producing longer stories in personal narratives. Furthermore, children with ASD produced a narrower range of complex syntactic structures in their narratives in comparison with typically developing children.

Capps et al. (2000) found that length of the narratives was significantly different among children with ASD, children with developmental disorders and typically developing children. The typical population performed higher, followed by the participants with autism. The participants with developmental delays produced also the shortest narratives. Although children with autism and developmental delays exhibited more morphological errors, the difference among the three groups was not significant. It was nevertheless found that significant difference existed in the proportion of complex syntax with the typically developing children exceeding children with developmental delays and autism (Capps et al., 2000).

In the study of Banney et al. (2015) difficulties were found in the ASD group in the domains of episodic structure, syntactic complexity and pronoun ambiguity. In more detail, the narratives of children with ASD were syntactically less complex, episodic structure was also poorer and there were more problems with pronominal referencing, with more ambiguities (more agreement problems especially) in comparison to typically developing children. Except for the differences between the two groups, there was a similar performance in the use of evaluative comments. Both groups performed relatively low in the specific area. All these difficulties are according to Banney et al. (2015) part of the overall difficulty of individuals with ASD in the area of pragmatics.

Diehl et al. (2006) has also argued that children with ASD encounter difficulties when they have to represent and recall the gist of the stories, as they cannot put the events they narrate in a meaningful order and they appear to simply describe and not narrate the story. Additional deficits described to characterize the narration of ASD children include incomplete episodes and deficits in establishing coherence. Verbal short-term memory appears rather intact, with impairments being observed in conceptual and inferential processing. Good memory skills may be linked according to Diehl et al. (2006) with the fact that children with ASD appear to perform similarly to the TD children in the number of episodes that are recalled. What is more, good memory skills may be related to the difficulty ASD children have to make inferences and more generally construct coherent narratives.

Nevertheless, research findings are mixed, with a part of studies suggesting performance similar to TD peers and another part suggesting important deficits in children's with ASD narratives. As for deficits in coherence, children with ASD have been shown to include fewer causal connections something that impacted on the overall coherence of the narratives. Research about narratives has found that children with ASD encounter difficulties in causal relations, in the organization of their narratives and referencing (Miranda et al.,

2013). A cognitive deficit in central coherence in ASD has been linked to difficulties in global structure, since children with ASD tend to fail extracting context-dependent meaning and their narrative may appear more like a description of pictures rather than a combination of events (Norbury & Bishop, 2003). For example, Capps et al. (2000) found that children with ASD produce narratives that are less complex in relation to story grammar and they also produce shorter stories without resolution, with ambiguous reference to new characters and absence of causal relations in the stories (Capps et al., 2000).

The pattern that children with ASD followed in Diehl et al. (2006) was that they had more c-units (communication-units consist of a verb and its arguments) that had connections to or from other c-units. Typically developing children on the other hand had more c-units that had three or more connections from or to other c-units. This is linked to the remark of Diehl et al. (2006) who noted the fact that the narratives of children with ASD appear as more discrete events rather than a structured narrative. The recall of the gist correlated with the connectedness of the narrative in typically developing children but not in ASD, indicating a basic understanding of the story but lack of the ability to go deeper and link the story with inferences (Diehl et al., 2006).

Diehl et al. (2006) found marginally smaller number of c-units for children with ASD but similar performance with typically developing children in the syntactic complexity measure and no significant group differences with regards to subordinate clauses per c-unit. An interesting finding was that both groups of participants showed similar sensitivity in the causal importance of story events and they tended to recall events that had more causal connections (Diehl et al., 2006). Similar performance between the two groups was also found for causal chain, meaning that there was a tendency for both groups of recalling main events rather than details. No significant difference was found for the elements that were recalled and the number of intrusion, with the exception of inappropriate storytelling, the only type of intrusion that was significant.

The ability to establish relations among elements of the story may be related to deficits in ToM as well. Narrative skill deficits for children with ASD include difficulties in considering the listener's perspective, predicting and explaining characters' behaviors and difficulties in understanding the function of narrative activity itself (Capps et al., 2000; Norbury & Bishop, 2003). Regarding mental states, people with ASD face substantial difficulties in incorporating mental state verbs in their narration and they cannot efficiently establish an order in narration that takes into consideration the intention of the speaker. This

suggests difficulties in manipulating psychological concepts to establish causal links among the elements of the story (Capps et al., 2000).

As for evaluation terms, typically developing children in Capps et al. (2000) referred to characters' emotions and established causal relations, while children with developmental delays simply referred to characters' emotion and children with autism offered most of the times a basic description of the events. It is important here to mention that ToM includes the aforementioned elements that regard motions and thoughts of the characters, but it additionally regards the use of devices in order to maintain listener's interest and involvement, where children with ASD display deficits (Siller et al., 2014). Typically developing children in Capps et al. (2000) included emphatics, repetition, character speech and sound effects, attention-getters, whereas the other two groups did not use such elevated devices. Measures of ToM in Capps et al. (2000) showed positive correlations with mental state language in autism but negative correlations with references to the affective states of the characters. In conclusion, although the proportion of evaluation terms were not substantial, typically developing children used a broader range of those devices, and children with autism tended to simply label emotional and cognitive state and they had perspective where events were less integrated (Capps et al., 2000).

On the other hand, there is evidence indicating no differences in mental state language and causal statements among children with ASD, children with intellectual disability (but without ASD) and typically developing children (Tager-Flusberg & Sullivan, 1995, as cited in Capps et al., 2000). Even in that case though, children with ASD have been found to face more difficulties in characters' emotions and causal explanations in relation to controls.

Another distinction regards performance in relation to storybooks and personal narratives. Losh and Capps (2003) found that children with ASD employed on the one hand comparable range of evaluative devices in the storybooks, although they used a narrower range of evaluative devices in the personal narratives in relation to typically developing children.

Children with ASD appear not to be able to identify apart from the actual ToM states, the causes of the characters' thoughts and actions as well. Nevertheless, Caps et al. (2000) and Siller et al. (2014) mentioned that there are studies (Tager-Flusberg, 1995) that have found no difference in the use of mental state verbs among autistic children and typically developing children. There is difference also between emotion and cognitive terms when we refer to ToM. For instance, Siller et al. (2014) found that as for emotional terms, after controlling for narrative volume, children with ASD included fewer emotional terms, while

for cognitive terms no significant difference was found between TD children and children with ASD.

There was also an inclination of children with ASD to use less causal explanations than the comparison group. This deficit in using causal language in the narratives may be linked to a broader problem in causal understanding which may affect according to Losh and Capps (2003) communicative and cognitive functioning. As far as the structure of the stories is concerned, children with ASD showed a significant preference towards computers and they produced significantly less stories about sports. Clarification and elaboration prompts were more frequent for children with ASD and they included more irrelevant information in their personal narratives than they did in the storybook. In relation to ToM tasks, it was noted that the ASD group showed more problematic responses in labeling emotions and in defining emotions (Losh & Capps, 2003).

Apart for including the necessary information in narratives, another important issue is the inclusion of additional irrelevant information in a narrative. Manolitsi and Botting (2011) examined narrative abilities in children with SLI and children with ASD. For the children with ASD high associations were traced between narrative and receptive language, and between the score in micro-analysis and pragmatic language. Difficulties were found in story content and more specifically in reporting the goals and the actions of the characters. In addition, problems were traced in referents and there was use of neologisms or words that did not have clear semantic meaning. Children with ASD appeared furthermore to incorporate in their narratives information from their experience, making the comprehension of the narratives more difficult for the researchers.

Having discussed the features of children's with ASD narrative skills, it is worth noting that in the case of HFA script knowledge about social situations may act as a mask in storytelling. According to Goldman (2008), adequate script knowledge may be the result of a learning procedure, since children with HFA may have mastered different narrative formats and in this way they could be able to compensate for their communication impairment. It has been found that narratives of children with HFA may incorporate major story elements in their narration like openings, action and obstacles resolutions are not obvious in their narratives creating confusion. Goldman (2008) found that goals and other information necessary for a listener in order to follow a story, something that made children's narration socially meaningless. Citing Goldman (2008), "[a]lthough HFA children had learned the mechanics of story-telling, they did not seem to understand why we tell stories" (p. 1986).

Moving to ADHD, Moonsamy et al. (2009), examined 30 children with ADHD aged between 9 and 11 years old and used one structured and one personal story generation task along with the Cognitive Assessment System (CAS). Results after the assessment of narratives on the basis of macro- and microanalysis, showed that the scores in the subscales of CAS about Attention and Planning were lower than Simultaneous and Successive processing, although there were not any significant associations between measures of cognitive processing and narrative skills. This was interpreted by Moonsay et al. (2009) as an indication that oral narratives may be developmentally inappropriate, since by the age of nine approximately, children may have learnt the story grammar structure. This could have assisted children with ADHD to cover their weaknesses in attention. Another possibility is that intervention could have assisted children with ADHD to do well in narration. A finding that was more or less expected was the difficulty of children with ADHD in coherence.

Miranda et al. (2013) examined 54 participants between 18 and 24 years old, who were equally divided in two groups, the one with the combined type of ADHD and the second without ADHD. The results from the narrative assessment showed that ADHD participants produced stories with fewer words, a smaller number of different words used but a similar type-token ration. Moving on to the morphosyntactic parameter, the ADHD group exhibited inferior performance in relation to the control group in measures regarding mean length of T-unit, subordinate clauses and they made more morphosyntactic errors. ADHD participants were also worse in the category of setting and the controls did better in all other story-grammar categories. However, as Miranda et al. (2013) mentioned, differences between the two groups were not significant.

With regards to internal state language, Miranda et al. (2013) found that controls outweighed the ADHD group, with the latter having incorporated less terms of emotion and evaluation as well as cognition in their narratives, but not significantly. Differences between the two groups of participants, according to Miranda et al. (2013), were more obvious in the evaluation and especially emotion terms like “have fun” or “scare somebody”, rather than in the other categories. Building upon this last remark, it was highlighted that problems in children with ADHD are more pronounced in emotional and not so much in cognitive terms. According to Miranda et al. (2013) this deficit in emotional terms could affect the difficulties of this group in interpersonal relations and communication even in adulthood since social interactions call for inferring the emotions of other people.

It has also been supported that narrative skills in ADHD have not been examined thoroughly and in most cases the area examined is pragmatics and narrative organization. It

has been found that ADHD children face difficulties in the production of an organized, accurate, and cohesive narrative (Kuijper et al., 2017). It is difficult for children with ADHD to understand what causal connections exist in a story and this results in difficulty maintaining cognitive engagement (Lorch et al., 2009). It has also been observed that there are problems in the description of goal-directed actions, while at the same time there are studies that have found no disparities between typically developing and ADHD children (Kuijper et al., 2017). The difficulty in the use of goal-directed actions affects story recall and production, since children with ADHD do not use these units to build an effective narrative (Lorch et al., 2009). Additionally, there are difficulties in both recognizing and choosing the essential information of the story (Lorch et al., 2009). Miniscalo et al. (2007), as cited in Kuijper et al. (2017), examined narrative skills in 3 groups of children: one with ASD, another with ADHD and a third group with children with no neurodevelopmental disorder but with late development in language. No typically developing participants were included in the study. The findings indicated no difference among the three groups in sentence length, number of subordinate clauses and the amount of relevant information in the retelling task. Rumpf, Kamp-Becker, Becker, and Kauschke (2012), as cited in Kuijper et al. (2017), examined narratives of children with Asperger Syndrome (AS), children with ADHD and typically developing children. The AS and ADHD groups faced difficulties in stating the main aspects of the story, with AS children having additional problems. More specifically they generated shorter narratives, included less cognitive terms in their narratives and referred to the characters with more explicit forms.

With regards to causal relations, it has been found that children with ADHD produce less causal relations in their narratives which might be due to the shorter narratives children with ADHD produce (Renz et al., 2003). However, it is not clear whether length or a broader cognitive deficit is responsible for the smaller number of causal/inferential links found in those children's narratives. Additionally, Renz et al. (2003) argued that children with ADHD encode fewer goals attempts to reach the goal and do not tend to correct their errors spontaneously.

3. Method

3.1. Study Aims

This study aimed at examining structural characteristics of narratives produced by children with ADHD and children with ASD in relation to narratives produced by their TD peers. For this reason, we examined narrative skills of children in a retelling and a free narration task, to see which aspects could differentiate the three groups (cohesive devices, sequencing, introduction, character development, problem reference, outcome, vocabulary quality in both tasks and faithfulness in the retelling task). Based on existing research, differences were expected in coherence and cohesion.

Analyses of children's narratives also included the application of the model of causal networks. Evidence suggests difficulties to recognize and produce causal relations in narratives, especially in children with ASD. In this study we aimed at examining whether there were differences among the three groups in the quantity and quality of causal relations produced in children's free narrations. Free narration was chosen on the assumption that children have to figure out which causal relations exist among the pictures provided. A final analysis regarding linguistic features was carried out on the data of the free narration task in order to examine which linguistic features are employed by all children while narrating a story. In addition we aimed at detecting linguistic devices that differentiate the three groups of participants, like ToM terms as well as causal and goal terms which seem to be difficult for children with ASD and sometimes for children with ADHD.

3.2. Participants

The study comprised by 84 children aged between 4 and 9 years old. Participants were divided in three groups: the first group consisted of 12 children with ASD (mean = 7.41 years, SD = 1.11) the second group of 32 children with ADHD (mean = 6.61 years, SD = .40) and the third group of 40 typically developing children (mean = 6.38 years, SD = .64) that were matched to the other two groups according to age, gender and/or language development. The participants were part of a wider research study that evaluated the linguistic development of Greek speaking children, aged between 4 and 7 years of age (Mouzaki et al., 2017). The sample of the original study was randomly selected from different geographic and demographic areas and the participants came from different schools in Greece.

The matching procedure was carried out in accordance to Vatsina (2017). More specifically, matching between typically developing participants and participants with ASD was completed according to gender and performance in a receptive vocabulary task (Mouzaki et al., 2017). For the ADHD group matching was based on the age and gender of the participants. Therefore four groups of participants were formed (typically developing children – children with ADHD and typically developing children - children with ASD). The groups had equal number of male and female participants. Children in the ASD group were older than typically developing children since matching was carried out in accordance to their receptive language skills.

Participating children had been diagnosed with ASD or ADHD from a public or private diagnostic institution. However, standardized assessments were also administered to confirm the diagnosis. Criteria used included a score between 30-37,5 in CARS (Schopler, Reichler & Renner, 1998) for verifying mild ASD and a score over 85% in either of the two factors of the Greek adaptation of the ADHD scale (Kalantzi-Azizi, Ageli & Efstathiou, 2012) for the other group. All participating children were administered the Greek standardization of the Raven matrices (Sideridis, Antoniou, Mouzaki & Simos, 2015) in order to verify typical intelligence (over 85).

Demographics of the participating children are presented in table 1. A large part of the children (45%) came from one geographical region (Attica), while the remaining 55% came from the region of Thessaly and the island of Crete. Regarding parental education, most of the fathers had finished senior high school (42,8%) and the majority of the mothers (54,7%) had graduated from a technological institute or had a university degree. All participating children had Greek as their dominant language.

Table 1: Information about participants: Total number of participants, number of participants according to gender, age with standard deviation (SD) and details about the area children lived (rural, semi-urban, urban).

	TotalNumber	**Males**	**Females**	**Age (SD)**	**Rural**	**Semi-urban**	**Urban**
TD	40	27	13	6.38 (.64)	6	6	28
ADHD	31	21	11	6.61 (.40)	1	0	30
ASD	9	9	0	7.41 (1.11)	1	0	10

3.3. Measures

Children's narrative skills were assessed with *Logometro* (Mouzaki et al., 2017), a standardized assessment tool for language development for preschool children and children in the first years of primary school. The particular assessment examines phonological and morphological awareness, receptive and expressive vocabulary, pragmatic competence and narrative skills. The narrative tasks in Logometro include a re-telling and a free-narration task.

In the retelling task, children are evaluated through a sequence of six pictures. The examiner narrates each of the episodes of the story that corresponds to a specific picture, while the child looks at the same time the pictures. As Kanellou et al. (2016) described, the participants of the study are informed before the beginning of the task that they will have to re-tell the story they hear in order not to get distracted and stay focused during the narration by the examiner. After the examiner has finished the narration, urges the participant to re-tell the story from the beginning, while looking at the pictures.

The second task is a free-telling one, consisting again by a specific sequence of six pictures. The participant is asked to narrate the story the best way he/she can using as many words as possible. The participant is looking at the picture during the narration. In case that a child doesn't say anything or produces only few sentences, the examiner encourages them to try to produce a narrative (Kanellou et al., 2016).

3.4. Procedures

Assessment data collection procedures for conducting research in public school had been approved by the special committee for research of the Greek Education Ministry. All research activities were carried in cooperation with school principals and staff after parental consent for children participation was obtained.

Children were assessed individually in a quiet school room by properly trained research assistants who were experienced in working with young children. The complete battery of language assessment lasted between 45 to 90 minutes (depending on child's age and performance) and was completed in one to three sessions. Due to administration format (through an Android application for mobile devices (tablets) children were engaged in the task and participated with enthusiasm. The touch-screen enabled direct recording of children's oral responses. A standard version of the story was presented to participants in the

context of the Retelling task who were then asked to repeat the story. In the Free Narration task children were invited to navigate through the 6 story pictures and then "make up their own story".

3.5. Data coding

Children's narrative skills were evaluated using two tasks (Retelling and Free Narration) that employed a set of six drawings representing a short story. The story had a simple story structure: three leading roles, an introduction, an event, a problem and a solution. The theme was interesting and compatible with existing knowledge of most children referring to a simple incident faced by two children playing in a park.

For both narration tasks the mean number of total words and different words was calculated and analyzed for evaluating development of narrative skills. With regards to the number of total words, we excluded words and phrases that were not part of the narration, such as "I do not know how to move on" and "This is the end". Derivatives of a word were coded as one word (for example the words "play", "played" and "player" count as one word). Compound words (i.e. "start" and "restart") classified as different words. Narratives were also coded using the Logometro scoring scheme and in terms of causal networks (Trabasso, den Broek & Suh, 1989).

- Structural evaluation:

Language samples were scored on the following macrostructure criteria: (a) conjunctions/ cohesion, (b) temporal sequencing, (c) narrative introduction (convention and/ or place/ time/ heroes), (d) development of characters (state of mind and feelings of heroes), (e) problem reporting (how and/ or why and solution), and (f) result/conclusion. Two additional criteria were assessed: (g) quality of vocabulary used, (h) accuracy of retelling (compared to the presented story).

A composite index was created by summing the individual scores on each of the 8 aforementioned criteria (total score = 0-16 points). To assess the reliability of the scoring method, samples from 30 randomly selected children were scored independently by four raters achieving average inter-rater agreement of 90%.

The first criterion for the evaluation of coherence, was the temporal succession of the episodes of the story. Narratives that included a beginning, a main part and an ending, containing accurate story succession were scored with 2 points. No score was assigned to narratives with errors in ordering of events and/or omissions while simple repetitions of

events or minor gaps received 1 point. Narratives that did not refer to one of the episodes, were extremely short but did not disrupt the temporal succession of the story, were also scored with 1 point. Narratives whose temporal succession of the episodic structure and succession of story elements was disrupted resulting in inconsistency, were scored with 0 points (Kanellou et al., 2016).

According to Kanellou et al. (2016), the criterion of expressive sufficiency was based upon Stein and Glenn (1979) and their description of Story Grammar. The aspects that were evaluated were, first, the introduction of the narrative and, more specifically, conventions in how a narration should start, along with information about the place, time and heroes. The second aspect of evaluation was children's reference to the main event in the story, which is namely the problem (why a particular situation may be a problem and/or the solution to the problem). The third aspect evaluated was the final outcome and the conclusion. The representation of the mental state and the emotions of the characters of the story was also evaluated (Kanellou et al., 2016). Each of the four aforementioned aspects was scored with either 0 points (minimum or immature), 1 point (developing) or 2 points (sufficient or mature).

Finally, with regards to vocabulary, if the amount of words used in a narrative was limited, if there were semantic errors and the child could not communicate his thoughts effectively, the score assigned was 0 points. In cases where the vocabulary communicated a message effectively, but there was repetition or use of common, stereotypical and simplistic phrases, the score was 1 point. If the vocabulary was rich, included effective words for the description of the story, 2 points were assigned (Kanellou et al., 2016). A composite index was created by summing the individual scores on each of the 8 aforementioned criteria (total score for both narratives = 0-16 points).

- Causal networks:

An additional coding was implemented according to the model of causal networks (Luo & Timler, 2008; Sah, 2013). First, in order to establish causal connection among events in the story, the criterion of necessity had to be fulfilled. One event had to have taken place in order for another to happen (Sah, 2013). The same criterion is highlighted in Trabasso et al. (1989), although in the latter the parameter of transitivity that allows the formation of chains is discussed. A category thus can have more than one roles and a cause may operate over a distance in the narrative (Trabasso et al., 1989). Opening events were found to include "details about the setting, the protagonists, the place and time as well as the trigger of the

following episodes" (Sah, 2015, p. 175). As for the closing events, they belong to the causal chain that has been established among the episodes of the story and they regard the attainment or the failure of the goals of the protagonists (Sah, 2013).

In more detail, in order to identify causal networks in our data, we espoused the methodology followed in Luo and Timler (2008) and Trabasso et al. (1989). We formed GAO units, with each of the units being consisted of the following elements: Goal, Attempt and Outcome. If all of the three elements were included in the unit, it was considered complete, whereas if one of the three elements was missing, the unit was considered incomplete. The information encoded in children narratives were settings, initiating events, internal responses, goals, attempts and outcomes, as well as other statements that did not fall in any of the above categories. Below, a modified version of the coding key with the definitions described by Luo and Timler (2008) and Trabasso et al. (1989) is included.

- "Settings" are statements that include background information regarding the characters, the place and time the story takes place.
- "Events" are statements regarding changes that affect the current goals of the characters. Events were considered all those statements that were not clearly connected causally to other network components, although they were temporally linked to one another. Young children first link temporally the episodes in their narrative. Temporally linked episodes can influence other goals of the characters.
- "Internal responses" are statements regarding the mental states of the characters in relation to the events that take place in the story.
- "Goals" are statements made regarding the plans of the character in order to deal with the events that take place in the story.
- "Attempts" are statements regarding the actions of the character so as to reach different goals.
- "Outcomes" are statements referring to the consequences of the attempts.
- "Others" are statements that cannot be included in any of the aforementioned categories. This category was mainly used for sentences incorporated in the narrative in order to show that the story has reached its end, like "They lived happily ever after".

The above data coding is based upon the coding used by Trabasso et al. (1989).

One code was assigned to one idea unit, which usually corresponded to one clause as shown by Luo and Timler (2008). Additional code (i.e. [g-inferred]) was assigned if the goal

could be derived from the episodic sequencing (Luo & Timler, 2008). Two codes were assigned in cases an attempt included an embedded goal statement, with the latter being in the form of an infinitive phrase (Luo & Timler, 2008).

The main axis of segmentation was one sentence clause which corresponded to one idea unit most of the times. In cases a sentence with two or more clauses was encountered in the narrative, the syntactic rules of Luo and Timler (2008) were used in order to control the number of codes. In case a sentence included two or more clauses linked by coordinate conjunctions, the number of codes derived from the number of ideas being expressed in the sentence (Luo & Timler, 2008). According to Luo and Timler (2008), if a complex sentence was adverbial, each of the clauses would be given one code, while one code was assigned if the sentence included a nominal or a relative clause.

In most cases one code was assigned to one clause and there were some prepositional phrases that triggered an outcome or an attempt (i.e. “mum made a birthday cake, because of her daughter’s birthday”). Such cases consisted an exception (the daughter’s birthday was the reason mum made a cake for the specific occasion), and one code was assigned to a prepositional phrase (a unit with no verb).

Coding key according to Luo and Timler (2008, p. 33):

- **s** = setting
- **e** = initiating event
- **ir** = internal response
- **g** = goal. There is a distinction among superordinate and subordinate goals. Thus an index is used next to the goal in ascending order. G1 is considered a superordinate goal, whereas following numbers are subordinate goals.
- **a** = attempt to reach the goal
- **o** = outcome. There is also a distinction among different outcomes which are also assigned numbers in ascending order beginning with 1. Outcome is considered the superordinate outcome that relates to G1.
- **other**

4. Analyses

4.1. Results

Narration data (retelling and free narration scores) were analyzed for detecting between group differences examining both the total number of the individual scores on each of the criteria used (total score for both narratives = 0-16 points) and for specific criteria. Because the data were not normally distributed differences were tested with Mann-Whitney U tests.

4.2. Structural evaluation

Mean scores were calculated for total number of words and number of different words in the two narration tasks and the results are included in table 2. No statistically important differences among the three groups were found for the total number of words and use of different words. Differences between TD and ADHD children in the study was small in both the total number of words and the number of different words in free narration. What is more, in retelling the two groups of participants had almost the same performance, in terms of word counting.

Table 2: Total number of words (TW) and different words (DW) in retelling (R) and free narration (Fr)

Group		TW R	DW R	TW Fr	DW Fr
TD	Mean	76.65	33.15	66.45	33.20
	SD	35.96	14.41	37.2	13.54
ADHD	Mean	76.9	34.74	68.74	31.74
	SD	27.42	10.60	41.04	13.50
ASD	Mean	63.45	30.27	49.64	25.27
	SD	43.95	19.07	28.81	13.71

Results for the structural evaluation and scoring are presented table 3 and 4. The parameters assessed in Logometro are: cohesion, sequencing, introduction, character development, problem, outcome, faithfulness and vocabulary quality. Faithfulness is assessed only in the retelling task and all the other parameters are assessed in both retelling and free

narration. From these parameters we chose specific ones to be included in our analyses. Temporal sequencing is based on the assumption that the ability to link events temporally reflects a more advanced skill from the mere reference of events. Reference to the problem involves a broader picture of the narrative and such link of the events in order to present what triggered the actions of the heroes of the story. Quality of the vocabulary refers to the use of sufficient vocabulary and efficient narrating of the story.

Table 3: Mean score and standard deviation (SD) for structural dimensions of the retelling task of TD children, children with ADHD and ASD. Coh. stands for coherence, seq. for sequencing, introd. For introduction, char. for character development, prob. for reference to the problem, out. for outcome, faith. for faithfulness to the original narration and voc. to the quality of the vocabulary used.

	Coh.	**Seq.**	**Introd.**	**Char.**	**Prob.**	**Out.**	**Faith.**	**Voc.**
TD	1.37	1.26	1.08	.37	1.58	.95	1.05	1.53
	(.59)	(.72)	(.71)	(.54)	(.60)	(.40)	(.32)	(.51)
ADHD	1.71	.90	.87	.42	1.19	1.03	.97	.90
	(.53)	(.54)	(.67)	(.50)	(.54)	(.55)	(.18)	(.30)
ASD	1.27	.55	.73	.09	.55	.55	.64	.45
	(.65)	(.52)	(.47)	(.30)	(.82)	(.82)	(.51)	(.52)

Table 4: Mean score and standard deviation (SD) for structural dimensions of the free-narration task of TD children, children with ADHD and ASD. Coh. stands for coherence, seq. for sequencing, introd. For introduction, char. for character development, prob. for reference to the problem, out. for outcome and voc. for the quality of the vocabulary used.

	Coh.	**Seq.**	**Introd.**	**Char.**	**Prob.**	**Out.**	**Voc.**
TD	1.03	1.21	.97	.38	1.28	.74	1.03
	(.67)	(.70)	(.81)	(.59)	(.56)	(.55)	(.28)
ADHD	1.20	1.60	1.37	.47	1.67	1.00	1.00
	(.55)	(.62)	(.67)	(.63)	(.48)	(.53)	(0)
ASD	.67	1.11	.67	.33	1.33	.56	1.00
	(.71)	(.78)	(.71)	(.71)	(.71)	(.53)	(0)

According to results presented in figure 1 and table 3, TD children have outperformed the other two groups in the retelling task. The ADHD group performed better than the TD group in cohesion, character development and outcome scores. The non-parametric test

Mann-Whitney was used to examine differences in temporal sequencing, reference to the problem and quality of the vocabulary. For typically developing children and children with ADHD all of the parameters examined differed significantly [sequencing ($p < .007$), reference to the problem ($p < .003$) and vocabulary ($p < .000$)]. Regarding typically developing children and children with ASD significant differences were found in vocabulary ($p < .007$) while reference to the problem approached significance ($p < .031$). ADHD and ASD participants differed significantly in reference to the problem ($p < .015$) and approached significance in type of vocabulary used ($p < .028$).

Results of the assessment of the free-narration task are presented in table 4. In this task, ADHD children outperformed in total scores the TD children (figure 1). Regarding specific parameters, vocabulary quality was found to be higher for children with ADHD, with the difference between the other two groups being very small. Nevertheless, it is worth noting that TD and ADHD children performed quite similar in many cases, while performance of the ASD children was substantially below the other groups. Mann-Whitney test was also used to examine differences in the same three variables compared in the retelling task. For the typically developing participants and the ADHD group, reference to the problem differed nearly significantly ($p < .018$). For the other two pairs of participant groups no statistically significant differences were traced.

In total scores, as shown in figure 1 and table 5, TD children who were matched to the ADHD group performed higher in the retelling task but not in the free-narration task. Furthermore, the TD group differed significantly from the ADHD group in both tasks but in a reversed manner. In more detail, while TD children were significantly better than the ADHD group in retelling ($p < .02$), they performed lower in free narration ($p < .05$). The same tendency was evident between the TD and the ASD children. The ADHD group performed significantly lower in retelling but significantly higher than the TD children in free narration ($p < .05$).

Figure 1: Mean scores of the performance of the TD, ADHD and ASD children in the retelling and free-narration task.

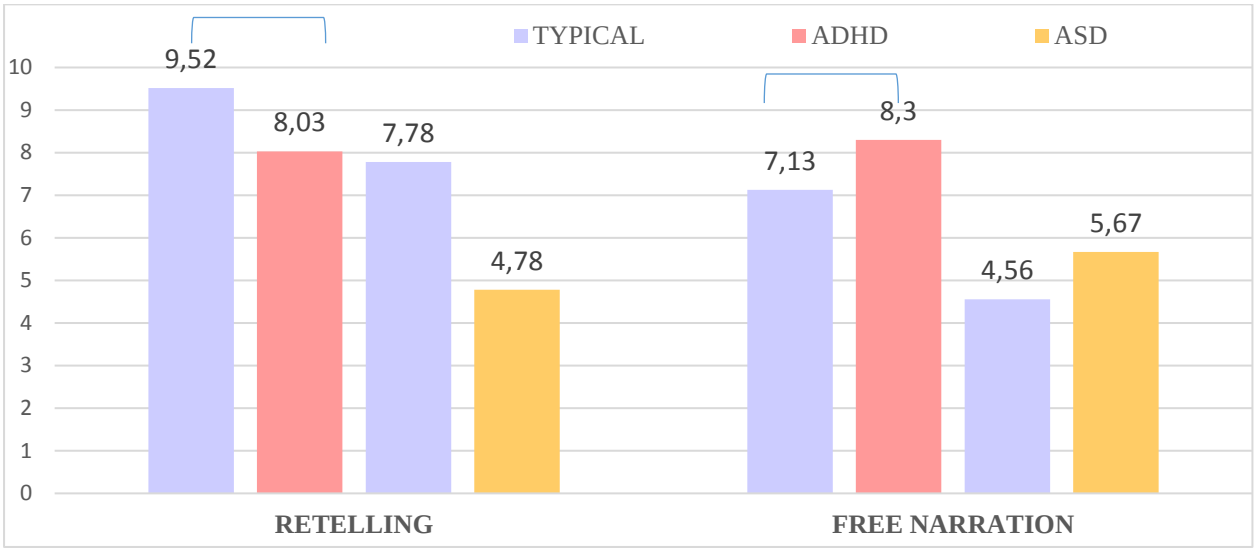


Table 5: Mean score, standard deviation (SD) and significance level (P) in the non-parametric Mann-Whitney test for the retelling and the free-narration task for the following pairs of participants: TD-ADHD and TD-ASD children.

	Mann-Whitney Test					
Matched Groups	**Retelling task**			**Free-narration task**		
	Mean (SD)	**Z**	**P**	**Mean (SD)**	**Z**	**P**
TD (N=31)	9.52 (3.09)			7.13 (2.69)		
ADHD (N=31)	8.03 (2.37)	-2.31	.02	8.30 (2.45)	-1.95	.05
TD (N=9)	7.78 (2.77)			4.561.87)		
ASD (N=9)	4.78 (3.49)	-1.83	.06	5.67 (3.31)	-.58	.05

4.3. Causal networks

In order to examine how young children organized their narratives as well as whether they use causal and goal relations in their narrations, we estimated causal networks using data from the free narration task. Because the data were not normally distributed differences among the three aforementioned variables were also tested with the non-parametric Mann-Whitney test. The level of significance was set to $p < .016$.

Tables 6 and 7 summarizes coding of the data of the free-narration task according to the model of causal networks. The category of initiating events was adapted and used as events. This was necessary due to the young age of the participants, as it was not evident in their narratives whether the events described initiated something in the story.

Table 6: Mean score and standard deviation (SD) for the parameters of causal networks. IR stands for internal responses, G1 for the main goal, O1 for the superordinate outcome, G2+ for the subordinate goals and O2+ for the subordinate outcomes.

Group	Settings	Events	IR	G1	G2+	O1	O2+	Attempts	Other
TD	.63	6.55	.23	.25	.90	.25	.60	1.15	.38
	(.77)	(3.00)	(.42)	(.44)	(1.37)	(.44)	(.90)	(1.58)	(1.19)
ADHD	.68	7.84	.94	.16	.42	.16	.77	.71	.23
	(1.05)	(3.49)	(2.08)	(.37)	(.89)	(.37)	(1.28)	(1.22)	(.62)
ASD	.64	4.00	0	.09	.55	.09	.27	.82	.91
	(.67)	(2.00)	(0)	(.30)	(1.04)	(.30)	(.91)	(1.17)	(1.45)

Table 7: Complete and incomplete units that include goal, attempt and outcome (GAO) for the three groups of participants.

Group	Complete GAO	Incomplete GAO
TD	.60	.63
	(.78)	(.90)
ADHD	.35	.48
	(.76)	(.81)
ASD	.27	.55
	(.47)	(.82)

Utterances that did not make sense and therefore could not be classified in any of the categories that carry some meaning were classified as “other”. This category indicated the utterances that violated rules of our language (grammatical, syntactic, semantic) to the extent

that no meaning could be derived. The ASD group produced most utterances of this category. No differences were found in the category of internal responses, although there was a clear tendency of ADHD and typically developing preschoolers to incorporate internal responses in comparison with ASD children. There was also a tendency of children with ADHD to produce more internal responses than their typically developing peers. There was not a clear tendency of one group to perform higher in all of the parameters examined. In settings and events the ADHD group had the highest performance and the TD group was better in goals (G1, G2+), outcomes of the goals (O1, O2+) and attempts. However, it could be suggested that TD children performed higher in forming GAO units (complete and incomplete).

From all the variables mentioned in tables 6 and 7, differences between groups for three parameters were examined and the level of significance was set to $p < .016$. One of the parameters examined was complete GAO units; this variable was chosen on the assumption that the inclusion of all three elements would be more difficult, especially for children with difficulties. Moreover, we included the parameters G2+ and events. An important observation is that most of the participants tended to include the broader goal of the party, maybe because this was a context familiar to them. However, we noticed problems in the subordinate goals, with many of them being presented as simple events that could not be easily linked in order to form a coherent whole.

Another parameter examined along with the variables previously mentioned before, was whether the participants differed in relation to complete and incomplete GAO units. As we can see in table 6, TD children produced more complete GAO units, even though the difference between TD and ADHD children was nearly significant ($p < .037$).

The variable of G2+ differed significantly between typically developing preschoolers and preschoolers with ADHD ($p < .014$). Typically developing children included more subordinate goals in their narratives. Between typically developing preschoolers and children with ASD we did not find any statistically significant differences but ASD participants were found to differ from ADHD participants significantly in events ($p < .001$), as the ADHD group included more events in their narratives, as opposed to the ASD children.

In sum, no major differences detected among the three groups of children in most variables encoded according to causal networks. Specifically, performance in settings was very close suggesting that children gave more or less quite similar information about the characters, the time and the place of the story. It was the GAO units and the subordinate goals that seemed to be sensitive indices that discriminated the participants.

4.4. Linguistic features analysis results

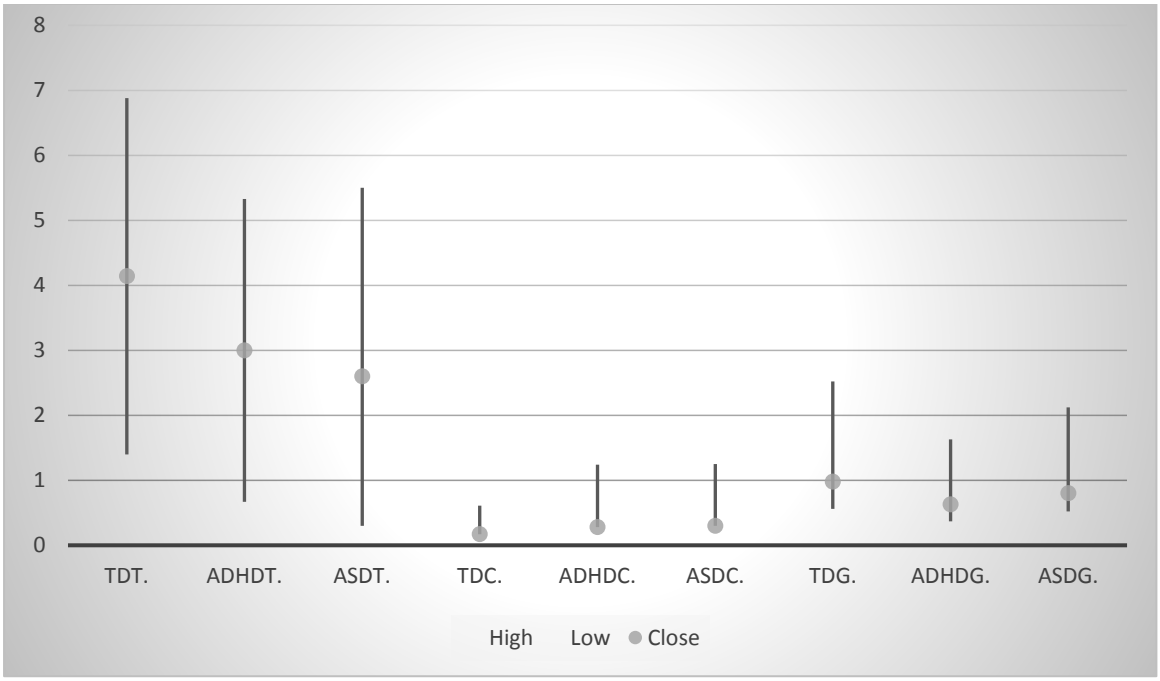
A short linguistic examination of the narration data was considered necessary for studying closely narrative language and unravelling potential fine differences among the three groups not detecting through previous comparisons.

Initially the number of verbs used by each group was examined. The total number of verbs produced in relation to the total number of words for TD children was 541/2658 (.005), for children with ADHD the proportion was 394/2131 (.006) and for children with ASD it was 93/546 (.019). Due to the different number of participants we calculated the respective proportion for each child in the parenthesis above.

All phrases and words that indicated a temporal connection between events/actions in the narrative were also examined, with 6 children in the TD group, 9 in the ADHD group and 5 in the ASD group not using any temporal terms in their narratives. In general, TD children used between 1 and 10 temporal terms (10 terms were used only by one child), ADHD children used between 2 and 7 terms and ASD children used 3 to 7 temporal terms in their narratives.

As for causal and goal terms we examined clauses and prepositional phrases indicating cause/goal. Children did not use many linguistic devises indicating the cause of something. However, it is worth noting that in most cases causal terms were used to explain why the heroes had a particular feeling (e.g. why the clown was sad) or to give the reason of the birthday cake (i.e. mum made the cake because a girl had her birthday). Only 6 TD children used 1-2 causal terms in their narratives, 4 children with ADHD used between 1 and 5 causal terms in their narratives and only 1 child with ASD used 3 causal terms. Regarding terms indicating a goal, we noticed that these terms were easier or more plausible for the participants, since more terms were produced in this category. Inspection of goal terms showed that 18 TD children referred to a goal using 1 or 2 terms. In the ADHD group, 11 children used between 1 and 3 terms indicating a goal and in the ASD group 4 children used 1 to 4 such terms. As also shown in figure 2, more children in all three groups used goal terms as opposed to causal terms and the number of terms used for goals was higher than in the causal terms.

Figure 2: Mean scores and standard deviations for the temporal (TDt., ADHDt., ASDt.), causal (TDc., ADHDc., ASDc.) and goal terms (TDg., ADHDg., ASDg.) used by each group in the narratives.

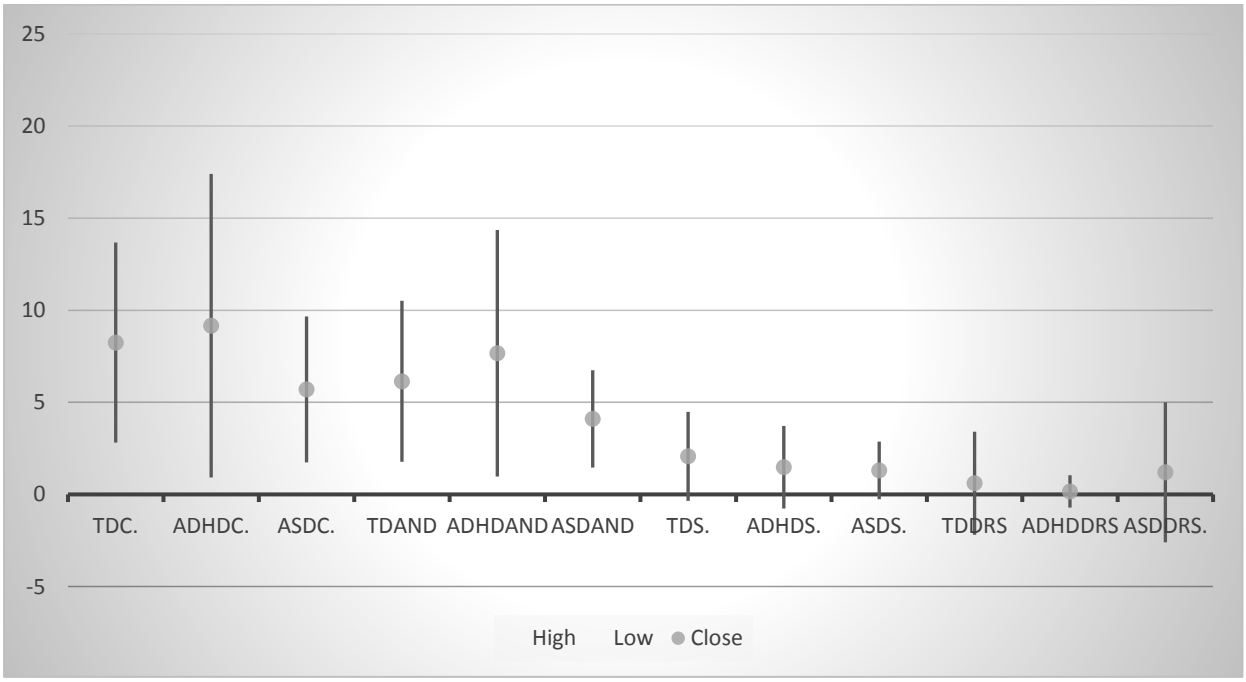


Analyzing coordinate and subordinate conjunctions that linked clauses and terms in the sentences, a distinct variable was nessessary to be formed due to frequent use of the conjunction “and” by the children. In figure 2 the frequency of the particular conjunction in relation to the general number of conjunctions used in the narratives is shown. In more detail, only three TD childrn did not use any conjunctions in their narratives and the mean score of the team was 8.24 (SD=5.43), while only one child with ADHD did not use conjunctions and the mean score of the team was 9.16 (SD=8.24). The ASD group used less conjunctions with the mean score being 5.70 (SD=3.97). The “and” conjunction was a major part of the total number of conjunctions used, with TD children using “and” very frequently (M=6.14, SD=4.37), while ADHD children preferred the particular conjunction more than the controls (M=7.66, SD=6.69). ASD children in turn, also used “and” to a large extent in relation to the overall number of conjunctions they produced (M=4.10, SD=2.64).

In sum, all children showed a preference towards the coordinate connection of words and clauses through the use of the conjunction “and”. However, there were also coordinating conjunctins like “but” and subordinationg conjunctions like “when”, “in order to”, “because” (όταν /ǒtan/, για να /jıa na/, επειδή /epı́ðı/). Except for the aforementioned subordianting conjunctions we had other subordinate clauses introduced with relative pronouns forming a distinct category for subordinate clauses incorporating all the types of subordinate clauses. For this category, TD children had the highest mean score (M = 2.07, SD=2.42), being

followed by ADHD children (M = 1.47 SD=2.24) and ASD children (M = 1.30, SD=1.57). It is important to note that some children, mostly in the ADHD and ASD groups, made wrong use of the subordinating conjunctions and especially of the temporal ones. Apart from the subordinate clauses, another linguistic device that caught out attention was use of direct speech. Only a limited number of children embodied such a device in their narrative. In order to code such utterances, we divided the direct speech into clauses that included one verb and counted the number of greetings/exclamation phrases that were formed. Interestingly, the ASD group had a higher mean score (M=1.20, SD=3.8), although only one child from the entire group produced 12 items in direct speech. TD children followed (M=0.60, SD=2.8), with 2 children producing 25 items. Then, ADHD group was last with 1 child having formed 5 utterances in direct speech (M=0.16, SD=0.88). Despite the ASD group outperforming other children, two TD children had produced direct speech.

Figure 3: Mean score and standard deviation for the total number of conjunctions (TDc., ADHDc., ASDc.), the "and" conjunction (TDand, ADHDand, ASDand), the number of subordinate clauses (TDs., ADHDs., ASDs.) and the number of utterances in direct speech (TDdrs., ADHDdrs., ASDdrs.) for our three groups of participants.



The last parameter we examined in the narratives of the three groups was Theory of Mind. ToM terms were considered an important parameter to be coded, since there is a lot of discussion around this ability in children with developmental disorders like ASD and ADHD.

Thought terms were considered terms showing beliefs and thoughts like *think, know believe*, while emotion terms were considered terms showing emotion or desire like *want, happy, sad, love* (Ensink & Mayes, 2010). We examined the kind of ToM terms children included in their narratives and we divided ToM terms into thought terms and emotional terms. As for the specific free narration task administered to the three groups of participants, ToM terms evident enough to have been identified by the articipating children were: sad/sadness for the clown due to the baby who appears to be crying in Figure 4 and happy/happiness at the end of the story where the baby and the rest of the gusts dance at the party with the rest of the children (Figure 5).

Figure 4: Picture from the free narration task showing the sadness of the clown due to the youngest child's crying.

Figure 5: Picture from the free narration task showing the child's and the guests' happiness at the end of the party.

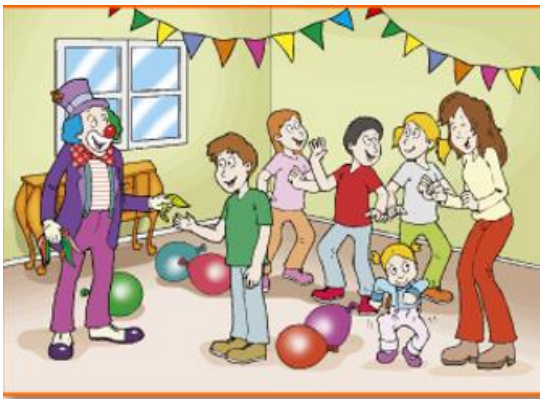


Figure 7 shows the mean performance of each group in ToM as a total. It seems that the ADHD group produced more ToM terms. More specifically, 12 ADHD children produced ToM terms (M=0.81, SD=2.16), and 12 children of the TD group produced such terms (M=0.43, SD=0.83). In the ASD group only 3 children used ToM terms in their narratives (M=0.50, SD=0.97). TD and ASD children have a close mean performance. As we can see in figure 7, children produced more terms relating to emotions rather than thoughts. TD children that produced emotional terms produced also the thought terms found in our data. All in all, ADHD children showed a stronger tendency of encompassing ToM terms in their narratives.

Figure 6: Mean score and standard deviation of ToM terms for the TD, ADHD and ASD group.

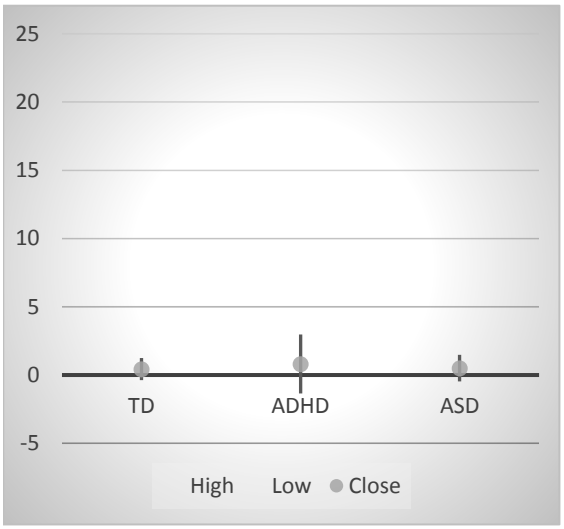
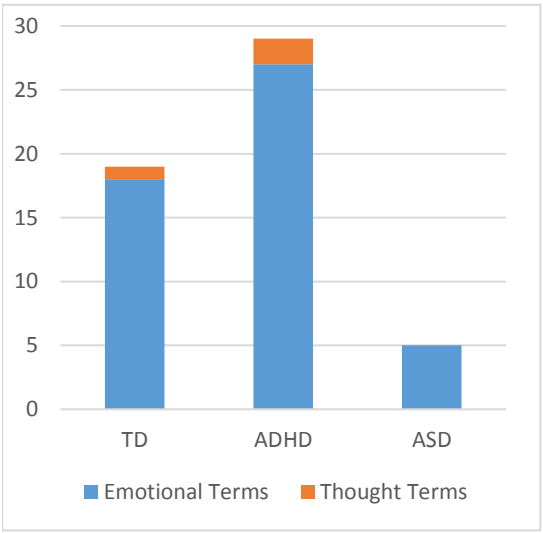


Figure 7: Total number of ToM terms for the TD, ADHD and ASD group. The ToM terms are divided into emotional terms and terms indicating mental states/thoughts.



5. Discussion

This study aimed at examining the way TD children, children with ADHD and children with ASD structure their narratives and for this reason we used both a retelling and a free narration task. Both coherence and cohesion parameters were examined. According to previous research, differences among the three groups of children have been found in sequencing, causal and goal aspects of narratives and ToM, guiding the focus of the study to these parameters. Narratives were analyzed both according to scoring procedures used by Logometro and according to the model of causal networks. An additional linguistic feature analysis aimed at the detection of possible features that could differentiate the three groups of participants.

As Ryan (2007) mentioned, narrativity is not a binary characteristic that either exists in a text or not. On the contrary, narratives have a spatial, temporal, mental, as well as a fourth formal and pragmatic dimension (Ryan, 2007). Therefore, children's narratives are used as a means of detecting developmental differences and as a means able to differentiate typical from atypical language development. Given the multiple information narratives offer the researchers and children's familiarity with narratives from a very young age, we examined linguistic competence of children with ADHD and children with ASD.

At first, children with ASD and ADHD have been found to produce shorter narratives than their TD peers (Capps et al., 2000; Miranda et al., 2013). However, there are also indications that high-performing children with ASD and children with ADHD may show a similar performance to TD children, recalling the same number of events and producing narratives of comparable length (Diehl et al., 2006; Flory et al., 2006; Kuijper et al., 2017; Rumpf, Kamp-Becker, Becker & Kauschke, 2012). This study did not find any significant differences among groups neither in the total number of words nor the number of different words produced. As for the ASD group, most of the children were high-performing children, which may have contributed to their good performance.

- Structural analyses.

Structural analyses revealed differences among the three groups as children with ADHD outperformed TD children in many of the parameters in the retelling task, while TD children were better in the free-narration task. Specifically, it was found that TD children differed significantly in sequencing, reference to the problem and vocabulary quality in relation to the ADHD participants. For TD and ASD children it was found that the former

were significantly better in reference to the problem. Moreover, vocabulary differed nearly significantly, with TD children using more advanced vocabulary.

All these parameters taken together indicate that TD children had an overall better performance, in various parameters assessed, suggesting possibly a construction of more coherent plots. According to Abbott (2007) various definitions of the term "plot" exist and those included economy and sequencing of events rather than having an impression of events as raw material. It was also mentioned that plot has a beginning, a middle and an end and may also be defined as a teleological sequencing of events which are linked via principles of causation, something that has an outcome convergence or resolution.

With regards to the demands of retelling, this task presupposes that an individual can organize discourse, manipulate linguistic devices efficiently and, more important, incorporate pragmatic features. In the particular task we found inferior performance of children with ADHD in referring to the problem and sequencing, something that could be partially explained by the problems in sustained attention that characterize children with ADHD (Flory et al., 2006). The characteristics of ADHD may interfere with the demands of retelling task which has a bigger cognitive load than free narration (Flory et al., 2006). In the first case, children have to pay attention to what the examiner says and retain information for some time, whereas in free narration children have to stick to the pictures and enrich them as they can. Besides, the only significant difference in the free narration task was traced in reporting a problem/story event. As for the tendency emerged in the free narration, with the children with ASD doing better than the matched TD children, this could be justified by the difference in age between the two groups. Participants with ASD were matched to the TD participants according to language, something that resulted in the ASD children being much older than TD children. This could result in the TD children being more immature cognitively, and therefore in having an inferior performance in the free-narration task.

- Causal networks.

The model of causal networks was also applied in order to examine the way children organized their ideas in the narratives and what relations they traced among the pictures of the free narration task. The analysis indicated a difference among the three groups, with TD children having a tendency to include more GAO units. This may be an indication that TD children could form an overall better plot, since they included elements that are integrated in their narratives. It was also found that all children were able to trace the first and superordinate goal/reason of the party (G1), which was to celebrate a child's birthday. Moreover, according to Loth et al. (2008) children with ASD and especially those that are

high-functioning individuals, may have relatively intact event schemas, or scripts. It is important to note that the script of the birthday party is very common to young children, something that can also be linked to the fact that the vast majority of children referred to the party as G1.

With regards to subordinate goals TD children outperformed significantly children with ADHD in G2+ units; TD children included more subordinate goals in their narratives and seemed thus to have a better established connection among different events. In turn, ADHD children appeared to have more developed narratives in relation to ASD children, since the former included significantly more events in their narratives.

Regarding goal terms, TD children in the linguistic feature analysis had a higher mean score being followed by ASD children and then by ADHD children. The model of causal networks detects primarily the presence of verbs in order to create units that indicate cause. However, in the narratives we found also many prepositional phrases with no verb near them (or implied) in order to form an incomplete GAO unit.

The good performance of children with ASD could attest to the claim of Loth et al. (2008) regarding the ability of children with ASD to process information at a global level as well. It has also been suggested that children with ASD have good memory skills, something that could explain the recall of the superordinate goal in the free narration task (Diehl et al., 2006). There are mixed findings in research and it has been suggested that although children with ASD may be better at local processing, global processing may not necessarily be impaired (Loth et al., 2008).

Diehl et al. (2006) argued that despite a relatively good performance of ASD children in the recall task, there were difficulties in recalling and reproducing the gist of the story. Producing unconnected events which resembled rather more a description of events than a story. In such cases good memory skills aided ASD children in retelling, although there were problems in drawing inferences and linking episodes. This was partially corroborated by this study, since the recall of the superordinate goal (G1) and some basic elements of the story (e.g. the birthday party, the clown with his tricks, the baby that cried and then returned to the party) did not necessarily result in overall coherent narratives. This suggested according to Diehl et al. (2006) that basic understanding of the story does not link necessarily to inference making, something that is verified to some extend by our findings.

As for children with ADHD, they appeared to capture the superordinate goal and produce the least G2+ units in this study. According to research, difficulties for children with ADHD are indeed goal structure generation, difficulty in inference generation and

identification of important events in the story, all resulting in deficits in the construction of coherent narratives (Derefinko et al., 2014). This observation guided Flory et al. (2006) towards the conclusion that special instruction aiming at identification of characters' goals and maintaining goal planning could have better results than stimulant medication aimed at increasing on-task behavior.

The linguistic feature analysis carried out in the narratives of the three groups showed further difficulties of children in identifying and producing causal relations. The ASD group produced more causal terms, being followed by children with ADHD (who performed nearly the same) and then by TD children. This was an unexpected finding, since ASD children had more fragmented narratives and some utterances had no verbs or objects sometimes. Children with ASD had also the most utterances that did not derive any meaning and were categorized as "other".

Causal terms were most of the times used by ASD children near terms indicating emotional states, finding related to ToM terms used. A larger sample of the ASD group might have provided us with a more accurate picture of causal term use among children with ASD. In addition, there were few cases of causal conjunctions in the two experimental groups being used in contexts where the causal relation was not clear. This was a minor tendency with 4 children out of 5 (1/1 in the ASD group and 3/4 with ADHD) having problems with causal conjunctions. For instance, the child with ASD mentioned that the mother prepared the birthday cake because the clown was about to arrive, a child with ADHD mentioned that the little baby cried because the clown was sad (while the opposite is the case) and another child mentioned the baby did not want to dance because she was sitting on the floor. What would be helpful for future investigations would be the creation of obligatory environments (contexts where the use of a causal conjunction is necessary due to elements being semantically causally connected) so that we could see whether children really grasp the causal links among elements in the story. It is interesting that some of the causal links produced by the aforementioned children were correct. As in this study, in Young, Diehl, Morris, Hyman and Bennetto (2005) causal conjunctions (along with adversive ones) were rarely used by both TD children and children with ASD. In cases those conjunctions were used, the ASD group performed lower than TD peers.

Interestingly, Diehl et al. (2006) also found that high-functioning children with ASD performed close to TD controls in a retelling task and tended to recall nearly the same amount of events that had causal relations. They also tended to recall events that had more causal connections to other events in the story. Another important finding of Diehl et al. (2006) was

that in TD children recall of the gist of the story correlated with connectedness, although this correlation was not found in ASD children. TD individuals tend to recall events that are part of the causal chain that leads from the beginning to the end, that is events which exhibit many causal relations to other events of the story and are central to the plot of the story and are thus necessary for the overall coherence of the story (Lorch et al., 1999). On the other hand, it is less likely that individuals recall more peripheral events which contribute less to the final outcome (Lorch et al., 1999).

Sah and Torng (2015) also found that children with HFA did not differ from TD peers in overtly marked causal relations. Furthermore, children with HFA showed a decreased tendency to include causal connections between events and a decreased tendency to produce events that had higher number of causal connections, resulting to less coherent narratives (Sah & Torng, 2015). In our data, children with ASD presented a similar pattern as they did not establish many links (e.g. causal ones) among story events. Even though causal terms and goal terms were present in narrations of children with ASD (and less of children with ADHD), they also included many incomprehensible utterances or their meaning was not clear.

Children with ASD have been found to face difficulties when narrating common events as they tend to produce factual information or personal experiences about what they are asked to narrate or they may appear to describe the pictures before them (Diehl et al., 2006; Loth et al., 2008). Children with ASD may also include inappropriate information and their narratives tend to remain rigid and narrower throughout their development. Nevertheless, there are mixed findings and it has been suggested that although children with ASD may be better at local processing, global processing may not necessarily be impaired (Loth et al., 2008). Children with ADHD despite producing narratives of comparable length to their TD peers, they have been found to produce fewer causal relations and more errors (Flory et al., 2006). Children with ADHD have difficulties in both understanding and organizing then their narration (Derefinko et al., 2014; Flory et al., 2006).

The difficulties in narrative production in children with ADHD have been found to correlate with sustained attention difficulties. Difficulties in sustained attention could be linked with difficulties in retaining the goal plan, resulting in children with ADHD not being able to retain the link among different pictures (Flory et al., 2006). Flory et al. (2006) suggested that a consequence of this difficulty in maintaining the goal plan among different pictures could lead children with ADHD approaching the pictures in front of them more like discrete events. Difficulties in sustained attention influence then the amount of cognitive

resources children with ADHD devote on storytelling (Lorch et al., 1999). Working memory deficits could also affect storytelling in ADHD, since impairments in working memory would result in more immediate connections among events being recalled at the expense of the broader connections governing the story (Lorch et al., 1999). Another possibility is that deficits in inhibition/suppression of secondary information, result in children with ADHD not being able to easily form a more coherent representation of the story (Lorch et al., 1999). These hypothesis regarded more retelling rather than free narration of a story, as this was the type of narrative assessment the researchers used. Nevertheless, both kinds of narrative tasks would be expected to be affected by limitations in cognitive resources in children with ADHD.

According to previous studies Lorch et al. (1999) referred to and according to their findings, difficulties are more pronounced when children with ADHD are called to recall a story, indicating among others that ADHD children are less sensitive to events that have many causal connections in relation to their TD peers. However, it was noted that factors like IQ and gender can as mediators in story recall. A similar picture was drawn in this study. According to the causal network analysis, it was shown that children with ADHD performed lower than TD children in nearly all measures in the free narration task. Higher performance was found in the amount of events recalled, attesting perhaps to the decreased amount of cognitive resources posed on the narrative task and the way these resources were allocated. However, according to the structural analysis, children with ADHD performed higher than their TD peers in nearly all measures of the free narration task. A possible explanation might be that children with ADHD may produce narratives with more structural elements, although these elements may not be causally related all of the times, leading to lower performance in units of goals, attempts and outcomes. In the analysis of the recall task this study indeed found lower performance in nearly all structural elements which come in agreement with Lorch et al. (1999).

- Linguistic feature analysis.

Linguistic feature analysis verified the shown differences among groups for the most part, as TD children were found to produce more temporal terms (being followed by children with ADHD and then by children with ASD) were included. In this category words (adverbs, conjunctions and connectives) and phrases that indicated time. In the vast majority of cases children in all groups used the Greek adverb “μετά” (/me'ta/, then) and many of the children also used the phrase “μια φορά και έναν καιρό” (/mıa fo'ɾa çe 'enan çe'ɾo/, once upon a time). Structural analysis showed that TD children had better sequencing in their free narrations,

while the linguistic feature analysis showed that ADHD children generated more temporal terms even though not always successfully.

These findings, along with problems in causal relation detection in children with ADHD and children with ASD may be linked to the aforementioned deficits in sustained attention in children with ADHD and the deficits in the detection of causal links in ASD mentioned before; those difficulties result in children producing narratives that seem more like descriptions of events (Derefinko et al., 2014; Diehl et al., 2006; Flory et al., 2006; Loth et al., 2008). Differences in the use of temporal conjunctions between TD children and children with ASD have also been found in Young et al. (2005), where the second in frequent cohesive device was temporal conjunctions. The ASD group in that study showed a tendency to include fewer temporal conjunctions in their narratives in relation to TD peers.

Temporal relations apart from causal ones are particularly important when trying to form coherent narratives (Sah & Torng, 2015). Children with ASD many times manage to cover their difficulty in narrative coherence as they are able to put events in an order (Sah & Torng, 2015). The fact that children with ASD manage to put events in an order along with their knowledge about scripts may have covered their deficits in narration, something that may be also linked with the smaller number of temporal terms used in narratives by these children. Additionally, van Lambalgen and Hamm (2004) noted that tense, aspect and temporal adverbials contribute to the overall coherence of the narratives and they entail the element of planning. This is a crucial observation, since both children with ADHD and children with ASD have difficulties in planning their narrative. Children with ADHD have difficulties in sustained attention and children with ASD face difficulties in ToM-taking into account listeners' perspective.

Devices children often employ in their narratives include direct speech, a linguistic device that was used only be few children in our sample. Direct speech has been claimed by Capps et al. (2000) to be a more advanced skill and according to our findings it was used more by children with ASD followed by TD children and then by children with ADHD. This is a surprising finding. Capps et al. (2000) found in their study that ASD children did not use such a device or other elevated devices as repetition and emphatics. Nordqvist (2001) indicated that a framed free speech can occur, meaning a clause that introduces the next one which is in direct speech. Another possibility is presence of free-standing utterances in direct speech. Direct and indirect speech often appear together while referring to past events and they arise in personal narratives and fictional contents. In such cases, direct speech and repetition have been claimed to be developmentally elevated devices and in our sample they

were often found to be used by children with ASD, ADHD and less by TD children. According to Nordqvist (2001) one possible explanation could be that it is easier for children to say what they think rather than use introductory verbs to make indirect speech when they want to state what characters may have said in the story.

Another linguistic device we examined in order to gain an insight into the linguistic abilities of our participants were subordinate clauses. The kind of subordinate clauses the participants used included clauses with relative pronouns (*who*) and other clauses with subordinate conjunctions like *when, because, in order to*. TD children included more subordinate clauses being followed by ADHD and then ASD children. It is worth mentioning that the ASD group not only produced less subordinate clauses, but they also produced some incomplete clauses, something that was traced in the other two groups but not to the same extent. Difficulties for ASD children in using complex syntax were also found by Capps et al. (2000).

Comparing the number of coordinating and subordinating conjunctions, led to the observation that the first group of conjunctions was pervasive in relation to the second type of conjunctions. Cain, Patson and Andrews (2005) and King, Dockrell and Stuart (2014) mentioned that conjunctions are used to show the semantic relations existing between propositions and sentences and help as such narrators maintain a common theme. Conjunctions were claimed to emerge approximately at the age of 5 years old with additive conjunctions (e.g. *and*) being first. Later, temporal, causal or adversative relations arise. What was noted is that the meaning of *and* is flexible, allowing children to use this term to encode other relations as well, such as temporal ones.

Narrations produced by participants of this study (between 4 and approximately 11 years old, as children with ASD were older) confirm what Cain et al. (2005) found about additive conjunctions. Findings indeed indicated that *and* comprised an important part of children's total number of conjunctions and it was used in many cases along with *then* in order to encode temporal relations. Young et al. (2005) also found that the additive and conjunction was the most frequent in both TD children and children with ASD, with the TD showing a tendency to include more times the specific conjunction in relation to the ASD group. Another important issue according to Bliss et al. (1998) is the inappropriate use of conjunctions which may lead to a confusion. In our free-narration samples there were some cases of wrong use of temporal and causal conjunctions. For instance, there was confusion in the sequence between two actions wrong to false use of the conjunction, resulting to difficulties in understanding which action happened first and which happened afterwards.

An interesting parameter of the findings was examining presence of ToM. We chose to examine the specific parameter as TOM and especially emotion recognition have been thought to be crucial in children's development and later social adjustment. We expected TD children to outperform the other two groups of participants, mainly because previous research has found problems in pragmatics and especially ToM in children with developmental disorders (Semrud-Clikeman & Schafer, 2000). According to Semrud-Clikeman and Schafer (2000), language is socially mediated and aids the communication of behavior and the communication of an emotion. It was also highlighted that when a child is grown up in a language that is emotionally rich he or she has a more advanced use of emotional language and understanding (Semrud-Clikeman & Schafer, 2000). Exposure to this kind of language and discussion of one's feelings enable children steadily to understand their feelings and then to communicate these feelings to other people (Semrud-Clikeman & Schafer, 2000). Apart from understanding one's own feelings it is essential that children acknowledge others' feelings as well. After children start recognizing emotional cues and facial expressions they connect a feeling to certain situations and they steadily become able to discuss emotions with other people (Semrud-Clikeman & Schafer, 2000).

For all of the above, emotional terms were thought to be particularly important for children with ADHD and children with ASD, as they have difficulties in recognizing emotional cues (which is the first step in the aforementioned procedures) (Semrud-Clikeman & Schafer, 2000). Children with ADHD and children with ASD are not able sometimes to negotiate meaning and to talk about their feelings and especially about other people's feelings. These difficulties could add to the already existing conduct problems they may have (Semrud-Clikeman & Schafer, 2000). According to Semrud-Clikeman and Schafer (2000), children by the age of 4 or 5 have a greater awareness of other's feelings, so we would expect our study participants, at least the TD ones, to recognize and/or acknowledge emotions in the story.

Children named frequently reactions of the characters appearing in the pictures, like cry or smile, but they did not always refer to the underlying emotion (e.g. sadness or happiness). However, children included more ToM terms relating to emotions rather than thoughts (only 2 terms and 1 term noted by the ADHD and the TD group indicated thoughts or beliefs of the characters respectively in the free narration task). No such terms were used by the ASD group. Thought terms seem to be more difficult for children, since emotion/desire terms (e.g. *mad, want*) are evident from approximately 18 months, whereas thought terms (e.g. *think, know*) arise by the 3rd year of life (Ensink & Mayes, 2010). In

general, more ToM terms were used by the ADHD children, being followed by the TD and then the ASD group. Although this finding was not anticipated, we need to bear in mind that some children made quite often repetitions during their narration, something that could have possibly influenced the results, especially for the ADHD group. These findings attest also to the internal responses we have examined in causal networks. Once more, the ADHD group produced more internal responses and was followed by TD and then ASD children.

Emotional terms used by the children most of the times arose near terms (verbs, adverbs, participle) that showed a facial expression (i.e. the man laughed because he was happy). This observation, along with the fact that children with ADHD and ASD often paid attention to heroes' facial expressions and labeled their reactions (cried, smiled) contradicts evidence that these two particular groups of children exhibit problems in the recognition of facial expressions (Pelc, Kornreich, Foisy & Dan, 2006).

However, this finding could be explained by the fact that story's plot was based upon characters' reactions that were quite distinct in the pictures. Moreover, basic emotions such as happiness and sadness were the only ones reported. Quintal (2001) and Gouin-De´carie, Quintal, Ricard, Deneault, and Morin (2005) cited in Thirion-Marissiaux and Nader-Grosbois (2008) studied the understanding of causes and consequences in four emotions (joy, sadness, anger and fear) among young TD children. Results in that study indicated that joy and sadness were more often recognized along with their results rather than the consequences. This is similar to what found also in our sample, as certain participants were able to recognize joy and sadness. What is more, participants often tended to link emotions with some reactions (e.g. smile, cry) or actions (e.g. "the mother went to the room to get the child because it was crying") which were projected as the cause for the emotions.

The question of whether children with ASD and even HFA really understand causal relations and types of emotional experiences was raised by Losh & Capps (2006). This question is relevant to the present study due to the problems in conjunctions (even though here we observed problems in causal conjunctions by children with ADHD as well), in ToM and the utterances that did not make sense. In the study of Losh and Capps (2006) children with ASD reported both emotional and non-emotional experiences and it was found that although children could map emotions to the appropriate context, they tended not to link their accounts in a personalized causal-explanatory manner. Researchers argued that emotional accounts resembled more script-like emotional accounts, where references to the causes of the emotions were absent. They thus questioned the depth of children's understanding of all kinds of emotional experiences. The question is whether the difficulties found emerge due to

an overall impairment in cause identification or from a more general difficulty in discussing past events (Losh & Capps, 2006).

- Implications for educational interventions.

Given the difficulties of children with ADHD and children with ASD in ToM and emotions, it is worth noting that intervention is of great importance. According to Izard, Trentacosta, King and Mostow (2004), poor emotion knowledge has been found as a risk factor for the development of social withdrawal and internalizing problems. Narratives can unravel difficulties in linguistic and thinking aspects of children's development but they can also prove a vital means in enhancing children's thought and language. According to research, storytelling in primary education can provide conceptual frameworks on which children can map their personal experiences and provide thus a model for both thought and language (Isbell, Sobol, Lindauer & Lowrance, 2004). Additional advantages of storytelling intervention include fluency, vocabulary acquisition and recall, concentration, ability to think symbolically and metaphorically, oral and written language development as well as reading and listening comprehension (Isbell et al., 2004).

Although the beneficial role of storytelling intervention has been replicated, there is evidence that more explicit intervention is necessary for individuals with ADHD. Derefinko et al. (2014) applied a story mapping intervention to adolescents with ADHD and found that participants were benefited in number of important events recalled, generation of inferences but there were not any differences in goal structure. Trentacosta and Izard (2007) argued that children with problems in attention often exhibit low scores in emotion knowledge tasks and in real social situations or academic tasks. This does not mean that they have lower abilities in cognitive and emotional abilities. It was suggested that this group of children will probably be assisted by specific training in understanding facial, behavioral, and situational cues regarding emotions. Typical treatments in the case of ADHD which is characterized by intense difficulties in attention, seem to be insufficient (Isbell et al., 2004). Simulant medication as well as interventions aimed at studying and note-taking skills have been proved inadequate for enhancing understanding at a global level (Isbell et al., 2004).

Considering the difficulties children with ASD face in social skills, the particular group of children may be deprived of opportunities for positive interactions with their peers (White et al., 2006). For this reason, a form of intervention that is probably the most helpful for children with ASD is explicit training. A type of intervention that has been suggested is *social skills training* (SST), which includes instruction of specific skills like maintaining eye contact and initiating conversation, through behavioral and social learning techniques (White

et al., 2006, p. 1859). Some techniques involved in SST is the instruction of simple social scripts that regard common situations, improvement of inappropriate social responding, instruction of social response scripts and use of modeling/role-play in order to teach specific skills (White et al., 2006).

However, ASD covers a wide range of individuals with varying abilities. In the case of HFA ToM may be learnt but after much effort (Solomon, Goodlin-Jones & Anders, 2004). Even then, individuals with HFA may face difficulties in giving appropriate responses in complex and rapidly evolving social situations. After appropriate intervention in children with HFA, Solomon et al. (2004) found increase of the ability to recognize facial expressions for simple emotions. The intervention curriculum addressed emotion recognition (including facial recognition), ToM (Including perspective taking) and executive functions (emphasis on problem solving).

Rice, Wall, Fogel and Shic (2015) also examined an intervention about facial recognition and employed the software *FaceSay*. They found that children with ASD showed improvements as in recognition of basic emotions and in mentalization abilities (ToM). *The Transporters* animated series was used by Baron-Cohen, Golan and Ashwin (2009) and Golan et al. (2010) in children with ASD. In both studies researchers found significant improvement for children with ASD in emotion recognition and comprehension. Moreover, in the second study, the difference between TD children and their peers with ASD after the intervention was not significant anymore. Additionally, children with ASD were able after the intervention to generalize their knowledge at a level similar to the TD children.

Based on the above information, training targeting specific areas that trouble children with ADHD and children with ASD can be very helpful, although children may not be always able to cover their difficulties. Finally, it is worth noting that the use of technology like in *The Transporters* above has appeared rather promising.

5.1. Limitations - Suggestions

This study aimed at examining narrative skills in preschoolers and children in the first year of school. Participants included TD children, children with ADHD and children with ASD. The sample was carefully matched for age and gender, although the group of children with ASD was very small and included high-performing children with ASD. This could have affected study's findings and their generalizability.

Based on the present study, it is imperative to examine both quantitative and qualitative data in future endeavors. Quantitative data could help us draw conclusions on well-established measures that are easily generalizable. Qualitative data are valuable as well, since they can give us detailed indications of language use. For example, this study detected indications of conjunctions being developmentally dependent, a finding worth exploring in future studies. Finally, future research should include larger groups of participants since populations under study (e.g. children with ADHD and children with ASD) are highly heterogeneous.

5.2. Conclusions

The present study aimed at examining storytelling abilities of children with ADHD and children with ASD in relation to TD peers. Both a retelling and a free narration task were administered to the participating children in order to observe structural characteristics of the narratives and find differences among the three groups. In addition, an aim of the present study was to examine whether children use causal networks while narrating, to see to what extent children use causal relations and whether differences arise among the three groups of participants. Finally, a linguistic feature analysis was carried out to trace linguistic devices that differentiate TD children from children with ADHD and children with ASD.

Results showed significant differences among the three groups of participants. TD children and children with ADHD differed significantly in reference to the problem, sequencing and vocabulary quality in retelling and in free narration they approached significance in reference to the problem, with the TD group outperforming the rest. Children with ASD and TD children differed significantly in vocabulary quality and their difference in reference to the problem in the retelling task approached significance, while no important differences were found in free narration. According to the model of causal networks, differences were traced in complete GAO units and G2+, between TD children and children with ADHD, with the TD group performing better.

However, based on our quantitative and qualitative analyses, in linguistic features like conjunctions and terms examined by ToM, we did not find any major differences and we thus tried to detect tendencies. Even though we expected TD children to perform better than the other groups overall this was not apparent. Children with ADHD seem to perform better than

TD children and children with ASD in areas like total number of words, emotional terms and conjunctions. Nevertheless, TD children outperformed the other two groups in the majority of measures like vocabulary quality, subordinate goals, sequencing, reference to the problem and number of verbs. Consequently, it is not entirely clear whether TD children produce richer narratives than the other two groups, a finding that is not entirely in agreement with existing literature. Conflicting evidence concerning TD children and children with ASD is also reported by King, Dockrell and Stuart (2014). Specifically, they referred to study findings indicating shorter, less complex narratives with fewer evaluative devices in the narratives of children with ASD and other studies unravelling only few differences when this group is matched on cognitive and linguistic abilities with TD children.

In general, although the ASD group in this study performed highly in both narrative tasks, more weaknesses were evident in the free-narration task. Difficulties characterizing children with ASD included, limited use of ToM terms, smaller number of conjunctions, more utterances that could not be coded as part of narrative's causal networks (and therefore included in the category "other"). All the aforementioned evidence could attest to the observation of Diehl et al. (2006) who argued that narratives of children with ASD are characterized by organization and coherence problems. However, their good memory skills aid their recollection of information in the case of the retelling task.

Structural analysis provided us with a more unified picture, offering a system to evaluate each narrative. Causal networks were also proved important since they examine how narratives are constructed based on temporal and causal relations. In this study however, causal relations seem not to characterize narratives produced by children of this young age and did not differentiate the narratives among the three groups. Finally, our linguistic feature analysis provided a very useful view of the children's narratives and indicated interesting elements that are worth studying further in future projects. In sum, all of the above findings need to be further examined and verified by other studies in the future.

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