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Review

Grammar in Adults with Neurodevelopmental Disorders: A Scoping Review from the Last 10 Years

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Abstract: Little is known of the trajectory of grammar in neurodevelopmental disorders (NDDs) once adulthood and language maturity are reached. Yet, impairments in grammar are reported in children with both communication NDDs, such as Developmental Language Disorder (DLD), and other NDDs, including ASD and ADHD. In the present study, we review studies collected in the last ten years on the grammar of adults with NDDs. Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines were applied. Included studies assessed sentence-level grammatical abilities through quantitative experiments on adults with a diagnosis of a developmental disorder. Out of 1550 contributions, 29 were selected. The studies included in the review showed that individuals with NDDs show a language deficit when compared to healthy adults. However, a lack of a unified approach to investigations of grammar prevents comparisons on the nature of the language disorder across NDDs, consequently highlighting the existence of a gap in knowledge. This gap must be filled to the benefit of speech pathologists and, ultimately, their patients.

Keywords: grammar; adulthood; neurodevelopmental disorder; ADHD; DLD

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1. Introduction

Grammatical skills in the adult speaker are investigated at great length when a traumatic event experienced in adulthood, such as stroke or brain injury, results in an interruption of some linguistic skills. When grammar is impaired, this condition is known as agrammatic aphasia (one of the many faces of aphasia, see Ardila 2010). Agrammatic aphasia is a diverse disorder with great individual variation, but it is generally understood to show some common patterns at the level of syntax (see Garraffa and Fyndanis 2020 for a review of findings), including difficulties both in the production and the comprehension of complex sentence structure (such as relative clauses and passives. Included but not limited to Caramazza and Zurif 1976; Caplan and Hanna 1998; Thompson 2003; Bastiaanse and van Zonneveld 2005; Caplan et al. 2007; Garraffa and Grillo 2008; Thompson and Choy 2009). Crucially, similar difficulties have also been reported in neurodegenerative conditions linked to dementia, including Primary Progressive Aphasia, Parkinson's Disease, and Mild Cognitive Impairment (Thompson et al. 2013; Grossman et al. 2000; Kemmerer 1999; Lieberman et al. 1990; Troche and Altmann 2012; Colman et al. 2009; Dick et al. 2018; Longworth et al. 2005; Ullman et al. 1997; Zanini et al. 2010; López-Higes et al. 2012; Sung et al. 2020), suggesting a similar trend is in place despite different types of disorder. Little is known about the adult grammar of neurodevelopmental disorders (NDDs).

As they are defined in the DSM-V, NDDs are a group of conditions with onset in the developmental period. The disorders typically manifest early in a child's life, often producing developmental deficits in several areas of the child's life including personal, social, and academic functioning (American Psychiatric Association 2013). Language disorder is one of the conditions that the DSM-V identifies as being strongly connected with NDDs across the board, together with memory, motor skills, social skills, and emotion

regulation. While grammar in children with NDDs, and communication NDDs in particular, has been the topic of much research in recent decades, little is known on the stage of cognitive maturity, which provides important indicators on the quality of the disorder.

In this scoping review, we will be investigating studies on grammar in adults with an NDD published in last decade. In the following sections, we will broadly review the main findings on grammar in children with NDDs, then we will present the studies selected that feature experimental investigations of grammar in adults with the same NDDs published in the last decade.

1.1. Grammar in Children with Neurodevelopmental Disorders

NDDs are disorders usually first diagnosed in infancy, childhood, or adolescence, that comprise different disorder types. The main disorder types as classified in the DSM-V are provided in Table 1.

Table 1. Neurodevelopmental disorder classification according to the DSM-V (American Psychiatric Association 2013).

NDD	Definition
Intellectual disabilities	Significant limitations in both intellectual functioning and adaptive behaviour. Typically comorbid with other disorders, including genetic disorders (Down Syndrome, Fragile X syndrome).
Specific learning disorder	Difficulties in reading, writing, maths. These include dyslexia, dysgraphia, and dyscalculia.
Communication disorder	Significant problems with processing, comprehending, and sending communicative symbols. They include language disorder, speech sound disorder, and social communication disorder.
Autism Spectrum Disorder	Deficits in social communication and interaction, nonverbal communicative behaviour, and in social relationships.
Attention-deficit/Hyperactivity Disorder	Persistent pattern of inattention and/or impulsivity and hyperactivity.
Motor disorders	Presence of tic disorders of a motor and/or vocal nature. These encompass Tourette's disorder, Developmental Coordination Disorders, and so on.

Although language disorders are a class of NDD, some disorders of language are reported in any condition tapping into the cognitive functions ancillary to language. The need for systematic investigations of language in these disorders is therefore crucial, as expressed in the call for action by Rice et al. (2005)

One of the areas that seems to be most affected is that of pragmatics. Impairments in pragmatics have been reported for children with ADHD (Helland et al. 2016; Willcutt 2018), where they are as frequent as 80% of children with ADHD (Green et al. 2014), and for Autism Spectrum Disorders (ASD), for which they are in fact one of the defining characteristics (e.g., Baird and Norbury 2016; La Valle et al. 2020). Disorders in structural language (or grammar) were thought to be mainly limited to Developmental Language Disorder (DLD). Simplifying grossly, DLD is characterized by delays in different areas of language, especially in morphosyntax, that are likely to persist as they move through childhood (Bishop 2017; Leonard 2014; Rice et al. 2004; Tomblin et al. 2003). Children with DLD have been shown to perform worse than age-matched controls on tasks of sentence repetition (Archibald and Joanisse 2009; Conti-Ramsden et al. 2001; Stokes et al. 2006;

among others), as well as on the production of specific grammatical phenomena (that Leonard and Kueser (2019) identify as those that include bare stems); prosodic challenges; gender and/or aspect; and deviations from canonical word order. These include, but are not limited to, tense marking, the production of pronouns, and the production of relative clauses (Wexler 1994; Rice and Wexler 1996; Bortolini et al. 2002, 2006; Leonard and Dispaldro 2013; Hamann et al. 2003; Jakubowicz et al. 1998; Garraffa et al. 2015, 2018; Abu Bakar et al. 2022). It is important to note that studies investigating grammar in DLD identify different patterns of accuracy but also of preferred structures (typically described as structurally simpler). For example, Contemori and Garraffa (2010) find that children with DLD who were elicited to produce relative clauses often divert to declarative clauses by omitting the relative complementizer and producing a sentence with no dependencies, as in Example 1.

(1)

Target:	Il bambino	che	pettina	il re
	The boy	that	combs	the king
'The boy that is combing the king('s hair)'				
Produced:	Il bambino		pettina	il re
	The boy		combs	the king
'The boy is combing the king('s hair)'				

Disorders in structural language are defining of DLD, but they have also been reported in other NDDs. Developmental Dyslexia (DD) is a communicative learning disorder which is characterized by poor decoding and spelling abilities (Hulme and Snowling 2009; Lyon et al. 2003; Scarborough 1990). Phonological awareness, letter knowledge, verbal memory and non-word repetition are identified as good predictors of the presence of the disorder in young children (Lyytinen et al. 2004; Snowling et al. 2003; Van Alphen et al. 2004). Besides extensive phonological deficits, children with DD have been reported to have morphosyntactic deficits, for example when dealing with verb inflection (e.g., Joanisse et al. 2000; Vender et al. 2017; Melloni and Vender 2022), and syntactic deficits such as relative clauses, agreement operations and noncanonical word orders (e.g., Bishop and Snowling 2004; Talli et al. 2013; Wiseheart et al. 2009; Wilsenach 2006; Reggiani 2010). Grammatical difficulties have also been reported in autism, for example in production of pronouns and the application of specific syntactic operations (Kjelgaard and Tager-Flusberg 2001; Durrleman et al. 2016; Perovic et al. 2013; Durrleman and Delage 2016; Perovic et al. 2013; Prévost et al. 2017; Tuller et al. 2017; Terzi et al. 2016), ADHD (DaParma et al. 2011; Helland et al. 2012; van Lambalgen et al. 2008), and Down Syndrome (DS, Laws and Bishop 2004; Ring and Clahsen 2005; Levorato et al. 2009).

1.2. Purpose and Research Question

Very few studies have investigated the trajectory of language impairment into adulthood in developmental disorders prior to the last decade, with the exception of DLD, where the impairment has been reported to be carried into adulthood. This was the case in Johnson et al. (1999)'s longitudinal study, which shows that approximately 70% of adults who were identified as having a speech or language disorder in childhood continued to demonstrate below-normal language skills at a 14-year follow-up, and in several studies on adolescents and adults with DLD (Stothard et al. 1998; Snowling et al. 2000; Young et al. 2002; Durkin and Conti-Ramsden 2007; Tomblin 2008; Brizzolara et al. 2011; Johnson et al. 1999; Clegg et al. 2005; Whitehouse et al. 2009; Stuart and van der Lely 2015). Information on the linguistic trajectory of other NDDs is few and far between (Altmann et al. 2008; Abbeduto et al. 2003). The description of the linguistic profile of adults with an NDD is therefore far from clear, and several crucial questions remain open. As summarized in 1.1, data from children suggest that difficulties in grammar in NDDs are not limited to communication disorders or intellectual impairments, but it is unclear whether the same is true into adulthood, or whether language maturity bridges some gaps in what seems otherwise to be a cross-sectional disorder. This information is particularly relevant for clinical purposes, as speech and language therapy services may be required in adult

individuals due to late diagnoses (as often happens in the case of ASD, Robison 2019) and to contrast the possible consequences of language impairment in the life of these individuals, ranging from high rates of unemployment to limitations forming and maintaining personal relationships (as evidenced in a systematic review by McCormack et al. 2009 and the literature therein). Secondly, it is unclear to what extent the language disorder at the level of grammar is similar across NDDs. On the one hand, a theoretical prediction could be made that communication disorders should present specific patterns compared to other NDDs; this should be the case specifically for DLD, which is, by definition, characterized by specific linguistic patterns. On the other hand, generalizations on grammatical abilities are hard to reach without systematic investigations, which have been seldom employed in the field. In this scoping review, we aim to explore the studies featuring analyses of grammar in adult NDD populations while attempting to answer the following questions: 1. Do adults with an NDD show a disorder of grammar across diagnoses? 2. Are similarities detectable in the grammatical profiles of adults with NDDs? Since the definition of NDDs and related conditions is greatly shaped in the clinical and academic community by the DSM, we will consider a timeframe of 10 years starting around the time of the publication of the latest version of the DSM-V (2012–2023).

2. Methods

This scoping review follows the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) (Moher et al. 2009) guidelines. The protocol for this review was published on PROSPERO (record number: CRD42022302802 on 13 January 2022, available at https://www.crd.york.ac.uk/prospero/display_record.php?ID=CRD42022302802).

2.1. Study Selection Process

For this review, database searches were conducted on the PsycInfo, Scopus, ERIC, Web of Science, Medline, and Embase databases. The research was conducted for the first time on 12 September 2021, and for the last time on 18 July 2023. Contributions written in English from 2012 onwards were searched, using the following search string: ("language impairment" OR "language disorder" OR "intellectual disability" OR "cognitive impairment" OR "autism" OR "down syndrome" OR "developmental disorder" OR "developmental delay" OR "communication disorder" OR "attention-deficit hyperactivity disorder" OR "learning disorder" OR "motor disorder") AND (gramma* OR synta*) AND adult*. Searches included title, abstract, and keywords in all databases except Web of Science, where searches are run through all fields. Relevant references in the revised papers were also considered for inclusion to manually add any relevant paper. Studies were included if they: a. explicitly investigated grammatical competence; b. featured exclusively adults/young adults, or a mixed-age group with mean age > 16; or c. had a control group or normative data.

Citations were downloaded and exported to Mendeley, where duplicates were automatically removed. The authors independently screened each title and abstract using a priori inclusion/exclusion criteria, and meetings were held between the reviewers to result in 100% consensus. First, title and abstract were screened, and entries were retained for full text review if they met the inclusion criteria. These were read in their entirety to be evaluated for eligibility. Any disorder that fell under the category of a NDD was potentially included, as well as genetic disorders with comorbid intellectual disorder (which is an NDD).

2.2. Full Text Review and Data Extraction Process

Two authors (G.S. and B.B.J.) undertook full-text review and data extraction. Extracted data were registered in an electronic Microsoft Excel spreadsheet. Demographic characteristics including age, education, language, cognitive tools, and clinical diagnosis were noted, as well as the clinical phenotype. Assessment tools and specific criteria used to assess cognitive function were extracted. Assessment tools and designed ad hoc tasks for grammatical abilities were extracted. The following language-related data were noted: investigated

language components, task methodology, and main outcomes. Two authors (G.S. and B.B. J.) independently evaluated the extracted data to assess whether to include or exclude each study following the aforementioned criteria. When they were not in agreement, a third author expressed their opinion.

2.3. Risk of Bias Management

To assess the scientific quality and risk of bias of the studies included in our review, the checklist for behavioural studies developed in de Beer et al. (2023) was adapted (Appendix A). The checklist has an overall score of 36. Studies were assigned a green light with a score of 75% or above (low risk of bias), a yellow light for a score of 51–75% (moderate risk of bias), and a red light for scores under 50% (high risk of bias). All papers included had a score above 85%.

3. Results

3.1. Study Selection and Outcomes Overview

Searches yielded 1546 entries, to which four entries were added manually, for a total of 1550. Following title and abstract screening and full-text review, 67 studies were selected as potentially meeting inclusion criteria. Study exclusion followed a three-step process. First, we excluded studies that were not relevant to the subject matter because they were either not on humans, not on language, or not on neurodevelopmental disorders (R1). Next, we excluded studies that did not feature adults or young adults (or with a mean age < 16 years), or did not have a control group (R2). Next, studies were excluded if they investigated areas of language other than grammar (i.e., investigations were word-level, or sentence-level pragmatics, semantics, or phonetics), or they were evaluations of assessments or interventions (R3). After full text screening, a further 38 studies were removed. Figure 1 illustrates the study selection process.

The following information was extracted from included studies: (a) authors, (b) title, (c) year, (d) disorder, (e) patient sample size, (f) patient demographics, (g) relevant clinical information, (h) type of task employed, and (i) outcome. A total of seven disorders were represented in the scoping review. Table 1 provides a summary of the featured disorders.

All studies reported data from samples where the mean age was >16. However, the age range of five studies started below 15 (Loveall et al. 2019; Sanoudaki and Varlokosta 2015; Durrleman et al. 2015; Bertho et al. 2014; Geelhand et al. 2020; Michael et al. 2012). Seven studies do not report the age range, but only standard deviation. Control groups are age-matched with adults, except for intellectual disability, the control group typically used in the literature is of children matched for either nonverbal intelligence and/or language.

All studies featured background cognitive measures. The most common IQ measures were the abbreviated version or subtests of the Wechsler Adult Intelligence Scale-III (Wechsler 1999) and the National Adult Reading Test (Nelson and Willison 1991), and digit ordering and digit spans for working memory. Most studies included background measures of general linguistic abilities. Frequently administered tests included naming and/or category fluency tests and receptive vocabulary tests, —the most common being the Peabody Picture Vocabulary Test (Dunn 1997) and the Boston naming test (Kaplan et al. 1983)—and sentence comprehension tests, most frequently (variations in) the TROG (Bishop 2003). Of the studies, 19 feature a specific linguistic task developed for the study, while others administer standardised batteries. Table 2 summarizes the information extracted for each study.

Table 2. Synopsis of data extracted from the selected papers. ID = intellectual disorder. WS = Williams Syndrome. DLD = Developmental Language Disorder. DD = Developmental Dyslexia. DS = Down Syndrome. ASD = Autism Spectrum Disorder. ADHD = Attention-Deficit/Hyperactivity Disorder. MA = Mental-age matched. NSp = not specified. RT = reaction time. NS = not significant. * = significance 0.0 ** = significance 0.00. *** = significance < 0.001.

Reference (Authors, Year)	Disorder	Relevant Clinical Information	Sample Size (Controls)	Age in Years (SD)	Edu in Years (SD)	Tasks	Language(s) Tested	Primary Outcomes of Grammar	Group Differences
(Altman et al. 2022)	ID		17 (16)	41.65 (8.85) 24.87 (1.82).	NSp (University)	Narrative task (MAIN)	English	Number of produced sentences Number of clauses per sentence Grammaticality	Number of produced sentences * Grammaticality ** Number of clauses per sentence NS
(Bertho et al. 2014)	WS	WS participants were positive on the FISH test for elastin deletion.	18 (18 MA 18)	21.10 (4.6). 11.2 (3.1) 21.10 (4.7)		Grammaticality judgment task (tense agreement, person agreement, verb morphology, etc.)	French	Accuracy in grammatical vs. ungrammatical	Accuracy vs. CA controls *** Accuracy vs. MA controls ***
(Botting 2020)	DLD		83 (86)	24 (NSp)		Clinical evaluation of Language Fundamentals (CELF-4)	English	Core Language Index	Core Language Index ***
(Canette et al. 2020)	DD	All dyslexic participants had developmental dyslexia and reported having seen a speech therapist for the diagnosis and for training sessions designed to reduce reading difficulties for at least two years during childhood.	13 (13)	23.2 (2.95) 22.5 (2.07)	14.92 (1.55)	Grammaticality judgment (S-V agreement)	French	Accuracy in grammatical vs. ungrammatical	Accuracy *** Interaction between grammaticality and group at trend

Table 2. *Cont.*

Reference (Authors, Year)	Disorder	Relevant Clinical Information	Sample Size (Controls)	Age in Years (SD)	Edu in Years (SD)	Tasks	Language(s) Tested	Primary Outcomes of Grammar	Group Differences
(Cantiani et al. 2013a)	DD	Participants with dyslexia reported a history of difficulty with reading and spelling (10th percentile or lower on a standardized text reading speed and comprehension test (Lesegeschwindig-keits- und Verständnistest für die Klassen 6–12 [LVGT 6–12]; Schneider et al. 2007) and/or on a standardized spelling.	17 (17)	24.02 (2.97) 24.31 (2.85)	NS	Grammaticality judgment (S-V agreement with manipulation of the acoustic salience of the verbal inflection)	Italian	Accuracy RT	Accuracy NS RT **
(Cantiani et al. 2013b)	DD	Participants with DD had been referred to the Unit of Cognitive Psychology and neuropsychology because of learning difficulties during childhood and had been diagnosed as dyslexics based on standard inclusion and exclusion criteria (normal IQ, reading scores below 2 SD with respect to age norms, absence of neurological and sensoneural disorders, inadequate schooling and sociocultural opportunity) by an expert clinician using ICD-10 (World Health Organization 1992).	16 (16)	22.67 (2.29) 22.36 (3.48) (NSp)	14.06 (2.74)	ERP during Grammaticality judgment (S-V agreement)	Italian	Accuracy in grammatical vs. ungrammatical	Overall accuracy * Ungrammatical sentences * Grammatical sentences NS

Table 2. *Cont.*

Reference (Authors, Year)	Disorder	Relevant Clinical Information	Sample Size (Controls)	Age in Years (SD)	Edu in Years (SD)	Tasks	Language(s) Tested	Primary Outcomes of Grammar	Group Differences
(Christodoulou and Wexler 2016)	ID and DS	Down syndrome (trisomy 21) and moderate mental disability (Raven's IQ test).	15 (15 MA)	19–45 7–8	NSp	Task of elicited production, imitation production, free elicitation, act out, narratives oh phonology, phonetic and syntactic level	Greek	Accuracy case production	Nominative case production ** Production matching target for accusative ** Production matching target for genitive **
(Christodoulou and Wexler 2023)	DS	Down syndrome (trisomy 21) and moderate mental disability (Raven's IQ test).	15 (15 MA)	19–45 7–8	NSp	Elicitation task of copula production	Greek	Copula omission Copula accuracy	Copula omission ** Copula accuracy NS
(Durrleman et al. 2015)	ASD	Diagnosed with ASD according to DSM-IV-TR criteria (American Psychiatric Association 2000) as well as ADOS-G (Lord et al. 1994).	18 10 with LI (28)	21.8 (7.8) 21.11 (7) 22.07 (7)	NSp	Sentence-picture matching task (relative clauses)	French	Accuracy	Accuracy vs. controls *** Accuracy ASD with LI vs. ASD without LI **
(Engelhardt et al. 2012)	ADHD	Adult who had had ADHD but no longer met the DSM-IV diagnostic criterion and adult who still met the diagnostic criteria for ADHD.	44 21 remitted (20)	22.91 (3.82) 24.14 (4.94) 23.60 (4.99)	NSp	Sentence production task (active and passive)	English	Number of ungrammatical sentences	ADHD "remitted" vs. ADHD * ADHD "remitted" vs. control *
(Geelhand et al. 2020)	ASD	Clinical diagnosis of ASD was confirmed by a research-accredited ADOS assessor using Module 3 or 4 of the ADOS-2.	18 (18)	28.90 (11.80) 28.79 (11.84)	NSp	Narrative task (ADOS-2)	French	Number of words Number of syntactic sequences Number of syntactic unit Number of incomplete dependencies clauses	Number of words *** Number of syntactic sequences * Number of syntactic unit ** Number of incomplete dependencies clauses **

Table 2. *Cont.*

Reference (Authors, Year)	Disorder	Relevant Clinical Information	Sample Size (Controls)	Age in Years (SD)	Edu in Years (SD)	Tasks	Language(s) Tested	Primary Outcomes of Grammar	Group Differences
(Geelhand et al. 2021)	ASD	Clinical diagnosis of ASD was confirmed by a research-accredited ADOS assessor using Module 3 or 4 of the ADOS-2.	12 (12)	34.71 (12.71) 36.56 (10.87)	NSp	Semi-structured tasks, friends, Relationships, and Marriage and Solitude administered during the standard procedure of the ADOS-2	French	Number of words Number of syntactic sequences Number of syntactic unit Number of discourse-structuring devices Number of adjunct Number of BDU (basic discourse units) Number of silent-BDU	Number of words *** Number of syntactic sequences *** Number of syntactic unit *** Number of discourse-structuring devices ** Number of adjunct ** Number of BDU ** Number of silent-BDU **
(Hall et al. 2019)	DLD		17 (16)	20.7 (1.1) 21.0 (1.9)	13.9 14.1	Sentence processing with mouse tracking (PP attachment)	English	Accuracy of comprehension Sensitivity to verb bias	Accuracy NS Sensitivity to verb bias *
(Lee et al. 2018)	ASD	Previous clinical diagnosis confirmed by administration of the Autism Diagnostic Observation Schedule (ADOS) and/or the Autism Diagnostic Interview–Revised (ADI-R).	19 (14)	24.22 (9.48) 19.11 (2.20)	NSp	Storytelling assessment from the Thematic Apperception Test	English	Number of words Use of complex syntax Use of coordinate and adverbial clause	Number of words * Use of complex syntax ** Use of coordinate and adverbial clause ***

Table 2. *Cont.*

Reference (Authors, Year)	Disorder	Relevant Clinical Information	Sample Size (Controls)	Age in Years (SD)	Edu in Years (SD)	Tasks	Language(s) Tested	Primary Outcomes of Grammar	Group Differences
(Loveall et al. 2019)	DS, ID	School classification or clinical diagnosis of ID.	35 27 (29)	15.83 (2.91) 16.07 (2.49) 5.24 (0.72)	NSp	Picture-story description task	English	Verb density Verb type-token ratio Lexical verb density Verb diversity Lexical verb diversity Lexical verb TTR	Verb density DS vs. TD * Verb type-token ratio DS vs. ID * Lexical verb density DS vs. TD * Verb diversity NS Lexical verb diversity NS Lexical verb TTR NS
(Martzoukou et al. 2017)	ASD		20 (20)	29.8 (10.7)	14.25 (2)	Sentence completion task (subject/object NP ambiguity)	Greek	Accuracy RT Prosodic cue sensitivity	Accuracy Prosodic cues * RT ***
(Martzoukou et al. 2020)	DS		20 (20 MA 20 verbal ability level matched)	28.2 4.2 5.10	NSp	Story telling task (LITMUS-MAIN tool first two stories)	Greek	Microstructure variable (content words, function words, MLU, adverbial clauses, relative clauses, complement clauses) sentence repetition task comprehension questions	DS vs. TD verbal ability level matched microstructure variable *** comprehension questions ** DS vs. controls Sentence repetition task ***

Table 2. *Cont.*

Reference (Authors, Year)	Disorder	Relevant Clinical Information	Sample Size (Controls)	Age in Years (SD)	Edu in Years (SD)	Tasks	Language(s) Tested	Primary Outcomes of Grammar	Group Differences
(Michael et al. 2012)	DS		9 (9 receptive vocabulary aged matched)	18.9 (NSp) 6.1 (NSp)	NSp	1st PPVT–4,a digit-span task, a word-span task, a sentence-repetition task, a single word-naming task, and the hearing screening. 2nd a digit-span task that required, nonverbal response, a word-span task with nonverbal response, a spatial-memory task, a single-word comprehension task, a grammaticality judgment task, and a narrative task	English	Noun comprehension task Verb comprehension task Noun naming task Verb naming task Target sentences containing verbs ((Narrative) Obligatory argument structure	Noun comprehension task NS Verb comprehension task NS Noun naming task NS Verb naming task NS Target sentences containing verbs (Narrative) * Grammaticality judgment * obligatory argument structure **
(Miranda et al. 2013)	ADHD	ADHD clinically diagnosed in childhood.	26 (26)	18–24 (NSp)	NSp	Composition of a written narration based on short story number 11, "Shark", from the WAIS III (Wechsler 1999).	Spanish	N. of different words Mean length of T-unit Subordinate clauses Morphosyntactic errors Type–token ratio Total story grammar	N. of different words * Mean length of T-unit * Subordinate clauses * Morphosyntactic errors * Type–token ratio NS Total story grammar *

Table 2. *Cont.*

Reference (Authors, Year)	Disorder	Relevant Clinical Information	Sample Size (Controls)	Age in Years (SD)	Edu in Years (SD)	Tasks	Language(s) Tested	Primary Outcomes of Grammar	Group Differences
(Perovic and Wexler 2019)	WS, DS		6 6 (6)	38, 30 (NSp) 3 4.6	NSp	Sentence-picture matching task (passive clauses)		Accuracy	Accuracy DS ** Accuracy DS vs. WS ** Accuracy WS vs. controls NS
(Poll et al. 2015)	DLD	Participants were classified as SLI with a positive history of language difficulties and scores in the affected range on language ability tests. Reported language difficulties were either a prior diagnosis of SLI (14 cases from the Iowa registry) or difficulties with reading comprehension (four cases) or spoken grammar (two cases).	20 (23)	22.5 (2) 21.5 (1.8)	13.1 (1.1) 14.5 (0.9)	Truth value judgment task (active, passive, compound subject structures)	English	Accuracy RT	Accuracy NS RT NS
(Poll et al. 2015)	DLD	Individuals in the group with DLI reported a history of language difficulties (prior diagnosis of DLI (14), difficulties with reading comprehension (4) or spoken grammar (2)).	21 (22 age-matched CA)			Self-paced listening task (noun argument vs. verb adjunct processing)	English	Accuracy on comprehension questions RT	RT NS
(Sanoudaki and Varlokosta 2015)	DS	Cognitive abilities ranging from average to high (with regard to the range typical for this clinical population)	14 (14 productive vocabulary matched)	20.02 (7.6) 5	NSp	Sentence-picture matching task (pronouns)	Greek	Accuracy in: Clitic condition Reflexive condition Reflexive with two nouns condition Control condition	Clitic condition NS Reflexive condition ** Reflexive with two nouns condition NS Control condition NS

Table 2. *Cont.*

Reference (Authors, Year)	Disorder	Relevant Clinical Information	Sample Size (Controls)	Age in Years (SD)	Edu in Years (SD)	Tasks	Language(s) Tested	Primary Outcomes of Grammar	Group Differences
(Schiff and Ravid 2013)	DD	Dyslexia assessed 3 years prior to attending university or while attending university	30 (30 30 6th graders)	23.5 (1.83) 12.4 (3.2)	NSp (University) 6	Morphological production task (noun-adjective pluralization)	Hebrew	Accuracy of noun plurals and adjective agreement RT	Noun plurals * adjective agreement * RT *
(Schiff et al. 2015)	ADHD	Diagnosed by university disability service	35 (36)	26.67 (7.46) 25.82 (5.32)	NSp (University)	Grammaticality judgment task (noun-adjective agreement)	Hebrew	Accuracy in grammatical vs. Ungrammatical RT	Accuracy ** RT **
(Slocombe et al. 2013)	AS	All participants were previously diagnosed by a clinical psychologist, psychiatrist or paediatrician following an evaluation of communication, reciprocal social interactions and repetitive behaviours. No participant had received a clinical diagnosis of a co-morbid behavioural or motor disorder.	17 (17)	26.41 (9.08) 22.25 (2.70)	NSp NSp	Syntactic alignment task Lexical and Frame of Reference Alignment Task	English	Percentage of syntactic alignment-the percentage of trials where the participants used the same sentence structure as the immediately previous prime.	Syntactic and lexical alignment NS
(Stella and Engelhardt 2019)	DD	Self-reported dyslexia.	50 (50)	24.7 (5.1) 20.7 (3.1)	NSp (University)	Sentence comprehension with eye tracking (temporary syntactic ambiguity)	English	Accuracy with ambiguous and unambiguous sentences Reading Times	Accuracy ambiguous sentences ** Accuracy unambiguous sentences ** RT **

Table 2. *Cont.*

Reference (Authors, Year)	Disorder	Relevant Clinical Information	Sample Size (Controls)	Age in Years (SD)	Edu in Years (SD)	Tasks	Language(s) Tested	Primary Outcomes of Grammar	Group Differences
(Suddarth et al. 2012)	DLD	Assessment of language impairment through standardized tests.	Study 1 30 (30) Study 2 48 (29)	25.3 24.4 22.4 27.4	12.7 13.1	Written Narrative Elicitation task	English	Number and percentage of words and sentences	Study 1 number of words NS percentage of total verbs *** percentage of one-part verbs *** verb phrase ellipses *** percentage of total nouns ** percentage of passives * Total number of sentences NS Number of errors * Study 2 number of words NS percentage of total verbs NS percentage of one-part verbs NS Number of errors ***
(Wiseheart and Altmann 2018)	DD	Participants both with formal diagnosis and life-long difficulties with reading and writing but no formal diagnosis.	23 (28)	16–28 (NSp)	NSp (university)	General language battery including sentence formulation from 3-word stimuli (different verb type with animate and inanimate noun)	English	Accuracy with all type of verbs RT	Accuracy *** RT ***

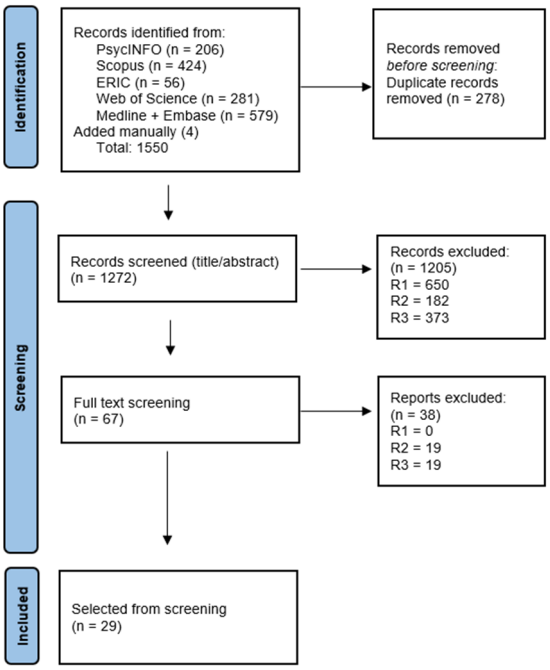

Figure 1. PRISMA flow diagram displaying the study selection process (adapted from Page et al. 2021). R1 to 3 are described in Section 3.1.

Participants with dyslexia reported a history of difficulty with reading and spelling (10th percentile or lower on a standardized text reading speed and comprehension test (Lesegeschwindig-keits- und Verständnistest für die Klassen 6–12 [LVGT 6–12]; (Schneider et al. 2007) and/or on a standardized spelling.

3.2. Grammar in Adults with NDDs

3.2.1. Communication Disorders

Studies on adults with DLD included in this review show mixed results. As part of a larger investigation, a measure of grammatical proficiency is extracted from the core language index of the CELF-4 for a large sample of adults with DLD in Botting (2020), where DLD participants are found to have significantly lower scores than their controls. A difference from controls was also found in written narratives in Suddarth et al. (2012), where participants produced written narratives elicited through picture sets. Different measures were analysed in the study, including the percentage of total verbs, total nouns, percentage of passives, and more. DLD participants were different from controls across all measures except total number of sentences and total number of words. In the second part of the study, where a second sample of participants was tested, only the measures with the most reliability were retained. Interestingly, with this analysis, only the number of errors produced in the written text was significant. It must be noted that what was categorised as "error" was not necessarily syntactic in nature, as errors of this kind (for example errors in verb tense) were accompanied by errors of punctuation, self-corrections, etc. Conversely, no difference between adults with DLD and healthy adults is reported in Poll et al. (2015) in a grammaticality judgement task (both accuracy and reaction times, RTs) and in a comprehension task following self-paced reading as well as in accuracy in a sentence-picture matching task in Hall et al. (2019). Here, adults with DLD were compared to healthy adults on sensitivity to verb cues in PP attachment disambiguation (modifier or instrumental reading). PP attachment was cued by verb meaning in a sentence–picture matching task (e.g., *the elephant pokes the camel with the feather* has a modifier reading given by the meaning of the verb *to poke*). While accuracy was similar between groups, however, online sensitivity to verb cues as measured by mouse curvature was lower in adults with DLD.

All studies included on dyslexia (developmental dyslexia, DD) show a group difference with healthy controls across different tasks. In Wiseheart and Altmann (2018), participants completed a general language battery which contained a measure of grammar in a constrained sentence-production task where three-word stimuli (a verb in the past participle and two nouns) were given. Adults with DD were found to be considerably less precise as well as slower in RTs than controls in producing grammatical sentences. The grammatical operation of agreement, and S-V agreement in particular (e.g., *the child.SG is.SG/*are.PL playing*), was tested in Cantiani et al. (2013a, 2013b) and Canette et al. (2020). Cantiani and colleagues utilised a grammaticality judgement task on Italian. In the 2013a study, participants with DD were less accurate than controls in detecting ungrammatical sentences. In the 2013b study, where acoustic salience of the verbal inflection was manipulated, participants with DD were slower than controls, but not significantly less accurate. S-V agreement was also investigated in French DD participants in Canette et al. (2020), where accuracy was considerably worse in DD than in control participants. In Stella and Engelhardt (2019), adults with DD were tested on a garden-path reading task with optionally transitive and reflexive verbs (e.g., *While Susan wrote the letter that was long and eloquent fell off the table,* optionally transitive (*to write*)). DD participants were overall less accurate than controls, showing below-chance performance on most conditions. The eye-tracking measures showed DD had longer first pass reading times, overall higher reading times, and an interaction between sentence structure and reading time. Morphological abilities were measured in adults with DD in Schiff and Ravid (2013) with a task on person agreement on nouns and adjectives in Hebrew, where participants were asked to produce plural morphology on stems. Participants with DD were worse in producing the correct morphology in both conditions and were also slower than controls.

3.2.2. ADHD and ASD

Most studies included report adults with ADHD and ASD to have lower accuracy and less complex grammar compared to controls. In Schiff et al. (2015), ADHD and typical participants were compared on a Truth Value Judgement Task with sentences with Noun–Adjective agreement violations on plural morphology in Hebrew, with manipulation on suffix regularity (high to low) and syntactic position of the adjective (attributive initial, attributive final, predicative). The ASD participants were less likely to follow prosodic, but not morphosyntactic cues to produce licit sentences. ADHD participants were less accurate than controls and were more likely to show a decrease in performance as suffix regularity diminished and adjective position changed. Sensitivity to S-V agreement morphology was explored in Martzoukou et al. (2017), were ASD participants were compared to controls in a sentence completion task featuring ambiguous (subject/object) NP readings in Greek (e.g., *While (s)he was sewing the buttons/((s)he)) slipped on the floor*) which are resolved at the level of the verb (*slipped* bearing either singular or plural morphology). Complex structures were investigated in Engelhardt et al. (2012) and Durrleman et al. (2015). In Engelhardt et al. (2012), three ADHD groups (ADHD primarily attentive, ADHD combined, ADHD remitted) were found to be worse than controls in the primed production of (active and) passive sentences, with ADHD remitted being the significantly lowest performers. In Durrleman et al. (2015), adults with ASD were significantly less likely to reach ceiling than controls on a sentence comprehension task featuring different types of relative clauses. The narrative abilities of adults with ASD were investigated in Geelhand et al. (2020, 2021) and in Lee et al. (2018). Geelhand et al. (2020, 2021) employed parts of the ADOS-2 battery (Lord et al. 2012) and coded results for specific measures of grammar, including the number of syntactic units and number of incomplete dependencies. Differences between groups were significant across the board, with ASD participants showing fewer syntactic units, more incomplete dependencies, fewer adjuncts, and so on. Similar results were found in Lee et al. (2018), where individuals with ASD produce significantly fewer coordinate and adverbial clauses and 'complex syntax' than controls on a picture-story description task. Narrative abilities of adults with ADHD were investigated in Miranda et al. (2013) and

were found to produce more morphosyntactic errors and fewer subordinates than controls in a written narrative task.

3.2.3. ID

Studies on adults with an ID were mostly on adults with Downs Syndrome (DS) or Williams Syndrome (WS). It must be noted that, unlike the studies seen so far, comparison groups for ID are mostly mental-age-matched children. This is because there is a general consensus that the behavioural phenotype associated with ID is one of cognitive delay and difficulties in expressive language that are not consistent with the chronological age of the individuals (see Chapman and Hesketh 2000). All studies report a difference between individuals with an ID and controls.

In Christodoulou and Wexler (2016), adults with DS are tested on a series of tasks eliciting case production in Greek, and in Christodoulou and Wexler (2023) on copula omission. DS showed higher levels of copula omission than controls, and accuracy in case production was lower in DS than in controls. As pointed out by the authors, however, significance was likely due to ceiling effects. In Sanoudaki and Varlokosta (2015), DS participants were compared to vocabulary-matched child controls on the interpretation of reflexive pronouns in Greek using sentence matching tasks, where children are asked to select the correct picture for a sentence containing a pronoun (e.g., *the princess is touching herself*). Accuracy was lower in DS adults. Interestingly, this was not the case for the control object pronoun condition (e.g., *the princess is touching her*), which might signal the presence of a specific morphosyntsactic problem and not just a pragmatic one (see, for instance, Terzi et al. 2016). Perovic and Wexler (2019) tested the comprehension of passive clauses in six adults with DS and six with WS. In this study, a significant effect of group was found in DS vs. controls but not WS vs. controls. Michael et al. (2012) employed a series of tasks including a grammaticality judgement task with sentences containing illicit and licit argument omissions, where DS participants were less accurate than controls in detection of grammaticality. In Altman et al. (2022), participants with ID had lower grammaticality scores in the MAIN narrative task (Gagarina et al. 2012). Narrative abilities of adults with DS are investigated in Loveall et al. (2019), Michael et al. (2012), and Martzoukou et al. (2020). DS participants use fewer verbs, have lower verb type-token ratio, shorter MLU, and generally lower scores on microstructure values compared to controls across the board.

4. Discussion

In this scoping review, we collected the results of studies from the last 10 years that contained measures of grammar in adults with an NDD. Our first aim was to check whether grammatical abilities of individuals with NDDs were found into adulthood. Results presented suggest that adults with a NDD generally show lower accuracy and grammatical completeness compared to healthy controls in elicited and narrative production, comprehension, and in grammaticality judgement, as confirmed by most of the studies featured, which present an effect of group across the board. Adults with a diagnosis of NDD are considerably less accurate than healthy controls on comprehensive assessments of language, which include measures of grammar as well as on experiments testing finer-grained grammatical competence. The results are mostly consistent across disorders as well as across tasks. This is true across studies using grammatical assessments, studies with an outcome of accuracy on tasks designed for the study, which were mostly Grammaticality Judgement Tasks, and studies employing narrative tasks. The abilities tested where adults with NDDs are worse than controls range from identification of syntactic violations, mostly on S-V agreement, and the production of sentences of increased syntactic complexity. Therefore, individuals with an NDD seem to carry some form of grammatical disorder found in children into adulthood, suggesting this is not a stage that children with an NDD overcome with age, but rather, to some extent, a characteristic of the disorders, such as avoidance of complex structures, and lower accuracy on some grammatical operations such as agreement. Another question that was raised in the present review was whether

there were qualitative similarities in the grammatical profiles of adults with NDDs across different disorders. The results described above are found in communication disorders, in genetic disorders that are typically co-morbid with IDs, such as Down Syndrome, as well as in NDDs that are not specifically linguistic in nature, such as attention disorders.

If true, this finding would have crucial implications for both the clinical diagnosis and the description of the disorders, and for speech and language therapy. However, a crucial point that emerges is that studies exploring grammar in NDDs are still very inconsistent in the outcomes measured and the methodologies employed. Language abilities of neurodiverse adults are sometimes investigated with the employment of standardized assessments of language (2 out of the 29 studies). Although these are important tools for clinicians, as they are designed to detect language disorders, they encounter issues of construct validity (see Aryadoust 2023 for a recent account). Narrative tasks, on the other hand, have great potential for exploring different patterns among participants, and they are employed in several studies on grammar for this very purpose (particularly in aphasia, Saffran et al. 1989; Schwartz et al. 1994; Marini et al. 2011). They are also used consistently in speech and language therapy practice, where language sample analysis is frequently used as the gold standard measure of communicative competence (Miller et al. 2016). However, the procedure for the analysis of discourse differs across studies, from productivity (verb count, MLU) to different approaches to the measurement of sentence complexity, making them once again hard to compare. A similar point can be made for Grammaticality Judgement Tasks that, rather than measures of grammatical abilities, have been proposed to be a measure of metalinguistic awareness (see Marshall and Morton 1978; Tunmer and Herriman 1984 for seminal works in this area[1]). Other methodologies that are known to be useful to investigate grammatical abilities are virtually absent from this scoping review. These include sentence repetition and syntactic priming (Rujas et al. 2021; Garraffa and Smith 2022).

Another point we can note is that level of education is often not reported for the participants featured in this review. However, level of education is a factor which is at the very least suggested to be associated with the cognitive functions related to language and language abilities (Opdebeeck et al. 2016; Lövdén et al. 2020), and should therefore be considered as a factor when matching adults with NDDs with controls.

Of the studies exploring sentence comprehension or production in a controlled setting (elicitation, priming, or comprehension), there is little convergence on the structures investigated, with structures varying from PP attachment to N-Adj agreement to structures like passive and relative clauses, which are more utilized in studies investigating grammatical complexity because of their known effects even in typically developing children (e.g., Durrleman et al. 2017; Ambridge et al. 2021 on passives; Novogrodsky and Friedmann 2006; Contemori and Garraffa 2010 on relative clauses; Moscati et al. 2020; Rispens and Been 2007 on agreement and many more). Studies are also across different languages, but are not sufficiently similar in methodologies for cross-linguistic comparisons, and are too few for language-specific considerations.

Another point that makes comparisons impossible in the current literature is that very few of these direct comparisons exist in the literature itself: only four of the studies contain more than one profile of NDD. Therefore, despite the interest in neurodevelopmental disorders which has arisen in recent decades, and the call for a systematic investigation of grammar in NDDs in the seminal paper by Rice et al. (2005), little progress has been made in theory-driven systematic investigations that would allow us to describe the differences and similarities in the grammatical profile of different disorders.

5. Conclusions

The topic of grammar abilities in neurodiversity has gained considerable momentum in the last decade, but only a few studies explore the trajectory of language development in these individuals, and the picture of grammatical difficulties in neurodevelopmental conditions is still underdefined. In this scoping review, we collected recent studies that aimed to

bridge this gap in scientific knowledge published in the last 10 years, approximately from the publication of the latest version of the DSM. The studies collected overwhelmingly find individuals with an NDD to have a persistent difficulty in language even in adulthood when compared to healthy adults. This finding is crucial for clinical purposes, since it suggests that a disorder of grammar in NDD is not simply a product of language delay. Unlike studies in aphasiology, however, where methodologically rigorous approaches to the investigation of grammatical abilities have been adopted systematically, it is clear from this scoping review that no unified approach to research on grammar in adults with an NDD exists. For this reason, while this scoping review reveals the existence of a language disorder across the board, it is still not possible to make clear assumptions on how similar the language of adults with different NDDs really is. This review has revealed the presence of a pocket of research that needs to be addressed. More studies are needed that consistently and coherently test similar structures across disorders as well as across the individuals' lifespan.

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Appendix A

Table A1. Checklist for assessment of bias (adapted from de Beer et al. 2023).

Section	Item	Score (1/0)
abstract	summary of the study	
introduction	issue under analysis	
introduction	current scientific knowledge	
introduction	gaps in that knowledge base	
introduction	purpose/aims of the study	
introduction	research question	
introduction	hypotheses	
method	identification of the design	
method	inclusion exclusion criteria	
method	method of recruitment	
method	demographics	
method	clinical information	
method	sample size	
method	participant groups	
method	characteristics of the procedure	
method	location it was conducted	
method	description of tasks	
method	reasonable justification of methods	
method	ethics	

Table A1. *Cont.*

Section	Item	Score (1/0)
method	informed consent	
method	definition of target behaviours and outcome measures	
method	clear description of any equipment	
method	clear description of any materials	
method	number of items in testing material	
method	careful description of linguistic material	
method	description of grammatical analyses	
method	grammatical analyses	
method	description and justification of all statistical methods used	
results	for each group, results	
results	results of any other analyses	
discussion	summary of findings and interpretation of the results in the context of current evidence	
discussion	interpretation consistent with results	
discussion	discussion of limitations	
discussion	discussions of applicability and implications or future research	
funding and registration	sources of funding	
funding and registration	registration number	
total		x/36

Note

[1] We thank our anonymous reviewer for this observation.

References

Abbeduto, Leonard, Melissa M. Murphy, Stephanie W. Cawthon, Erica K. Richmond, Michelle D. Weissman, Selma Karadottir, and Anne O'Brien. 2003. Receptive Language Skills of Adolescents and Young Adults with Down or Fragile X Syndrome. *American Journal on Mental Retardation* 108: 149–60. [CrossRef] [PubMed]

Abu Bakar, Norsofiah, Giuditta Smith, Rogayah A. Razak, and Maria Garraffa. 2022. The comprehension and production of Wh-questions among Malay children with developmental language disorders: Climbing the syntactic tree. *Frontiers in Psychology* 13: 948992. [CrossRef] [PubMed]

Altman, Carmit, Ilanit Avraham, Shlomit Shnitzer Meirovich, and Hefziba Lifshitz. 2022. How do students with intellectual disabilities tell stories? An investigation of narrative macrostructure and microstructure. *Journal of Applied Research in Intellectual Disabilities* 35: 1119–30. [CrossRef] [PubMed]

Altmann, Lori J. P., Linda J. Lombardino, and Cynthia Puranik. 2008. Sentence Production in Students with Dyslexia. *International Journal of Language & Communication Disorders* 43: 55–76. [CrossRef]

Ambridge, Ben, Amy Bidgood, and Kate Thomas. 2021. Disentangling syntactic, semantic and pragmatic impairments in ASD: Elicited production of passives. *Journal of Child Language* 48: 184–201. [CrossRef] [PubMed]

American Psychiatric Association. 2000. *Diagnostic and Statistical Manual of Mental Disorders, DSM-IV-TR*. Washington, DC: American Psychiatric Association.

American Psychiatric Association. 2013. *Diagnostic and Statistical Manual of Mental Disorders*, 5th ed. Washington, DC: American Psychiatric Association.

Archibald, Lisa M. D., and Marc F. Joanisse. 2009. On the sensitivity and specificity of nonword repetition and sentence recall to language and memory impairments in children. *Journal of Speech, Language, and Hearing Research: JSLHR* 52: 899–914. [CrossRef] [PubMed]

Ardila, Alfredo. 2010. A proposed reinterpretation and reclassification of aphasic syndromes. *Aphasiology* 24: 363–94. [CrossRef]

Aryadoust, Vahid. 2023. The vexing problem of validity and the future of second language assessment. *Language Testing* 40: 8–14. [CrossRef]
Baird, Gillian, and Courtenay Frazier Norbury. 2016. Social (pragmatic) communication disorders and autism spectrum disorder. *Archives of Disease in Childhood* 101: 745–51. [CrossRef]
Bastiaanse, Roelien, and Ron van Zonneveld. 2005. Sentence production with verbs of alternating transitivity in agrammatic Broca's aphasia. *Journal of Neurolinguistics* 18: 57–66. [CrossRef]
Bertho, Marie, Margot Ehret, Juliette Schweyer, Nathalie Tyson, and Yves Boloh. 2014. French Williams syndrome's ability to produce judgments of grammaticality. *Research in Developmental Disabilities* 35: 3345–53. [CrossRef] [PubMed]
Bishop, Dorothy V. M. 2003. *Test for Reception of Grammar (TROG-2)*. San Antonio: Pearson Assessments.
Bishop, Dorothy V. M. 2017. Why is it so hard to reach agreement on terminology? The case of developmental language disorder (DLD). *International Journal of Language & Communication Disorders* 52: 671–80. [CrossRef]
Bishop, Dorothy V. M., and Martha J. Snowling. 2004. Developmental dyslexia and specific language impairment: Same or different? *Psychological Bulletin* 130: 858–86. [CrossRef] [PubMed]
Bortolini, Umberta, Barbara Arfé, M. Cristina Caselli, Luisa Degasperi, Patricia Deevy, and Laurence B. Leonard. 2006. Clinical markers for specific language impairment in Italian: The contribution of clitics and non-word repetition. *International Journal of Language & Communication Disorders* 41: 695–712. [CrossRef]
Bortolini, Umberta, M. Cristina Caselli, Patricia Deevy, and Laurence B. Leonard. 2002. Specific language impairment in Italian: The first steps in the search for a clinical marker. *International Journal of Language & Communication Disorders* 37: 77–93. [CrossRef]
Botting, Nicola. 2020. Language, Literacy and Cognitive Skills of Young Adults with Developmental Language Disorder (DLD). *International Journal of Language and Communication Disorders* 55: 255–65. [CrossRef] [PubMed]
Brizzolara, Daniela, Filippo Gasperini, Lucia Pfanner, Paola Cristofani, Claudia Casalini, and Anna M. Chilosi. 2011. Long-Term Reading and Spelling Outcome in Italian Adolescents with a History of Specific Language Impairment. *Cortex: A Journal Devoted to the Study of the Nervous System and Behavior* 47: 955–73. [CrossRef] [PubMed]
Canette, Laure-Hélène, Anna Fiveash, Jennifer Krzonowski, Alexandra Corneyllie, Philippe Lalitte, Dave Thompson, Laurel Trainor, Nathalie Bedoin, and Barbara Tillmann. 2020. Regular rhythmic primes boost P600 in grammatical error processing in dyslexic adults and matched controls. *Neuropsychologia* 138: 107324. [CrossRef]
Cantiani, Chiara, Maria Luisa Lorusso, Maria Teresa Guasti, Beate Sabisch, and Claudia Männel. 2013a. Characterizing the morphosyntactic processing deficit and its relationship to phonology in developmental dyslexia. *Neuropsychologia* 51: 1595–607. [CrossRef]
Cantiani, Chiara, Maria Luisa Lorusso, Paolo Perego, Massimo Molteni, and Maria Teresa Guasti. 2013b. Event-Related Potentials Reveal Anomalous Morphosyntactic Processing in Developmental Dyslexia. *Applied Psycholinguistics* 34: 1135–62. [CrossRef]
Caplan, David, and Joy E. Hanna. 1998. Sentence production by aphasic patients in a constrained task. *Brain and Language* 63: 184–218. [CrossRef] [PubMed]
Caplan, David, Gloria Waters, Gayle DeDe, Jennifer Michaud, and Amanda Reddy. 2007. A study of syntactic processing in aphasia I: Behavioral (psycholinguistic) aspects. *Brain and Language* 101: 103–50. [CrossRef] [PubMed]
Caramazza, Alfonso, and Edgar B. Zurif. 1976. Dissociation of algorithmic and heuristic processes in language comprehension: Evidence from aphasia. *Brain and Language* 3: 572–82. [CrossRef] [PubMed]
Chapman, Robin S., and Linda J. Hesketh. 2000. Behavioral phenotype of individuals with Down syndrome. *Mental Retardation and Developmental Disabilities Research Reviews* 6: 84–95. [CrossRef] [PubMed]
Christodoulou, Christiana, and Kenneth Wexler. 2016. The morphosyntactic development of case in Down syndrome. *Lingua* 184: 25–52. [CrossRef]
Christodoulou, Christiana, and Kenneth Wexler. 2023. Copula Omission in Down Syndrome. *Language Learning and Development* 19: 49–73. [CrossRef]
Clegg, Judy, Chris Hollis, Lynn Mawhood, and Michael Rutter. 2005. Developmental language disorders—A follow-up in later adult life. Cognitive, language and psychosocial outcomes. *Journal of Child Psychology and Psychiatry* 46: 128–49. [CrossRef] [PubMed]
Colman, Katrien S. F., Janneke Koerts, Marije van Beilen, Klaus L. Leenders, Wendy J. Post, and Roelien Bastiaanse. 2009. The impact of executive functions on verb production in patients with Parkinson's disease. *Cortex* 45: 930–42. [CrossRef]
Contemori, Carla, and Maria Garraffa. 2010. Comparison of modalities in SLI syntax: A study on the comprehension and production of non-canonical sentences. *Lingua* 120: 1940–55. [CrossRef]
Conti-Ramsden, Gina, Nicola Botting, and Brian Faragher. 2001. Psycholinguistic markers for specific language impairment (SLI). *Journal of Child Psychology and Psychiatry* 42: 741–48. [CrossRef]
DaParma, Alyssa, Donna Geffner, and Nancy Martin. 2011. Prevalence and Nature of Language Impairment in Children with Attention Deficit/Hyperactivity Disorder. *Contemporary Issues in Communication Science & Disorders* 38: 19–125.
de Beer, Carola, Isabell Wartenburger, Clara Huttenlauch, and Sandra Hanne. 2023. A systematic review on production and comprehension of linguistic prosody in people with acquired language and communication disorders resulting from unilateral brain lesions. *Journal of Communication Disorders* 101: 106298. [CrossRef] [PubMed]
Dick, Jessica, Jennifer Fredrick, Grace Man, Jessica E. Huber, and Jiyeon Lee. 2018. Sentence Production in Parkinson's Disease. *Clinical Linguistics and Phonetics* 32: 804–22. [CrossRef] [PubMed]
Dunn, Lloyd M. 1997. *PPVT-III: Peabody Picture Vocabulary Test*. Circle Pines: American Guidance Service.

Durkin, Kevin, and Gina Conti-Ramsden. 2007. Language, social behavior, and the quality of friendships in adolescents with and without a history of specific language impairment. *Child Development* 78: 1441–57. [CrossRef]
Durrleman, Stéphanie, and Hélène Delage. 2016. Autism Spectrum Disorder and Specific Language Impairment: Overlaps in Syntactic Profiles. *Language Acquisition* 23: 361–86. [CrossRef]
Durrleman, Stephanie, Loyse Hippolyte, Sandrine Zufferey, Katia Iglesias, and Nouchine Hadjikhani. 2015. Complex syntax in autism spectrum disorders: A study of relative clauses. *International Journal of Language & Communication Disorders* 50: 260–67. [CrossRef]
Durrleman, Stephanie, Theodoros Marinis, and Julie Franck. 2016. Syntactic complexity in the comprehension of wh-questions and relative clauses in typical language development and autism. *Applied Psycholinguistics* 37: 1501–27. [CrossRef]
Durrleman, Stéphanie, Hélène Delage, Philippe Prévost, and Laurice Tuller. 2017. The comprehension of passives in autism spectrum disorder. *Glossa: A Journal of General Linguistics* 2: 88. [CrossRef]
Engelhardt, Paul E., Sean N. Veld, Joel T. Nigg, and Fernanda Ferreira. 2012. Are Language Production Problems Apparent in Adults Who No Longer Meet Diagnostic Criteria for Attention-Deficit/Hyperactivity Disorder? *Cognitive Neuropsychology* 29: 275–99. [CrossRef]
Gagarina, Natal'ja Vladimirovna, Daleen Klop, Sari Kunnari, Koula Tantele, Taina Välimaa, Ingrida Balčiūnienė, Ute Bohnacker, and Joel Walters. 2012. MAIN: Multilingual assessment instrument for narratives. *ZAS Papers in Linguistics* 56: 155–55. [CrossRef]
Garraffa, Maria, and Giuditta Smith. 2022. Syntactic priming as a window to investigate grammatical learning in non-typical populations. In *Syntactic Priming in Language Acquisition. Book Series Trends in Language Acquisition Research (TiLAR)*. Edited by Kate Messenger. Amsterdam: John Benjamins.
Garraffa, Maria, and Nino Grillo. 2008. Canonicity effects as grammatical phenomena. *Journal of Neurolinguistics* 21: 177–97. [CrossRef]
Garraffa, Maria, and Valantis Fyndanis. 2020. Linguistic theory and aphasia: An overview. *Aphasiology* 34: 905–26. [CrossRef]
Garraffa, Maria, Moreno I. Coco, and Holly Branigan. 2015. Effects of immediate and cumulative syntactic experience in language impairment: Evidence from priming of subject relatives in children with SLI. *Language Learning and Development* 11: 18–40. [CrossRef]
Garraffa, Maria, Moreno I. Coco, and Holly Branigan. 2018. Impaired implicit learning of syntactic structure in children with developmental language disorder: Evidence from syntactic priming. *Autism and Developmental Language Impairments* 3: 1–15. [CrossRef]
Geelhand, Philippine, Fanny Papastamou, and Mikhail Kissine. 2021. How do autistic adults use syntactic and prosodic cues to manage spoken discourse? *Clinical Linguistics & Phonetics* 35: 1184–209. [CrossRef]
Geelhand, Philippine, Fanny Papastamou, Gaétane Deliens, and Mikhail Kissine. 2020. Narrative production in autistic adults: A systematic analysis of the microstructure, macrostructure and internal state language. *Journal of Pragmatics* 164: 57–81. [CrossRef]
Green, Benita C., Katherine A. Johnson, and Lesley Bretherton. 2014. Pragmatic language difficulties in children with hyperactivity and attention problems: An integrated review. *International Journal of Language and Communication Disorders* 49: 15–29. [CrossRef]
Grossman, Murray, Julia Kalmanson, Nechama Bernhardt, Jennifer Morris, Matthew B. Stern, and Howard I. Hurtig. 2000. Cognitive resource limitations during sentence comprehension in Parkinson's disease. *Brain and Language* 73: 1–16. [CrossRef]
Hall, Jessica E., Amanda Owen Van Horne, Karla K. McGregor, and Thomas A. Farmer. 2019. Deficits in the Use of Verb Bias Information in Real-Time Processing by College Students with Developmental Language Disorder. *Journal of Speech, Language, and Hearing Research* 62: 337–55. [CrossRef]
Hamann, Cornelia, Stéphanie Ohayon, Sébastien Dubé, Ulrich H. Frauenfelder, Luigi Rizzi, Michal Starke, and Pascal Zesiger. 2003. Aspects of grammatical development in young French children with SLI. *Developmental Science* 6: 151–58. [CrossRef]
Helland, Wenche Andersen, Eva Biringer, Turid Helland, and Mikael Heimann. 2012. Exploring language profiles for children with ADHD and children with Asperger syndrome. *Journal of Attention Disorders* 16: 34–43. [CrossRef] [PubMed]
Helland, Wenche Andersen, Maj-Britt Posserud, Turid Helland, Mikael Heimann, and Astri J. Lundervold. 2016. Language impairments in children with ADHD and in children with reading disorder. *Journal of Attention Disorders* 20: 581–89. [CrossRef] [PubMed]
Hulme, Charles, and Margaret J. Snowling. 2009. Reading disorders I: Developmental dyslexia. *Developmental disorders of language learning and cognition* 28: 37–89.
Jakubowicz, Celia, Lea Nash, Catherine Rigaut, and Christophe-Loic Gerard. 1998. Determiners and clitic pronouns in French-speaking children with SLI. *Language Acquisition* 7: 113–60. [CrossRef]
Joanisse, Marc F., Franklin R. Manis, Patricia Keating, and Mark S. Seidenberg. 2000. Language deficits in dyslexic children: Speech perception, phonology, and morphology. *Journal of Experimental Child Psychology* 77: 30–60. [CrossRef] [PubMed]
Johnson, Carla J., Joseph H. Beitchman, Arlene Young, Michael Escobar, Leslie Atkinson, Beth Wilson, Lori Douglas, Nathan Taback, Isabel Lam, Min Wang, and et al. 1999. Fourteen-year follow-up of children with and without speech/language impairments: Speech/language stability and outcomes. *Journal of Speech, Language, and Hearing Research* 42: 744–60. [CrossRef] [PubMed]
Kaplan, Edith, Harold Goodglass, and Sandra Weintraub. 1983. *Boston Naming Test (BNT)*. Philadelphia: Lea & Febiger.
Kemmerer, David. 1999. Impaired comprehension of raising-to-subject constructions in Parkinson's disease. *Brain and Language* 66: 311–28. [CrossRef]
Kjelgaard, Margaret M., and Helen Tager-Flusberg. 2001. An investigation of language impairment in autism: Implications for genetic subgroups. *Language and Cognitive Processes* 16: 287–308. [CrossRef]

La Valle, Chelsea, Daniela Plesa-Skwerer, and Helen Tager-Flusberg. 2020. Comparing the pragmatic speech profiles of minimally verbal and verbally fluent individuals with autism spectrum disorder. *Journal of Autism and Developmental Disorders* 50: 3699–713. [CrossRef]

Laws, Glynis, and Dorothy V. M. Bishop. 2004. Verbal deficits in Down's syndrome and specific language impairment: A comparison. *International Journal of Language & Communication Disorders* 39: 423–51.

Lee, Michelle, Gary E. Martin, Abigail Hogan, Deanna Hano, Peter C. Gordon, and Molly Losh. 2018. What's the story? A computational analysis of narrative competence in autism. *Autism* 22: 335–44. [CrossRef] [PubMed]

Leonard, Laurence B. 2014. *Children with Specific Language Impairment*. Cambridge: MIT Press.

Leonard, Laurence B., and Justin B. Kueser. 2019. Five overarching factors central to grammatical learning and treatment in children with developmental language disorder. *International Journal of Language and Communication Disorders* 54: 347–61. [CrossRef] [PubMed]

Leonard, Laurence B., and Marco Dispaldro. 2013. The effects of production demands on grammatical weakness in Specific Language Impairment: The case of clitic pronouns in Italian. *Journal of Speech Language and Hearing Research* 56: 1272–86. [CrossRef] [PubMed]

Levorato, M. Chiara, Maja Roch, and Rossella Beltrame. 2009. Text comprehension in Down syndrome: The role of lower and higher level abilities. *Clinical Linguistics & Phonetics* 23: 285–300.

Lieberman, Philip, Joseph Friedman, and Liane S. Feldman. 1990. Syntax comprehension deficits in Parkinson's disease. *Journal of Nervous and Mental Disease* 178: 360–65. [CrossRef] [PubMed]

Longworth, Catherine E., Shannon E. Keenan, Roger A. Barker, William D. Marslen-Wilson, and Lorraine K. Tyler. 2005. The basal ganglia and rule-governed language use: Evidence from vascular and degenerative conditions. *Brain* 128: 584–96. [CrossRef] [PubMed]

López-Higes, Ramón, Ma T. Del Rio Martín-Aragoneses, and G. Mejuto. 2012. Assessment of grammatical comprehension in normal and pathological aging: A summary of the results obtained with ECCO and ECCO_Senior tests. *International Journal of Psychological Research* 5: 96–108. [CrossRef]

Lord, Catherine, Michael Rutter, and Ann Le Couteur. 1994. Autism Diagnostic Interview-Revised: A revised version of a diagnostic interview for caregivers of individuals with possible pervasive developmental disorders. *Journal of Autism and Developmental Disorders* 24: 659–85. [CrossRef]

Lord, Catherine, Michael Rutter, Pamela C. DiLavore, Susan Risi, Katherine Gotham, and Somer L- Bishop S. 2012. *Autism Diagnostic Observation Schedule*, 2nd ed. Torrance: Western Psychological Services.

Lövdén, Martin, Laura Fratiglioni, M. Maria Glymour, Ulman Lindenberger, and Elliot M. Tucker-Drob. 2020. Education and cognitive functioning across the life span. *Psychological Science in the Public Interest* 21: 6–41. [CrossRef]

Loveall, Susan J., Marie Moore Channell, Leonard Abbeduto, and Frances A. Conners. 2019. Verb Production by Individuals with Down Syndrome during Narration. *Research in Developmental Disabilities* 85: 82–91. [CrossRef]

Lyon, G. Reid, Sally E. Shaywitz, and Bennet A. Shaywitz. 2003. A definition of dyslexia. *Annals of Dyslexia* 53: 1–14. [CrossRef]

Lyytinen, Heikki, Mikko Aro, Kenneth Eklund, Jane Erskine, Tomi Guttorm, Marja-Leena Laakso, Paavo H. T. Leppänen, Paula Lyytinen, Anna-Maija Poikkeus, Ulla Richardson, and et al. 2004. The development of children at familial risk for dyslexia: Birth to early school age. *Annals of Dyslexia* 54: 184–220. [CrossRef] [PubMed]

Marini, Andrea, Sara Andreetta, Silvana del Tin, and Sergio Carlomagno. 2011. A multi-level approach to the analysis of narrative language in aphasia. *Aphasiology* 25: 1372–92. [CrossRef]

Marshall, John C., and John Morton. 1978. On the mechanics of EMMA. In *The Child's Conception of Language*. Berlin/Heidelberg: Springer, pp. 225–39.

Martzoukou, Maria, Despina Papadopoulou, and Mary-Helen Kosmidis. 2017. The Comprehension of Syntactic and Affective Prosody by Adults with Autism Spectrum Disorder without Accompanying Cognitive Deficits. *Journal of Psycholinguistic Research* 46: 1573–95. Available online: https://search.ebscohost.com/login.aspx?direct=true&db=eric&AN=EJ1158434&authtype=sso&custid=s8993828&site=ehost-live (accessed on 13 January 2022). [CrossRef] [PubMed]

Martzoukou, Maria, Anastasia Nousia, and Theodoros Marinis. 2020. Narrative abilities of adults' with Down Syndrome as a window to their morphosyntactic, socio-cognitive, and prosodic abilities. *Frontiers in Psychology* 11: 2060. [CrossRef] [PubMed]

McCormack, Jane, Sharynne McLeod, Lindy McAllister, and Linda J. Harrison. 2009. A systematic review of the association between childhood speech impairment and participation across the lifespan. *International Journal of Speech-Language Pathology* 11: 155–70. [CrossRef]

Melloni, Chiara, and Maria Vender. 2022. Morphological awareness in developmental dyslexia: Playing with nonwords in a morphologically rich language. *PLoS ONE* 17: e0276643. [CrossRef]

Michael, Sarah E., Nan Bernstein Ratner, and Rochelle Newman. 2012. Verb Comprehension and Use in Children and Adults with Down Syndrome. *Journal of Speech, Language, and Hearing Research* 55: 1736–49. [CrossRef]

Miller, Jon F., Karen Andriacchi, and Ann Nockerts. 2016. Using language sample analysis to assess spoken language production in adolescents. *Language, Speech, and Hearing Services in Schools* 47: 99–112. [CrossRef]

Miranda, Ana, Inmaculada Baixauli, and Carla Colomer. 2013. Narrative Writing Competence and Internal State Terms of Young Adults Clinically Diagnosed with Childhood Attention Deficit Hyperactivity Disorder. *Research in Developmental Disabilities* 34: 1938–50. [CrossRef]

Moher, David, Alessandro Liberati, Jennifer Tetzlaff, Douglas G. Altman, and the PRISMA Group. 2009. Preferred reporting items for systematic reviews and meta-analyses: The PRISMA statement. *Annals of Internal Medicine* 151: 264–69. [CrossRef] [PubMed]
Moscati, Vincenzo, Luigi Rizzi, Ilenia Vottari, Anna Maria Chilosi, Renata Salvadorini, and Maria Teresa Guasti. 2020. Morphosyntactic weaknesses in developmental language disorder: The role of structure and agreement configurations. *Journal of Child Language* 47: 909–44. [CrossRef] [PubMed]
Nelson, Hazel E., and Jonathan Willison. 1991. *National Adult Reading Test (NART)*. Windsor: Nfer-Nelson Windsor.
Novogrodsky, Rama, and Naama Friedmann. 2006. The production of relative clauses in syntactic SLI: A window to the nature of the impairment. *Advances in Speech Language Pathology* 8: 364–75. [CrossRef]
Opdebeeck, Carol, Anthony Martyr, and Linda Clare. 2016. Cognitive reserve and cognitive function in healthy older people: A meta-analysis. *Aging, Neuropsychology, and Cognition* 23: 40–60. [CrossRef] [PubMed]
Page, Matthew J., Joanne E. McKenzie, Patrick M. Bossuyt, Isabelle Boutron, Tammy C. Hoffmann, Cynthia D. Mulrow, Larissa Shamseer, Jennifer M. Tetzlaff, and David Moher. 2021. Updating guidance for reporting systematic reviews: Development of the PRISMA 2020 statement. *Journal of Clinical Epidemiology* 134: 103–12. [CrossRef] [PubMed]
Perovic, Alex, Nadezhda Modyanova, and Ken Wexler. 2013. Comparison of grammar in neurodevelopmental disorders: The case of binding in Williams syndrome and autism with and without language impairment. *Language Acquisition* 20: 133–54. [CrossRef] [PubMed]
Perovic, Alexandra, and Ken Wexler. 2019. The Effect of Age on Language in Adults with Intellectual Disabilities: A Comparison of Passives in Down Syndrome and Williams Syndrome. In *Interdisciplinary Linguistic and Psychiatric Research on Language Disorders*. Zagreb: Filozofski fakultet Sveučilišta u Zagrebu—FF Press, pp. 25–44. [CrossRef]
Poll, Gerard H., Carol A. Miller, and Janet G. van Hell. 2015. Evidence of Compensatory Processing in Adults with Developmental Language Impairment: Testing the Predictions of the Procedural Deficit Hypothesis. *Journal of Communication Disorders* 53: 84–102. [CrossRef]
Prévost, Philippe, Laurice Tuller, Marie Anne Barthez, Joelle Malvy, and Frédérique Bonnet-Brilhault. 2017. Production and comprehension of French wh-questions by children with autism spectrum disorder: A comparative study with specific language impairment. *Applied Psycholinguistics* 38: 1095–131. [CrossRef]
Reggiani, Danilo. 2010. Dyslexia and the Acquisition of Syntax: Passive and Control. Ph.D. dissertation, University of Verona, Verona, Italy.
Rice, Mabel L., and Kenneth Wexler. 1996. Toward Tense as a Clinical Marker of Specific Language Impairment in English-Speaking Children. *Journal of Speech, Language, and Hearing Research* 39: 1239–57. [CrossRef]
Rice, Mabel L., J. Bruce Tomblin, Lesa Hoffman, W. Allen Richman, and Janet Marquis. 2004. Grammatical tense deficits in children with SLI and nonspecific language impairment: Relationships with nonverbal IQ over time. *Journal of Speech, Language, and Hearing Research* 47: 816–35. [CrossRef] [PubMed]
Rice, Mabel L., Steven F. Warren, and Stacy K. Betz. 2005. Language symptoms of developmental language disorders: An overview of autism, Down syndrome, fragile X, specific language impairment, and Williams syndrome. *Applied Psycholinguistics* 26: 7–27. [CrossRef]
Ring, Melanie, and Harald Clahsen. 2005. Distinct patterns of language impairment in Down's syndrome and Williams syndrome: The case of syntactic chains. *Journal of Neurolinguistics* 18: 479–501. [CrossRef]
Rispens, Judith, and Pieter Been. 2007. Subject–verb agreement and phonological processing in developmental dyslexia and specific language impairment (SLI): A closer look. *International Journal of Language & Communication Disorders* 42: 293–305. [CrossRef]
Robison, John Elder. 2019. Autism prevalence and outcomes in older adults. *Autism Research* 12: 370–74. [CrossRef] [PubMed]
Rujas, Irene, Sonia Mariscal, Eva Murillo, and Miguel Lázaro. 2021. Sentence repetition tasks to detect and prevent language difficulties: A scoping review. *Children* 8: 578. [CrossRef] [PubMed]
Saffran, Eleanor M., Rita Sloan Berndt, and Myrna F. Schwartz. 1989. The quantitative analysis of agrammatic production: Procedure and data. *Brain and Language* 37: 440–79. [CrossRef] [PubMed]
Sanoudaki, Eirini, and Spyridoula Varlokosta. 2015. Pronoun Comprehension in Individuals with Down Syndrome: The Role of Age. *International Journal of Language and Communication Disorders* 50: 176–86. [CrossRef]
Scarborough, Hollis S. 1990. Very early language deficits in dyslexic children. *Child Development* 61: 1728–43. [CrossRef]
Schiff, Rachel, and Dorit Ravid. 2013. Morphological Processing in Hebrew-Speaking Students with Reading Disabilities. *Journal of Learning Disabilities* 46: 220–29. [CrossRef]
Schiff, Rachel, Dorit Ravid, and Adi Gur. 2015. Morpho-Syntactic Load in Judging Adjective Plural Agreement: Comparing Adults with and without ADHD. *Communication Disorders Quarterly* 36: 79–89. [CrossRef]
Schneider, Wolfgang, Matthias Schlagmüller, and Marco Ennemoser. 2007. *LGVT 6-12: Lesegeschwindigkeits-und-verständnistest für die Klassen 6–12*. Göttingen: Hogrefe.
Schwartz, Myrna F., Eleanor M. Saffran, Ruth B. Fink, Jessica L. Myers, and Nadine Martin. 1994. Mapping therapy: A treatment programme for agrammatism. *Aphasiology* 8: 19–54. [CrossRef]
Slocombe, Katie E., Ivan Alvarez, Holly P. Branigan, Tjeerd Jellema, Hollie G. Burnett, Anja Fischer, Yan Hei Li, Simon Garrod, and Liat Levita. 2013. Linguistic alignment in adults with and without Asperger's syndrome. *Journal of Autism and Developmental Disorders* 43: 1423–36. [CrossRef]

Snowling, Margaret J., Alison Gallagher, and Uta Frith. 2003. Family risk of dyslexia is continuous: Individual differences in the precursors of reading skill. *Child Development* 74: 358–373. [CrossRef] [PubMed]
Snowling, Margaret, Dorothy Vera M. Bishop, and Susan E. Stothard. 2000. Is preschool language impairment a risk factor for dyslexia in adolescence? *The Journal of Child Psychology and Psychiatry and Allied Disciplines* 41: 587–600. [CrossRef] [PubMed]
Stella, Marianna, and Paul E. Engelhardt. 2019. Syntactic Ambiguity Resolution in Dyslexia: An Examination of Cognitive Factors Underlying Eye Movement Differences and Comprehension Failures. *Dyslexia: An International Journal of Research and Practice* 25: 115–41. [CrossRef] [PubMed]
Stokes, Stephanie F., Anita M. Y. Wong, Paul Fletcher, and Laurence B. Leonard. 2006. Nonword repetition and sentence repetition as clinical markers of specifc language impairment: The case of Cantonese. *Journal of Speech, Language, and Hearing Research* 49: 219–36. [CrossRef]
Stothard, Susan E., Margaret J. Snowling, Dorothy V. M. Bishop, Barry B. Chipchase, and Carole A. Kaplan. 1998. Language-impaired preschoolers: A follow-up into adolescence. *Journal of Speech, Language, and Hearing Research* 41: 407–18. [CrossRef]
Stuart, Nichola J., and Heather van der Lely. 2015. Role of aspect in understanding tense: An investigation with adolescents with SLI. *International Journal of Language & Communication Disorders* 50: 187–201. [CrossRef]
Suddarth, Rachael, Elena Plante, and Rebecca Vance. 2012. Written Narrative Characteristics in Adults With Language Impairment. *Journal of Speech, Language, and Hearing Research* 55: 409–20. [CrossRef]
Sung, Jee Eun, Sujin Choi, Bora Eom, Jae Keun Yoo, and Jee Hyang Jeong. 2020. Syntactic Complexity as a Linguistic Marker to Differentiate Mild Cognitive Impairment from Normal Aging. *Journal of Speech, Language, and Hearing Research* 63: 1416–29. [CrossRef] [PubMed]
Talli, Ioanna, L. Sprenger-Charolles, and S. Stavrakaki. 2013. Phonological and morpho-syntactic abilities in children with developmental dyslexia and specific language impairment: Evidence from Greek. In *Advances in Language Acquisition*. Edited by Stavroula Stavrakaki, Marina Lalioti and Polykeni Konstantinopoulou. Newcastle: Cambridge Scholars Publishing, pp. 444–53.
Terzi, Arhonto, Theodoros Marinis, and Kostantinos Francis. 2016. The interface of syntax with pragmatics and prosody in children with autism spectrum disorders. *Journal of Autism Developmental Disorder* 46: 2692–706. [CrossRef] [PubMed]
Thompson, Cynthia K. 2003. Unaccusative verb production in agrammatic aphasia: The argument structure complexity hypothesis. *Journal of Neurolinguistics* 16: 151–67. [CrossRef] [PubMed]
Thompson, Cynthia K., and Jungwon Janet Choy. 2009. Pronominal resolution and gap filling in agrammatic aphasia: Evidence from eye movements. *Journal of Psycholinguistic Research* 38: 255–83. [CrossRef] [PubMed]
Thompson, Cynthia K., Aya Meltzer-Asscher, Soojin Cho, Jiyeon Lee, Christina Wieneke, Sandra Weintraub, and M-Marsel Mesulam. 2013. Syntactic and morphosyntactic processing in stroke-induced and primary progressive aphasia. *Behavioural Neurology* 26: 35–54. [CrossRef] [PubMed]
Tomblin, Bruce J. 2008. Validating diagnostic standards for specific language impairment using adolescent outcomes. In *Understanding Developmental Language Disorders: From Theory to Practice*. Edited by Courtenay F. Norbury, Bruce J. Tomblin and Dorothy V. M. Bishop. London: Psychology Press, pp. 93–114.
Tomblin, J. Bruce, Xuyang Zhang, Paula Buckwalter, and Marlea O'Brien. 2003. The stability of primary language disorder. Four years after kindergarten diagnosis. *Journal of Speech, Language, and Hearing Research* 46: 1283–96. [CrossRef] [PubMed]
Troche, Michelle S, and Lori J. P. Altmann. 2012. Sentence Production in Parkinson Disease: Effects of Conceptual and Task Complexity. *Applied Psycholinguistics* 33: 225–51. [CrossRef]
Tuller, Laurice, Sandrine Ferré, Philippe Prévost, Marie Anne Barthez, Joelle Malvy, and Frédérique Bonnet-Brilhault. 2017. The effect of computational complexity on the acquisition of French by children with ASD. In *Language and the Human Lifespan Series. Innovative Investigations of Language in Autism Spectrum Disorder*. Edited by Letitia R. Naigles. Berlin: de Gruyter, pp. 115–40. [CrossRef]
Tunmer, William E., and Michael L. Herriman. 1984. The development of metalinguistic awareness: A conceptual overview. *Metalinguistic Awareness in Children: Theory, Research, and Implications* 15: 12–35.
Ullman, Michael T., Suzanne Corkin, Marie Coppola, Gregory Hickok, John H. Growdon, Walter J. Koroshetz, and Steven Pinker. 1997. A neural dissociation within language: Evidence that the mental dictionary is part of declarative memory, and that grammatical rules are processed by the procedural system. *Journal of Cognitive Neuroscience* 9: 266–76. [CrossRef]
Van Alphen, Petra, Elise De Bree, Ellen Gerrits, Jan De Jong, Carien Wilsenach, and Frank Wijnen. 2004. Early language development in children with a genetic risk of dyslexia. *Dyslexia* 10: 265–88. [CrossRef]
van Lambalgen, Michiel, Claudia van Kruistum, and Esther Parigger. 2008. Discourse processing in attention-deficit hyperactivity disorder (ADHD). *Journal of Logic, Language and Information* 17: 467–87. [CrossRef]
Vender, Maria, Federica Mantione, Silvia Savazzi, Denis Delfitto, and Chiara Melloni. 2017. Inflectional morphology and dyslexia: Italian children's performance in a nonword pluralization task. *Annals of Dyslexia* 67: 401–26. [CrossRef] [PubMed]
Wechsler, David. 1999. *Escala de Inteligencia Wechsler para Adultos (WAIS-III). [Wechsler Intelligence Scale for Adults]*. Madrid: TEA Ediciones.
Wexler, Ken. 1994. Optional infinitives, head movement and the economy of derivations. In *Verb Movement*. Edited by David Lightfoot and Norbert Hornstein. Cambridge: Cambridge University Press, pp. 305–50.

Whitehouse, Andrew J. O., E. A. Line, Helen J. Watt, and Dorothy V. M. Bishop. 2009. Qualitative Aspects of Developmental Language Impairment Relate to Language and Literacy Outcome in Adulthood. *International Journal of Language & Communication Disorders* 44: 489–510. [CrossRef]

Willcutt, Erik G. 2018. ADHD and reading disorder. In *Oxford Textbook of Attention Deficit Hyperactivity Disorder*. Edited by Tobias Banaschewski, David Coghill and Alessandro Zuddas. Oxford: Oxford University Press, pp. 273–79.

Wilsenach, Carien. 2006. Syntactic Processing in Developmental Dyslexia and in Specific Language Impairment. Ph.D. dissertation, University of Utrecht, Utrecht, The Netherlands.

Wiseheart, Rebecca, and Lori J. P. Altmann. 2018. Spoken Sentence Production in College Students with Dyslexia: Working Memory and Vocabulary Effects. *International Journal of Language & Communication Disorders* 53: 355–69. [CrossRef]

Wiseheart, Rebecca, Lori J. P. Altmann, Heeyoung Park, and Linda J. Lombardino. 2009. Sentence comprehension in young adults with developmental dyslexia. *Annals of Dyslexia* 59: 151–67. [CrossRef] [PubMed]

World Health Organization. 1992. *The ICD-10 Classification of Mental and Behavioural Disorders: Clinical Descriptions and Diagnostic Guidelines*. Geneva: World Health Organization, vol. 1.

Young, Arlene R., Joseph H. Beitchman, Carla Johnson, Lori Douglas, Leslie Atkinson, Michael Escobar, and Beth Wilson. 2002. Young adult academic outcomes in a longitudinal sample of early identified language impaired and control children. *Journal of Child Psychology and Psychiatry, and Allied Disciplines* 43: 635–45. [CrossRef] [PubMed]

Zanini, Sergio, Alessandro Tavano, and Franco Fabbro. 2010. Spontaneous language production in bilingual Parkinson's disease patients: Evidence of greater phonological, morphological and syntactic impairments in native language. *Brain and Language* 113: 84–89. [CrossRef]