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REVIEW PAPER

Specific Language Impairment, Autism Spectrum Disorders and Social (Pragmatic) Communication Disorders: Is There Overlap in Language Deficits? A Review

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Abstract
Analysing language characteristics and understanding their dynamics is the key for a successful intervention by speech and language therapists (SLT). Thus, this review aims to investigate a possible overlap in language development shared by autism spectrum disorders (ASD), specific language impairment (SLI) and social (pragmatic) communication disorder (SPCD). The sources of this work were the PubMed, PsycInfo and SciELO databases, as well as the Scientific Open Access Repositories of Portugal. The final selection included 18 studies, focused on several linguistic areas. Results suggest that when individuals are matched according to some language or cognitive skills, they will also show similar characteristics in other language domains. Future work should be done based on spontaneous speech.

Keywords Autism spectrum disorders · Specific language impairment · Developmental language disorder · Social/pragmatic communication disorder · Language development · Comorbidity

Introduction

Clinical typologies of developmental language disorders are based either on etiological criteria or symptomatic criteria. Both types have shortcomings and limitations. Frequently, typologies based on etiological factors cannot explain properly the variable symptomatology exhibited by patients. Typologies based on symptomatic factors often fail to categorise and characterise patients unambiguously, essentially because of the widespread problem of comorbidity. Comorbidity entails that patients can exhibit symptoms that are characteristic of two or more different disorders, this resulting in a partial overlap of clinical categories. In truth, this overlap can be observed also at the brain level (with damages in the same region resulting in different disorders) and the genetic level (with mutations in the same gene resulting in diverse conditions). These circumstances make an accurate diagnosis of disorders troublesome, as there seems not to exist a causal link between specific language problems and specific cognitive deficits (or brain areas or gene mutations). Figure 1 summarises this complex scenario. Ultimately, this has a negative impact on the therapeutic approaches aimed to improve the language disabilities of people with these conditions. This problem is not easy to fix. As discussed by Benítez-Burraco (2020), for fixing this, it is urgent to consider developmental dynamics, from genes to language deficits. In order to understand the real nature of disorders, one needs to pay attention not only to the symptoms observed in the adult state, but also to how disorders manifest throughout development (Benítez-Burraco, 2013). Overall, this holistic approach should help find reliable endophenotypes of language disorders, that is, disorder-specific biological markers for each condition.

This review explores these issues, focusing on three disorders impacting on language that are defined symptomatically and that are often correlated by researchers: autism spectrum disorders (ASD), specific language impairment (SLI) and social (pragmatic) communication disorder (SPCD). The ultimate aim is to investigate whether a distinctive symptomatic profile can be proposed for each disorder in the domain of language to enable an accurate diagnosis, in spite of some overlap between symptoms. The paper is structured as follows: we first provide a detailed characterisation of

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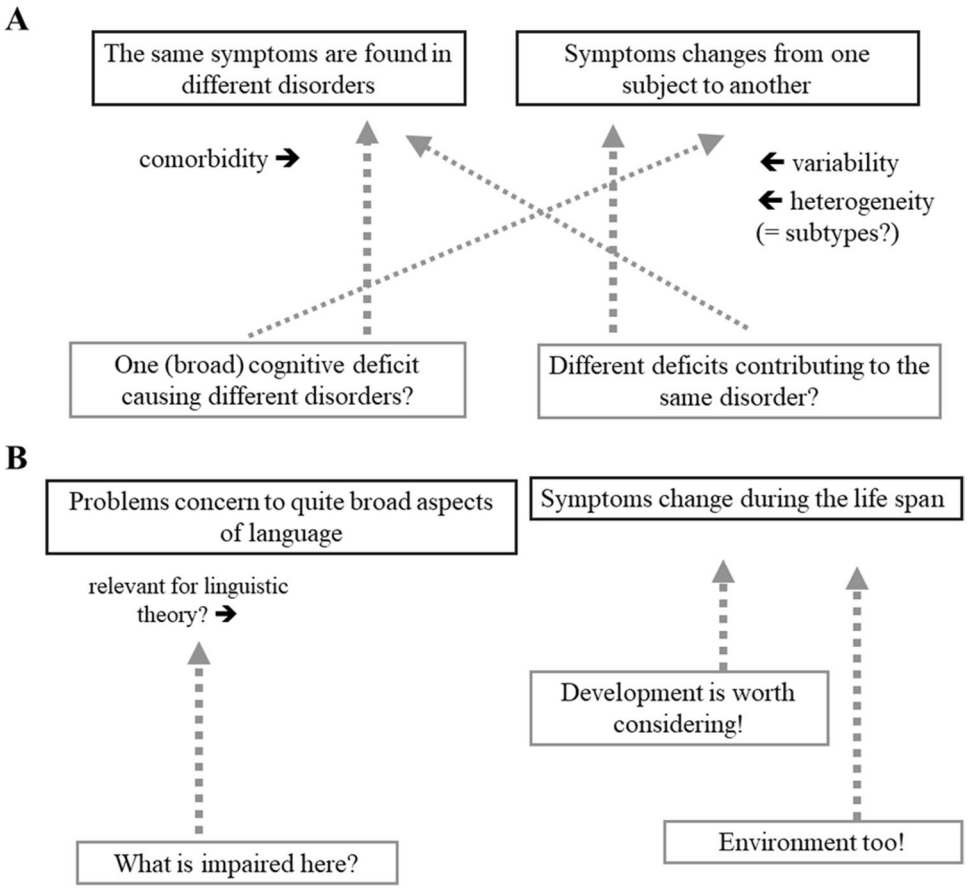

Fig. 1 An indirect link between cognitive and language problems in developmental disorders impacting on language. **A** The links between cognitive deficits and language problems in developmental language disorders are not straight or univocal. **B** The links between language problems and aspects of the grammar are not straight either and change thorough development

the language deficits observed in children with these three conditions, as it can be found in the relevant literature, with a special focus on the structural aspects of language (syntax, semantics), but also on how language is put into use (pragmatics). We then conduct a meta-analysis of the papers, by examining the simultaneous presentation of these disorders in patients, with the aim of fully identifying the overlapping aspects of the phenotype and the domains in which one can find disorder-specific features. We finally provide a detailed discussion of our results, particularly, how our analysis can contribute to achieve a better understanding of language deficits, strengths and dynamics in children with SLI (or DLD), ASD and SPCD, and ultimately, to achieve better therapeutic interventions.

Autism Spectrum Disorder

According to the classification established by DSM-5 (APA, 2013), ASD is defined by the presence of persistent deficits in social communication and social interaction across multiple contexts and restricted/repetitive patterns of behaviour, interests or activities. This disorder aetiology has been extensively explored in recent years, and may be related to different factors like genetics, advanced paternal or maternal age (Croen et al., 2007) and the grandparents age at parents' birth (Gao et al., 2020), among others. ASD symptoms must be present in the early developmental period and cause clinically significant impairment in social and occupational areas, or other dimensions of individual current functioning. Autism severity is defined by three levels, based on 'social communication' problems and 'restricted, repetitive behaviours/interests' (RRBIs) (APA, 2013).

Currently, there are standard diagnostic instruments that afford a diagnosis of ASD, such as the Screening Tool for Autism in Toddlers and Young Children (STAT) or the Autism Diagnostic Observation Schedule (ADOS), which can be applied from 1 year old (Lord et al., 2018). However, some researchers suggest that detection and diagnosis of ASD can only start accurately from 14 months of age (Pierce et al., 2019), through the administration of multiple direct assessment and parent-report instruments (Nevill et al., 2019). Regarding language assessment in high-functioning autism, Loukusa et al. (2018) suggest that the use of context-sensitive materials, like the Pragma test (Loukusa et al., 2018), allows the detection of social-pragmatic inferencing difficulties not only in real-life situations but also through parental reports, and in structured test situations.

Although little has been studied about language development in ASD during the first years of life, it is known that the development of expressive language is slower compared to language comprehension (Bruyneel et al., 2019), and it is also known that gestures, non-verbal cognitive ability and response to joint attention are significant predictors of receptive language. On the other hand, non-verbal cognitive ability, gestures and imitation are the most important predicting factors of expressive language skills (Luyster et al., 2008).

ASD may have concomitant language impairment (ASD-language impairment (LI)) or not (ASD-no language disorder (NLD)). Autistic children with LI showed lack of neural functional differentiation to speech stimuli in the superior temporal cortex and, similarly, a much lower activation pattern related to general auditory processing, compared to typically developed and autistic NLD peers. This suggests that abnormalities in auditory processing could be specifically related to a dysfunction in language and speech neural systems (Lombardo et al., 2015) and may impair the ability to process the speech of other people, hence reducing the ability to learn the phonology, syntax and semantics of one's native language (Yau et al., 2016). Moreover, autistic individuals present a decrease in cortical thickness in cerebral areas related to pragmatic language and social communication abilities (Crutcher et al., 2018).

In relation to gender differences, it is known that autistic females show a higher performance in narrative production, including more visible history elements and more descriptors of planning and intention (Conlon et al., 2019).

ASD and Pragmatics

Pragmatics is defined as the study of language in relation to context (Hart, 1981). Since there is a wide range of autistic individuals, being that around 25 to 30% of autistic children either fail to develop functional language or are minimally verbal (Brignell et al., 2018), La Valle et al. (2020) compared the pragmatic speech profiles in minimally verbal and verbally fluent autistic individuals, aged between 6 and 21 years old, through natural language sampling. This study firstly concludes that minimally verbal autistic individuals were not restricted to one communicative function. The primary communicative function used by this group was indicating agreement/acknowledgement/disagreement, followed by other communicative functions (such as responding to a question, requesting and labelling or naming an item/thing). The second conclusion was the use of comments as the key function distinguishing the two groups. Thus, for verbally fluent autistic individuals, the primary pragmatic function used is commenting, followed by responding to a question, and indicating agreement/acknowledgement/disagreement/refusal.

Pragmatic skills are often related to the theory of mind (ToM), that is, to the ability to attribute mental states to oneself and others (Cole & Millett, 2019). Explicit ToM skills begin to develop at 4 years old, with the understanding of false beliefs (Poulin-Dubois et al., 2020), and continue to evolve across the adult lifespan, with age being associated with decline in both cognitive and affective ToM skills (Laillier et al., 2019). Assessment of ToM skills requires the use of reliable measures and scales. However, although ToM has other important aspects (diverse desires; diverse beliefs; knowledge access; hidden emoticons; and understanding irony and idioms), the false belief tasks are the most implemented (Smogorzewska et al., 2018). Smogorzewska et al. (2018) consider that application of both *The Theory of Mind scale* (Wellman & Liu, 2004) and the *Faux Pas Recognition Test* (Baron-Cohen et al., 1999) assessment measures cover different aspects of ToM development and allow for a complete assessment. These measures also have the advantage of validation in children with and without disabilities. In adulthood, Laillier et al. (2019) suggest the administration of the Movie for Assessment of Social Cognition (Dziobek et al., 2006) to assess both cognitive and affective ToM skills.

Comparison Between Pragmatic Skills of Autistic Children and Typically Developed (TD) Peers

At the pragmatic level, as well as in social adaptation, ToM and executive functions, there are significant differences between autistic children and typically developed (TD) peers (Berenguer et al., 2018; Garrido et al., 2017). Autistic children have difficulties in understanding emotional speech, so they have problems drawing appropriate inferences, especially in multiple-cue environments (Le Sourn-Bissaoui et al., 2013), and present deficits in appreciating irony and sarcasm (Solomon et al., 2011).

Whyte and Nelson (2015) investigated difficulties in understanding pragmatic language and nonliteral language in children between 5 and 12 years old. The authors verified that, although these competences increase significantly with chronological age, autistic children showed slower rates of development, when compared to TD peers. They also concluded that pragmatic language and nonliteral language skills are at the same level as vocabulary comprehension and ToM competences in autistic children. Therefore, ToM skills, as structural language (speech, syntax, semantics, coherence) and working memory, are significant predictors of the pragmatic skills in autistic individuals (Baixauli-Fortea et al., 2019; Schuh et al., 2016). Regarding autistic individuals, pauses during discourse can be filled with words like 'um' or 'uh', being that 'um' is used to signal longer pauses and may correlate with greater social communicative sophistication than 'uh' (Parish-Morris et al., 2017). The 'um' rate is associated with autism symptom severity (Irvine

et al., 2016). The use of these fillers can thus contribute to distinguish autistic individuals from their TD peers. However, since girls use 'uh' less often than boys, their language impairment can be more easily camouflaged (Parish-Morris et al., 2017).

ASD and Semantics

Linguistic semantics is the study of literal meanings grammaticalised or encoded (Frawley, 1992). In general, autistic individuals present difficulties in high-level functions, like semantic integration (Coderre et al., 2017), due to presenting a delayed rate of processing and limited integration of mental representations (DiStefano et al., 2019). Receptive semantic knowledge of this population is sensitive to context conditions—semantic comprehension improves, when contextualised (Lucas et al., 2017). Thus, increasing the richness and complexity of semantic contexts helps autistic children to learn new words over time (Gladfelter & Goffman, 2018). Even so, autistic children with LI need additional stimuli, such as explicit teaching of words or additional tuition for learning, compared to autistic NLD children (Lucas et al., 2017).

Comparison Between Semantic Skills of Autistic Children and TD Peers

The most pronounced difference between autistic individuals with LI and their TD peers is at semantic-pragmatic level (Westerveld & Roberts, 2017). Individuals with SLI-LI show difficulties in naming and understanding compound words, even knowing each word included in a compound (Kambanaros et al., 2019). Verbal pre-schoolers on the autism spectrum evidence specific difficulties in oral narrative comprehension and production skills (intelligibility and grammatical accuracy), producing simple narratives that lack semantic richness and omit important story elements (Norbury et al., 2014). Their speech is characterised by low levels of language abstraction, with few words related to feelings (Chojnicka & Wawer, 2020) and production of descriptive or action sequences (Westerveld & Roberts, 2017), with reduced references to semantic-pragmatic elements, as basic story details (e.g. characters, settings, actions) and complex concepts, reflected in the story's central ideas (Kenan et al., 2019). Later, in school age, the narratives of autistic children remain syntactically less complex, contain more ambiguous pronouns and include fewer story grammar elements than those of TD peers (Banney et al., 2015). Losh and Gordon (2014) verified that narrative competence between 8 and 14 years old is comparable to controls in terms of semantic content when narrating from a picture book. However, narrative recall tasks remain a major challenge for autistic individuals, showing poor semantic content.

ASD and Syntax

In linguistics, syntax refers to the organisation of words in sentences and morphology refers to the internal structure of words (Sim Sim, 1998). Autistic individuals, even with high-functioning ASD (HFA), show syntactic and morphological impairments that should not be overlooked (Brynskov et al., 2017). They (especially ASD-LI) perform significantly worse than controls in relative clause comprehension (Durrleman et al., 2015; Garrido et al., 2017). The use of complex syntax is also a weak area, since they have difficulties integrating their narratives and explaining characters' intentions (Lee et al., 2018). Autistic individuals rarely produce clitics on their utterances (Terzi et al., 2016), 'wh' questions (Goodwin et al., 2012) and mental verbs (Song et al., 2017). However, these problems seem to be related to the interface between (morpho)syntax and pragmatics. Since, generally, autistic individuals have specific topics of interest, if the conversation is not revolving around those specific topics, they may not get enough reinforcement to carry on with the conversation. Thus, autistic children produce mainly noun phrases, instead of using clitics, indicating that they do not know that a clitic should be used to refer to a prominent entity in the preceding discourse (Terzi et al., 2016). In relation to 'wh' questions, it is known that even when they are understood by autistic individuals around 4½ years old, they are rarely produced. This can be due to several factors. One possible explanation is related to pragmatic weakness, as these individuals have difficulties in deliberate seeking of new information, assuming that such information is known by one's addressee. Still, autistic individuals present limitations knowing when and how such questions fit into discourse (Goodwin et al., 2012). On the other hand, it may be due to motivational issues, such as social motivation or IQ influence of expressive language (Kim et al., 2020).

Specific Language Impairment

SLI is characterised by language difficulties that do not arise from any known neurological, sensory or emotional causes (Ervin, 2001). The terminology used in this context has been the subject of much discussion since the term 'specific' does not apply to the majority of cases with this diagnosis. Still, the designation developmental language disorder (DLD) included in the *International Classification of Diseases–11th Revision* (ICD-11) has a very similar definition to that of SLI: these disorders are caused by persistent language acquisition, comprehension, production or use deficits, which arise during development and impair the subject's communicative competence. Language skills are thus remarkably below expectations, considering the age and level of intellectual functioning, and this is not caused by any other neurodevelopmental disorder, due to sensory

deficit or neurological condition (ICD-10, 2019). In recent years, several other terms have been used to designate these impairments, with no agreement or consensus between authors. The classification 'language impairment' used in the DSM-5 also becomes problematic because it covers a wide range of disorders (Bishop, 2014). This literature review follows Bishop's (2014) line of reasoning, conceiving the term 'specific' as 'idiopathic' (i.e. of unknown origin), rather than implying there are no other disorders beyond language. Therefore, we decided to maintain the term 'specific language impairment'. We also use the term 'developmental language disorder' (ICD-11), since we consider that both designate the same type of disorder (Gladfelter et al., 2019).

SLI (or DLD) and Pragmatics

Pragmatic disorders in individuals with SLI are seen differently by several authors. While some say that individuals with SLI are distinguished from autistic individuals or individuals with SPCD by the absence of social impairment (e.g. Gibson et al., 2013), others say that the screening of pragmatic skills while evaluating the communication skills of individuals with SLI should be seriously considered (Osman et al., 2011). In fact, there are some pragmatic skills that are affected in individuals with SLI (or DLD), as the maxim of quantity in sentence answers to 'wh' questions (Rombough & Thornton, 2018). Also, Katsos et al. (2011) confirmed that children with SLI do face difficulties in employing the maxim of informativeness as well as in understanding the logical meaning of quantifiers, and that these difficulties accompany their overall language difficulties. During narrative production, there are several impairing aspects, such as referencing, event content, mental state expressions and inferencing (Mäkinen et al., 2014). Even so, there is a wide range of individuals with SLI with different pragmatic skills that affect their relationships with peers. Overall, individuals with better pragmatic language skills and lower levels of emotional problems have less difficulty in developing peer relations (Mok et al., 2014).

SLI and Semantics

The neuronal processing of semantic information at sentence level is atypical in pre-schoolers with SLI (Pijnacker et al., 2017), and this reflects in their speech production, with longer silent pauses than TD individuals (Befi-Lopes et al., 2013). Children with SLI reveal deficits in lexical-semantic organisation, showing difficulties in lexical access (Girbau, 2014; Sheng & McGregor, 2010a, b). They have word-learning difficulties, potentially originated in the early stages of the process of fast mapping (Jackson et al., 2016) and statistical learning. The latter is related to lexical-phonological abilities, predicting them (Mainela-Arnold et al., 2010). Therefore, the ability of individuals with SLI to learn novel words increases when stimuli combine visual and verbal information (Gladfelter et al., 2019). However, it is possible to discriminate among children with SLI those who present greater lexical deficits (Befi-Lopes et al., 2010), showing associations between vocabulary level and naming abilities (Sheng & McGregor, 2010a, b) or lexical retrieval (Novogrodsky & Kreiser, 2015). Generally, all individuals with SLI perform worse when naming verbs compared to objects, which reveals problems encoding semantic representations (Andreu et al., 2012). This deficit is specific to the verbal domain, suggesting weakened and/or less efficient connections within the language networks (Cummings & Ceponiene, 2010).

SLI and Syntax

SLI has been traditionally characterised as a deficit of structural language (specifically grammar) (Davies et al., 2016). Children with SLI frequently omit tense-related morphemes (Rombough & Thornton, 2018) and present weaknesses in noun and verb inflections at 5 years old. At pre-school age, number agreement is a major challenge for children with SLI, with difficulties especially in oral production of 'quantifier + noun', compared to 'determiner + noun' (Rice & Oetting, 1993). However, all these difficulties tend to disappear with age. At 8 years old, individuals with SLI produce fewer relative clauses (Zwitserlood et al., 2015) and complex sentences (Domsch et al., 2012) than their TD peers. For children with SLI, some kinds of relative clauses are easier than others, displaying a similar profile to TD children but at a lower level of performance (Frizelle & Fletcher, 2014). At the age of 10, only complex sentence structure generation remains difficult (Ingram, 2019).

It is also important to highlight that some difficulties manifested by individuals with SLI, like the use of clitics (Stanford et al., 2019), as well as understanding complex sentences that include non-finite subject-verb sequences (Souto et al., 2016), are probably related to memory skills, rather than limitations on syntax (Montgomery et al., 2016). Individuals with SLI who show weaknesses in tense marking and verb agreement also reveal difficulties in non-word repetition, that is, in phonological short-term memory (Ebbels et al., 2012).

Social (Pragmatic) Communication Disorder

SPCD constitutes a recently created diagnosis (DSM-5, 2013), previously included in the ASD diagnosis, being the main difference the severity level of behaviours (Reisinger et al., 2011). SPCD refers to persistent difficulties in social use of verbal and non-verbal communication, deficits in understanding and following social rules of communication

in natural contexts and difficulties in adjusting communication to match context or the needs of the listener and in following storytelling and rules of conversation (APA; DSM-5, 2013). However, there is a lack of reliable and culturally valid assessment measures to make a differential diagnosis of SPCD (Norbury, 2014), and there is no qualitative evidence to distinguish SPCD from ASD. SPCD appears to lay on the borderline of the autism spectrum, describing those with autistic traits that are insufficiently severe for ASD diagnosis, but who nevertheless require support in the field of pragmatics (Mandy et al., 2017). Gibson et al. (2013) suggest that a rigorously defined diagnostic group of individuals with SPCD can be differentiated from those with HFA, with the support of a more detailed measure of RRBIs, focused on current functioning in everyday contexts. Lockton et al.' (2016) research reveals that some children with SPCD show awareness of the pragmatic rules they themselves do not follow when conversing, so it may be beneficial for therapeutic intervention to focus on improving motivation for use and better understanding of the impact of one's own pragmatic performance on others.

Between 5 and 7 years old, children with SPCD show difficulties in narrative competence, especially in narrative productivity and story content organisation. Although their developmental trajectory is largely similar to that of TD individuals, a persistent developmental delay of approximately 1 year is observable (Ketelaars et al., 2016).

Common aspects of language development in individuals with SLI and autistic individuals have been subject of research in recent years. However, despite the similarities observed regarding social interaction (Swineford et al., 2014), there are few studies including individuals with SPCD.

Bearing in mind that (1) in individuals with SLI, as well as in autistic individuals with LI, changes in comprehension as well as alterations in the use of language and in the structural component of language can be verified; and (2) in individuals with SPCD, only difficulties in terms of use of language are expected, this work aims to investigate if the dissociation between the three pathologies is factual or not.

This raises a central question in speech-language pathology: is there evidence to identify developmental language trajectories across autistic individuals and individuals with SLI/DLD and SPCD?

Methods

This literature review used the main research databases in this field: PubMed, PsycInfo and SciELO. We have also researched 'scientific grey literature' (not published literature) through the Scientific Open Access Repositories of Portugal. We used the keywords 'Autism Spectrum Disorders' and/or 'Social (Pragmatic) Communication Disorder' and/or 'Specific Language Impairment' or 'Developmental Language Disorder'. We selected papers published in the last 10 years in Portuguese, English, Spanish and French, languages spoken by the authors of this review, which focused on autistic individuals and individuals with ASD, SLI/DLD and SPCD. The keywords 'Autism Spectrum Disorders', 'Specific Language Impairment', 'Developmental Language Disorder' and 'Social (Pragmatic) Language Impairment' were used. The articles were reviewed and selected with full consensus among all authors, according to the following inclusion criteria: (1) they always included simultaneous language assessments regarding at least two of the studied populations; (2) comparative studies of any research design. The following exclusion criteria were defined: (1) assessment of only one of the target groups; (2) non-inclusion of the analysis of any aspect related to the understanding and/or expression of oral language. The research conducted with these databases identified 326 articles: PubMed, 301; PsycInfo, 7; SciELO, 5; Scientific Open Access Repositories of Portugal, 13. After eliminating the repeated papers and performing the first selection, according to the inclusion and exclusion criteria, by examining title and abstract, 18 papers were chosen for full text analysis. Figure 2 shows the selection criteria.

Results

The 18 included papers contemplate simultaneous language assessments with the study populations, comparing their results. In total, 1496 individuals, aged between 1 and 15 years old, were assessed. Of these participants, 482 were considered to have typical development (control group), 590 were diagnosed with ASD, 259 with SLI or DLD and 22 with SPCD.

Table 1 summarises the main contents of the included studies. Most of the authors divided the participants with ASD in two groups: ASD-LI and ASD-NLD. Phonological working memory (PWM), measured by pseudoword repetition, is the most investigated area.

Phonological Working Memory

Five research papers were included with comparable methodologies in the area of PWM. Of these studies, only Tager-Flusberg's (2015) identified a similar performance pattern among autistic individuals with LI and individuals with SLI, in terms of phonological errors, produced in pseudoword repetition. In the others, participants with SLI always displayed a weaker performance.

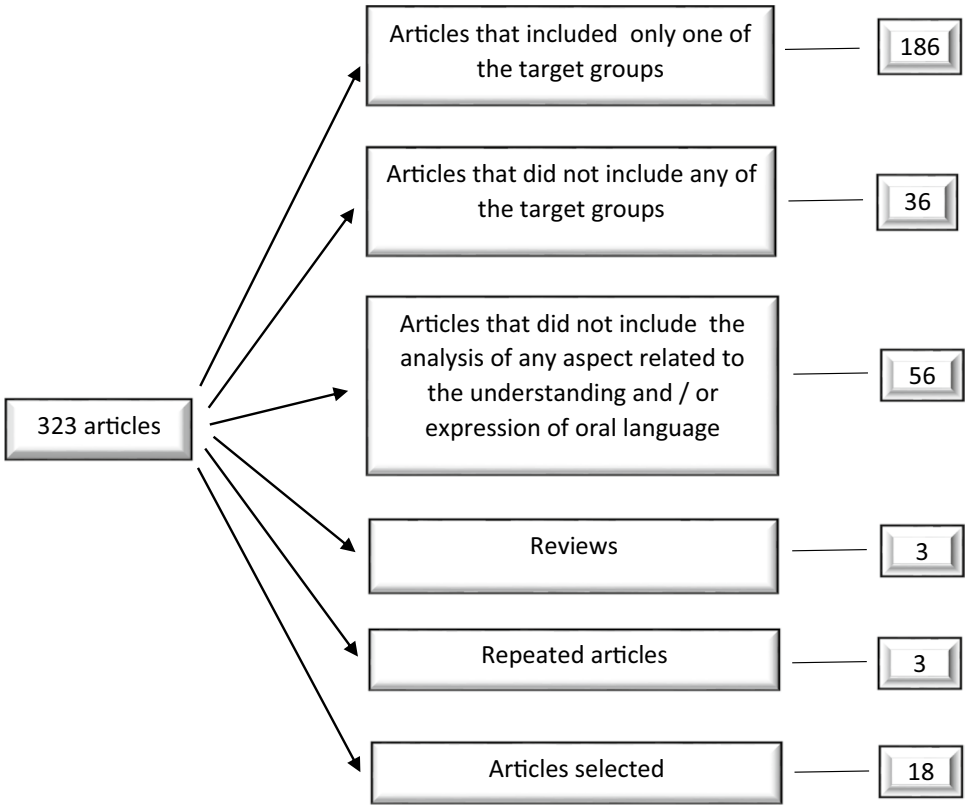

Fig. 2 Selection criteria of the articles

Semantic Skills

Semantic skills are addressed in four studies with distinct objectives and methodologies. The authors verified that children with SLI and autistic children with LI have similar lexical deficits regarding semantic knowledge, associations between lexicon and syntax through vocabulary, word definition/matching and sentence recalling tests (from a given word) and have difficulties in understanding compound nouns and interpreting the first noun as the agent. Haebig et al. (2015) also conclude that lexical-semantic knowledge is similarly organised in school-age autistic children and children with SLI, matched on receptive vocabulary knowledge. This study also suggests that lexical-semantic knowledge in autistic individuals and individuals with SLI may be immature but follows a similar organisation of knowledge as TD individuals. The mechanisms underlying word learning (statistical learning and fast mapping) were investigated by Haebig et al. (2017) through word segmentation tasks and matching an object to a label in artificial languages specifically created for the tests. These studies concluded that children with SLI performed worse than autistic children in all measures. However, when the groups were reorganised according to language skills, a new group of ASD was created—ASD-LI. Then, both children with SLI and autistic children with LI presented results below controls in fast mapping. In relation to statistical learning, children with SLI had poor results, unlike autistic children, which performed similarly to TD peers.

Syntactic Skills

Studies that addressed syntax also show completely different methodologies. Fortunato-Tavares et al. (2015) verified that children with SLI, HFA and Down syndrome have an overall deficit in structuring the syntactic relations necessary for sentence comprehension, also showing a similar performance in the tasks where working memory demands are higher. Even so, children with SLI perform better in understanding ambiguous sentences compared with autistic children (Ishihara et al., 2015). Craig and Trauner (2017), in turn, characterised differences in the use of language in children with SLI and HFA, by analysing verbal responses on standardised tests, verifying that changes in syntactic expression are completely different in terms of SLI and ASD. In order to prove the existence of a link between syntactic and ToM skills, Durrleman et al. (2017) verified that children with SLI, autistic children and TD children with similar skills in production of sentences also showed comparable performances regarding ToM.

Table 1 Summary of all studies analysed

Study	Research design	Objectives (O)/hypothesis (H)	Participants	Ages	Methodology	Results	Conclusions
Riches et al. (2011)	Quasi-experimental	H: Poor performance in repeating pseudowords in the SLI and ASD-LI groups indicates an overlap in the language phenotype	16 ASD 13 SLI 17 controls	14–15	Pseudoword repetition	Greater effect of pseudoword size in the SLI group, which may be due to greater short-term memory limitations. This group also had more phonemic errors	Differences in the profiles of individuals with SLI and ASD, but partial overlap cannot be ruled out
McGregor et al. (2012)	Quasi-experimental	O: To compare the depth of lexical knowledge and the associations between lexicon and syntax	12 ASD-LI 21 ASD-NLD 14 SLI 51 controls (same age) 26 controls (inferior age)	9–14	Vocabulary tests, sentences, definitions and word matching	ASD-NLD: age-appropriate word knowledge ASD-LI: similar results to SLI peers ASD-LI and SLI: lexical deficits, difficulties in word knowledge and the relationships between words	Similarity in ASD-LI and SLI phenotypes
Riches et al. (2012)	Quasi-experimental	O: To investigate whether adolescents with SLI and ASD-LI have difficulties in word formation, as well as a similar linguistic phenotype	16 ASD-LI 14 ASD-NLD 10 SLI 14 controls	14	Understanding compound names through a picture selection task	ASD and SLI: misinterpretation of compound nouns (interpreted first name as agent). Individuals with poor vocabulary and poor pseudoword repetition skills had more difficulties	Phenotypic overlap between SLI and ASD
Gibson et al. (2013)	Quasi-experimental	O: To compare ASD, SLI and SPCD in social functioning, $RRIB_S$ and language ability	21 HFA 22 SPCD 19 SLI	6–11	Standardised measures: MIPO (Gilbson et al., 2011); RBQ-2 (Leekam et al., 2007); CELF-4 (Semel et al., 2004)	Greater difficult degrees in interaction with peers discriminated HFA from SPCD. SPCD was differentiated from SLI by elevated difficulties in interaction with peers and higher expressive language ability	SPCD is a developmental impairment, distinguishable from HFA and SLI
Williams et al. (2013)	Quasi-experimental	O: To evaluate the performance of individuals with ASD-LI and SLI in a pseudoword repetition test	70 ASD-LI 15 SLI 19 older controls 19 younger controls	6–14	Pseudoword repetition	Individuals with SLI performed worse Individuals with ASD performed similarly to controls, matched by language level	The cognitive cause underlying the pseudoword repetition deficits is different in each of the groups

Table 1 (continued)

Study	Research design	Objectives (O)/hypothesis (H)	Participants	Ages	Methodology	Results	Conclusions
Roy and Chiat (2014)	Quasi-experimental	O: To determine the extent to which performance in school age can be predicted, what this reveal about the nature of children's deficits and what are the implications for the early identification of special needs children	91 children with language impairments	2;6–3;6	3 assessment moments: T1, 2;6–4 years. T2: 18 months after. T3: 9–11 years Language and non-verbal IQ assessment	Between 9 and 11 years old, of the 91 children who were initially assessed for language deficits (T1): - 11% had deficits in social communication - 27% language impairment - 20% both - 42% neither	Children who are initially referred for having language delay may have an undetected ASD, which may or may not, in the long run, be accompanied by language impairment
Seol et al. (2014)	Quasi-experimental	O: To investigate the differences between language comprehension and production	103 ASD 63 DLD	1–4	Language comprehension and production assessment	All participants (ASD and DLD) had lower results than controls (normative data) Children with DLD: better comprehension skills Children with ASD: better production skills	Different developmental language trajectories
Taylor et al. (2014)	Quasi-experimental	O: To check if children with SLI and ASD share a poor short-term phonological memory	18 ASD-NLD 14 ASD-LI 19 SLI 61 controls	5–2	Pseudowords and sentences repetition cognitive evaluation	Children with ASD-LI and SLI performed worse compared to the other groups	Distinct profiles between ASD and SLI
Fortunato-Tavares et al. (2015)	Quasi-experimental	O: To examine the syntactic assignment of predicates and reflexives in comprehension across age-matched groups of individuals with SLI, HFA, Down syndrome and TD	15 SLI 12 HFA 15 Down syndrome 15 controls	7–14	Computerised picture selection task	All three clinical groups presented lower accuracy than TD, exhibiting a similar performance only when memory demands were higher	Similar profiles when memory demands are higher
Haebig et al. (2015)	Quasi-experimental	O: To examine lexical processing in school-age children with ASD, SLI and TD	27 ASD 28 SLI 30 controls	8–11	Lexical decision task	Better results to words from high than from low semantic networks SLI with weaker semantic network effects	Similarity under the mechanisms which underlie semantic processing in ASD, SLI and TD
Hill et al. (2015)	Quasi-experimental	O: To examine differences in memory skills among children with SLI, ASD-LI and ASD-NLD	22 ASD-LI 20 ASD-NLD 18 SLI	5–8	Pseudoword repetition	More severe difficulties in SLI	Distinct performance between ASD and SLI

Table 1 (continued)

Study	Research design	Objectives (O)/hypothesis (H)	Participants	Ages	Methodology	Results	Conclusions
Ishihara et al. (2015)	Case study	H: Although there are language difficulties in ASD and SLI, they should be more pronounced in ASD	9 ASD 10 SLI	6–14	Ambiguous sentences test	Significant difference, with better performance of the group with SLI	Distinct performance between ASD and SLI
Tager-Flusberg. (2015)	Quasi-experimental	H: There is an ASD subgroup that simultaneously has SLI	18 ASD-NLD 20 ASD-LI 14 SLI 21 controls	8–13	Pseudoword repetition	Similar performance among individuals with ASD-LI and SLI	Comorbidity between the two ASD and the SLI
Ramírez-Santana et al. (2019)	Quasi-experimental	O: To examine and compare language phenotypes in Spanish-speaking children with a diagnosis of ASD or SLI	20 ASD 20 SLI 20 controls	7–11	Structuring and formulation of sentences, concepts and directions Structure and kinds of words Remembering sentences	No significant differences in language were found between groups	There is an overlap in linguistic profiles between ASD and SLI groups
Gorman et al. (2016)	Quasi-experimental	H: Children with ASD use different fillers compared to typical developmental peers or SLI, which reflect differences in social skills and communicative intents	50 ASD 17 SLI 43 controls	4–8	Investigation of the use of fillers during the submission of the ADOS instrument	The children with ASD used fewer fillers than the other two groups	The use of fillers, in concert with other researches, can help distinguish ASD from SLI
Craig and Trauner (2017)	Quasi-experimental	O: To characterise differences in language use in individuals with high-functioning SLI and ASD	28 ASD 16 SLI 52 controls	6–14	Standardised tests	SLI: higher responses, with more filler words ASD: more grammatical errors, conversational topic breakouts and rambling SLI and ASD: high perseveration rates The 3 groups did not reveal significant differences in the reviews	ASD and SLI have different patterns of language dysfunction

Table 1 (continued)

Study	Research design	Objectives (O)/hypothesis (H)	Participants	Ages	Methodology	Results	Conclusions
Durrleman et al. (2017)	Quasi-experimental	O: To investigate the connection between poor results in a verbal ToM task and the production of syntactic complements in SLI	34 ASD 20 SLI 30 controls	6–14	Sentence-picture matching tasks Picture-sequencing tasks	Competency in complements relates to ToM performance, with more difficulties in the SLI. In the 3 groups, individuals with equivalent performance in the complements also presented similar results in the ToM	Different groups with equivalent skills in the production of complements have similar results in TOM
Haebig et al. (2017)	Quasi-experimental	O: To examine the mechanisms underlying word learning	25 ASD 23 SLI 26 controls	8–11	Word segmentation Matching an object to a label	Children with SLI performed poorly on both tasks	Distinct underlying mechanisms in both disorders

ASD, autism spectrum disorder

ASD-LI, autism spectrum disorder with language impairment associated; *ASD-NLD*, autism spectrum disorder with normal language development

HFA, high-functioning autism

DLD, developmental language disorder

SLI, specific language impairment

SPCD, social (pragmatic) communication disorder

ToM, theory of mind

RRIBs, restricted and repetitive interests/behaviours

TD, typical development

Pragmatic Skills

Speech planning and production difficulties in autistic children and children with SLI were explored by Gorman et al. (2016) through the analysis of the use of 'uh' and 'um' fillers during the application of the *Autism Diagnostic Observation Schedule* (*ADOS*) instrument. The group with ASD revealed a lower rate in the use of these fillers. Similar results were observed among autistic individuals and the control group.

Oral Language Comprehension and Production

Oral language comprehension and production skills, in general, are addressed by four studies. Developmental trajectories in children with language impairments were explored by Roy and Chiat (2014). The authors concluded that the majority of children who showed no differences in all assessed skills among them at the first evaluation moment (between 2 and 4 years old) presented differences at the third evaluation moment (between 9 and 11 years old): social communication deficits (11%), language impairment (27%), both difficulties (20%) and neither of them (42%). They also found that these difficulties emerged gradually.

Differences between language comprehension and production in autistic children and children with DLD, aged between 18 months and 4½ years old, were investigated by Seol et al. (2014). They verified that the group with DLD had superior comprehension skills, that the two groups did not reveal significant differences in terms of production and that language comprehension difficulties in the ASD group were more pronounced in younger children.

In the same line, but with children between 7 and 11 years old, Ramírez-Santana et al. (2019) examined and compared language phenotypes in individuals with SLI and autistic individuals, focusing on expressive and receptive language, as well as on core language and other specific skills, more specifically related to language content and language structure. The authors verified that there are no significant differences between the studied populations in all evaluated areas, concluding that there might be an overlap between language phenotypes.

To further elucidate the behavioural and linguistic profile associated with SPCD, HFA and SLI, Gibson et al. (2013) resorted to standardised measures to evaluate three groups of school-age children, each with one of the mentioned diagnoses. The authors verified that (1) there was a pattern of increasingly severe social difficulties observed in SLI, SPCD and HFA groups; (2) there are similarities in social communication and social interactional difficulties between HFA and PLI, but they are distinguished by the presence or absence of restricted and repetitive behaviours; (3) children with SLI are distinguished from other groups by the absence of social impairment; (4) increased expressive language ability was important for distinguishing SPCD from SLI, and decreased expressive language ability differentiated SPCD from HFA; (5) both the SLI and PLI groups showed advantage for receptive over expressive language; and (6) for children with HFA, receptive and expressive language were at similar levels, with a slight but nonsignificant tendency towards superior expressive language.

In Table 2, we present the selected studies and their conclusion, regarding the existence of identical aspects in the populations under study. The first 5 studies evaluate PWM. All have similar methodologies: groups of pseudowords were formed, according to the number of syllables (between 3 and 5), in increasing order of length. The children immediately repeated the pseudowords perceived, and their response was recorded and later transcribed. The study by Tager-Flusberg (2015) also assesses sound discrimination of pseudowords: after the repetition test, pairs of pseudowords (previously recorded on the computer) were presented, and the children had to select 'yes' or 'no' on the monitor to indicate if they were the same. Of all the studies that evaluate this competence, Tager-Flusberg's (2015) is the only one which concludes the existence of phenotypic overlap between ASD and SLI.

The remaining thirteen studies address different semantic, syntactic, pragmatic, general language comprehension and production skills by using completely different methodologies. Only six of these studies (Riches et al., 2012; McGregor et al., 2012; Heabig et al., 2015; Fortunato-Tavares et al., 2015; Durrleman et al., 2017; Ramírez-Santana et al., 2019) conclude that there are similarities between ASD and SLI.

Table 3 and Fig. 3 provide a clearer view of linguistic areas where language phenotypes overlap. Semantics is clearly the area in which most authors conclude that there are similarities between SLI and ASD-LI.

Discussion

The majority of studies selected for this review focus on phonological working memory (pseudoword repetition), semantics (lexical processing, lexical knowledge, comprehension of compound nouns and lexical acquisition), syntax (sentence comprehension and syntactic expression) and pragmatics (social and communicative intent).

Phonological Working Memory

Working memory is highly associated with pragmatic competences and discourse comprehension in autistic individuals (Schuh et al., 2016). PWM, as well as receptive vocabulary, are considered significant predictors of fast mapping abilities in individuals with SLI (Alt

Table 2 Overview of the results from the various studies

Authors	Ages (years)	Title	Phenotypic overlap
Riches et al. (2011)	14–15	Non-word repetition in adolescents with specific language impairment and autism plus language impairments: a qualitative analysis	No
McGregor et al. (2012)	9–14	Associations between syntax and the lexicon among children with or without ASD and Language Impairment	Yes
Riches et al. (2012)	14	Interpretation of compound nouns by adolescents with specific language impairment and autism spectrum disorders: an investigation of phenotypic overlap	Yes
Gibson et al. (2013)	6–11	Social communication disorder outside autism? A diagnostic classification approach to delineating pragmatic language impairment, high functioning autism and specific language impairment	No
Williams et al. (2013)	6–14	Non-word repetition impairment in autism and specific language impairment: evidence for distinct underlying cognitive causes	No
Roy and Chiat (2014)	2–11	Developmental pathways of language and social communication problems in 9-11 year olds: unpicking the heterogeneity	No
Seol et al. (2014)	1–4	A comparison of receptive-expressive language profiles between toddlers with autism spectrum disorder and developmental language delay	No
Taylor et al. (2014)	5–12	Evidence for distinct cognitive profiles in autism spectrum disorders and specific language impairment	No
Fortunato-Tavares et al. (2015)	7–14	Syntactic comprehension and working memory in children with Specific Language Impairment, Autism or Down Syndrome	Yes
Haebig et al. (2015)	8–11	Lexical processing in school-age children with Autism Spectrum Disorder and Children with Specific Language Impairment: the role of semantics	Yes
Hill et al. (2015)	5–8	Memory in language impaired children with and without autism	No
Ishihara et al. (2015)	6–14	Compreensão da Ambiguidade em Crianças com Transtorno Específico de Linguagem e Fala e Transtorno do Espectro Autista	No
Tager-Flusberg (2015)	8–13	Defining language impairments in a subgroup of children with autism spectrum disorder	Yes
Gorman et al. (2016)	4–8	Uh and um in Children With Autism Spectrum Disorders or Language Impairment	No
Haebig et al. (2017)	8–12	Statistical word learning in children with autism spectrum disorder and specific language impairment	No
Durrleman et al. (2017)	6–14	Theory of mind in SLI revisited: links with syntax, comparisons with ASD	Yes
Craig and Trauner (2017)	6–14	Comparison of Spontaneously Elicited Language Patterns in Specific Language Impairment and High-Functioning Autism	No
Ramírez-Santana et al. (2019)	7–11	A comparative study of language phenotypes in Autism Spectrum Disorder and Specific Language Impairment	Yes

& Plante, 2006; Jackson et al., 2016). PWM has thus been proposed as a reliable measure to assess language, being extremely useful for the identification of SLI/DLD (McDonald & Oetting, 2019). Thus, if there is a phenotypic overlap between this pathology and ASD, both groups have difficulties in performing these tasks. We found only one study (Tager-Flusberg, 2015) identifying a comorbidity between SLI and ASD-LI, and this result can be explained by the heterogeneity existing among these individuals with regard to their auditory discrimination skills, since these are highly correlated with pseudo-repetition skills and verbal production (Ebbels et al., 2012; Tager-Flusberg, 2015). So, as Ebbels et al. (2012) suggested, there is a deficit with phonology per se, rather than a deficit with phonological short-term memory or storage. Therefore, we conclude that children of the studied ages presenting similar problems in pseudoword auditory discrimination will also show similar difficulties in PWM.

The remaining results are in line with those obtained by Heaton et al. (2018), who investigated the impact of auditory short-term memory impairments in musical perception (assuming that music, like language, relies on auditory memory). Heaton et al. (2018), as well as Hill et al. (2015), Riches et al. (2011), Taylor et al. (2014) and Williams et al. (2013), verified that participants with SLI performed at significantly lower levels than the ASD-LI and TD groups. It is thus possible to conclude that there is a general deficit in terms of phonological skills which covers all individuals with SLI.

Table 3 Linguistic areas in which phenotypes overlap

Tasks	Authors	Different performance in the ASD-LI, SLI (DLD) and/or SPCD	Similar performance in the ASD-LI and in the SLI (DLD) and/or SPCD
Phonology			
Phonological working memory—pseudoword repetition	Riches et al. (2011)	X	
	Williams et al. (2013)	X	
	Taylor et al. (2014)	X	
	Hill et al. (2015)	X	
Auditory discrimination	Tager-Flusberg (2015)		X
Semantics			
Semantic knowledge	McGregor et al. (2012)		X
Vocabulary			
Word matching/ definition			
Sentence recalling			
Comprehension of compound names	Riches et al. (2012)		X
Lexical processing	Heabig et al. (2015)		X
Word learning	Haebig et al. (2017)	X	
Syntax			
Understanding ambiguous sentences	Ishihara et al. (2015)	X	
Syntactic assignment for predicates and reflexives in sentence comprehension	Fortunato-Tavares et.al. (2015)		X
Production of verbal responses	Craig and Trauner (2017)	X	
Relation between theory of mind and syntax	Durrleman et al. (2017)		X
Pragmatics			
Use of fillers	Gorman et al. (2016)	X	
Oral language comprehension and production			
CELF–4	Gibson et al. (2013)	X	
Preschool Language Scale-3 (UK); CELF–4; Morphosyntactic battery	Roy and Chiat (2014)	X	
SELSI	Seol et al. (2014)	X	
CELF–4	Ramírez-Santana et al. (2019)		X

Semantic Skills

The work of Haebig et al. (2017), which assesses lexical acquisition processes, shows that children with SLI have more difficulties in statistical learning and fast mapping than autistic children and TD children. This result is in line with published literature. Jackson et al. (2016) found that word-learning difficulties of children with SLI may originate at fast mapping, in the scope of procedural deficit hypothesis (PDH). According to the PDH, those aspects of lexical acquisition and processing that rely on procedural sequential memory, namely the organisation and processing of lexical-phonological information, are impaired in children with SLI (Mainela-Arnold & Evans, 2014). However, we found that when the ASD group is divided according to language characteristics (ASD and ASD-LI), it is possible to observe that autistic individuals with LI also present difficulties in fast mapping. This result highlights the heterogeneity within the ASD group and reinforces the idea that it is extremely important to look at linguistic characteristics, rather than just at diagnoses. We can thus conclude that, in this ability, there is an overlap of linguistic phenotypes. The results of the study by Haebig et al. (2015) are also in line with these conclusions, attesting that lexical-semantic knowledge is similarly organised in all children who are matched on receptive vocabulary knowledge, regardless of the clinical group to which they belonged. Thus, once again, we can say that language skills go beyond diagnosis in their degree of importance. This work also suggests that lexical-semantic knowledge in autistic children and children with SLI may be immature but follows similar organisation of knowledge as in TD children, which corroborates published literature, referring to a delayed speed of processing in autistic children (e.g. Either DiStefano et al., 2019). However, in children/

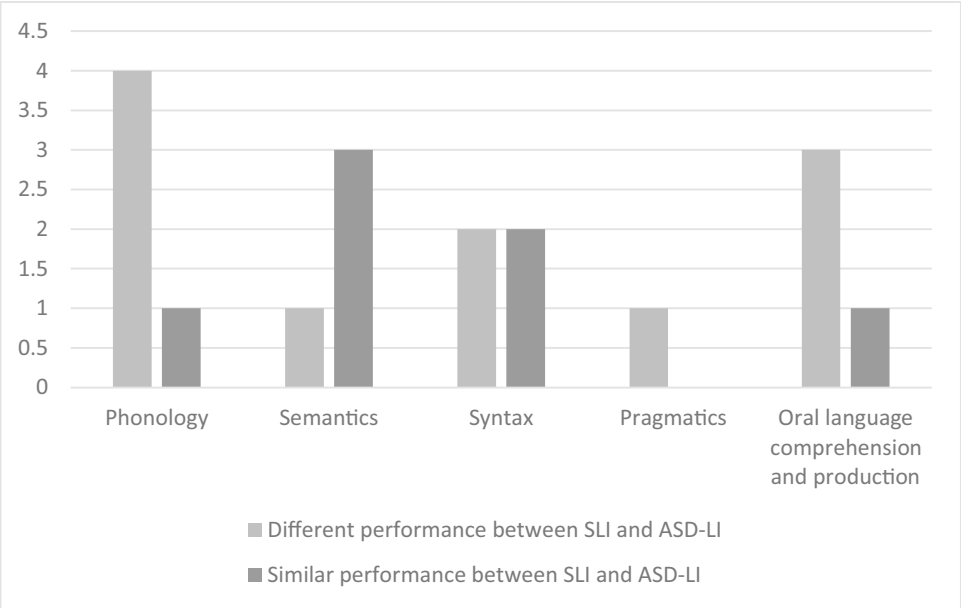

Fig. 3 Comparison between the results of the 18 studies, based on the observation of similar or different linguistic performances

individuals with SLI, semantic processing is considered atypical (e.g. Pijnacker et al., 2017). Haebig et al. (2015) bring ASD-LI and SLI closer, suggesting an overlap between the diagnoses whenever children are matched by vocabulary level.

The studies by McGregor et al. (2012) and Riches et al. (2012) also allow us to notice an overlap in language phenotypes. That is, there are clear similarities between SLI and ASD in terms of vocabulary, word definition and association, recalling sentences from a given word (McGregor et al., 2012) and understanding compound nouns (Riches et al., 2012).

Syntactic Skills

The objectives and methodologies of the studies addressing these abilities are very different. The results obtained by Ishihara et al. (2015) revealing better syntactic comprehension abilities in the group with SLI are considered to be expected, since this skill is also related to the semantic-pragmatic interface, which is a weak area in ASD (Westerveld & Roberts, 2017). Taking into account that the understanding of ambiguity was specifically assessed, the difficulties in semantic integration (Coderre et al., 2017) and the weaknesses of abstraction and conceptual generalisation of autistic children (Naigles et al., 2011), as well as their specific difficulties in oral narrative comprehension (Norbury et al., 2014) and in relative clause comprehension (Durrleman et al., 2015; Garrido et al., 2017), did not allow a good performance in the assessment. Through these results, we can verify the existence of distinct developmental profiles at the level of syntactic comprehension in individuals with SLI and autistic individuals.

Fortunato-Tavares et al. (2015), in turn, found an overall deficit in structuring syntactic relations necessary for sentence comprehension in SLI, HFA and Down syndrome. However, children with SLI exhibited similar performance to the children with Down syndrome and HFA when working memory demands were higher. In fact, there are several studies noticing the syntactic fragilities in SLI and ASD (e.g. Brynskov et al., 2017; Davies et al., 2016), being these results of special interest due to the importance of working memory. Also, Ebbels et al. (2012) concluded that SLI difficulties with tense marking were related to phonological short-term memory. Thus, we can notice that working memory, in general, assumes an important role, and that children with similar skills at this level also reveal an overlap in linguistic phenotypes.

Regarding morphosyntactic production, the results differ between studies. While Durrleman et al. (2017) conclude that there are similarities between individuals with SLI and autistic individuals, according to Craig and Trauner (2017), there are significant differences between the two groups, since individuals with SLI present more grammatical errors. Firstly, it is important to remember that the results obtained by Durrleman et al. (2017) show that, in the three groups, individuals with similar skills in the production of sentences also show comparable performances regarding ToM. Spanoudis (2016) verified that language skills and ToM are related and that syntactic and pragmatic abilities contributed significantly to the prediction of ToM performance in children with SLI. Thus, we found that children with SLI, autistic children and TD peers should have similar syntactic and pragmatic characteristics, and hence the similar results in ToM. It is also important to mention that this study was developed resorting to visual stimuli, which

may have possibly helped decrease the errors in the group with SLI (Harper-Hill et al., 2014). In the work by Craig and Trauner (2017), only verbal stimuli are given in order to elicit children's responses, which may be the reason for the high number of errors produced by individuals with SLI. We can conclude that the assessment of linguistic domains and the type of stimuli used are more important than the diagnosis.

The results of the studies described above emphasise the heterogeneity that exists in SLI and ASD, showing that a partial overlap of morphosyntactic phenotypes in both groups cannot be ruled out. This possibility is corroborated by neurological studies. On the one hand, some suggest that ASD-LI and SLI share neurodevelopmental changes in the cortical-cerebellar circuits that manage motor control and language, cognition, working memory and attention processing (Hodge et al., 2010). On the other hand, they conclude that there are different neuroanatomical substrates for language deficits in both disorders (Verhoeven et al., 2012), since different mechanisms for microstructural white matter alterations are observed in both groups (Roberts et al., 2014).

Pragmatic Skills

Similar results were observed among individuals with SLI and in the control group regarding the use of filler 'um', in contrast with the low rate of the fillers use presented by the ASD group (Gorman et al., 2016). These results are in line with the literature which, on the one hand, says that, during discourse, pauses can be filled with words like 'um' or 'uh', being that 'um' is used to signal longer pauses, and may correlate with greater social communicative sophistication than 'uh' (Parish-Morris et al., 2017). On the other hand, they agree with the results obtained by Irvine et al. (2016), which relate the low use of 'um' with the autism severity. This result allows us to suggest a specific pragmatic impairment in ASD.

Oral Language Comprehension and Production

With respect to oral language comprehension and production, in general, the conclusions are controversial. The results obtained by Seol et al. (2014) lead to the conclusion that there are different developmental language trajectories in autistic individuals and DLD individuals, since the first group reveals better production skills, compared to the second. These results corroborate those obtained by Davidson and Weismer (2017), who identified a greater impairment in language comprehension, compared to production, in the early years of life of autistic children. This characteristic affords the possibility of distinguishing autistic children from those presenting delayed language developments. Roy and Chiat's (2014) work allows us to confirm that both groups have different developmental trajectories, considering that children who initially had the same language pathology evolve to completely different diagnoses. Conversely, Ramírez-Santana et al. (2019) verified that there are no significant differences between SLI and ASD in all evaluated areas, suggesting an overlap between language phenotypes. We consider that the discrepant results between these studies are due most probably to the age of the population evaluated. Whereas in the Seol et al. (2014) work, the groups were between 1 and 4 years old, in the study by Ramírez-Santana et al. (2019), the ages were between 7 and 11 years old. We can thus conclude that most likely, the large differences initially noted in the two populations are dissipating with age.

Finally, Gibson et al. (2013) verified that SPCD, HFA and SLI are distinguishable in terms of social difficulties, RRBIs and language development. These results are opposite to the obtained by Ramírez-Santana et al. (2019) and, with respect to language, unexpected. The ages of the groups are comparable in both studies and the instrument used to access language skills was the same (*Clinical evaluation of language fundamentals UK version 4 [CELF-4]*). Thus, the differences found are probably due to specific differences of the individuals, which leads us to conclude that this field needs further investigation.

Limitations and Future Directions for Research

Bearing in mind that this is a review that aims to bring together studies wherein there is a diagnostic assessment of the subjects, the constant change in the nomenclature of diagnoses and, specifically, the recent creation of the SPCD diagnosis may have been important limitations in this study. Future work should be performed through spontaneous speech, to better characterise language profiles and investigate if these similarities and differences persist over time. It is also important to analyse semantic, syntactic and pragmatic skills through samples of spontaneous speech, and understand not only how they work but also how they correlate with each other. It was clear in this work that phonology and working memory are related and that their development has repercussions in other areas, mainly in semantics and, therefore, in pragmatics. This aspect should also be studied. Language and cognition are complex systems, in which some skills depend on and are highly related to others, and this understanding is extremely important for the construction and implementation of rehabilitation programs by speech-language pathologists. The lack of spontaneous discourse analysis prevents us from realising how linguistic systems really work, and this should be the main objective for the future.

Conclusions

After analysing different research fields, we have noticed that some are clearly more explored than others, and that PWM is the most studied area, followed by semantics. This review draws our attention to the effects of heterogeneity within the diagnoses studied and to the specific characteristics of individuals, which may change the results obtained in different extents. It is thus possible to conclude that, when individuals in the studied groups are matched according to some language or cognitive skills (e.g. auditory discrimination, vocabulary, working memory, ToM), they will also show similar characteristics in other language domains. Therefore, it is extremely important to look at linguistic characteristics, rather than just at diagnoses, mainly when we are comparing two or more groups. Moreover, the type of stimuli used is extremely important, completely conditioning the result. The results of the analysed studies also suggest that the great differences between individuals with SLI and autistic individuals in their early years of life probably dissipate with age, resulting in similar language phenotypes in school age. Probably due to being a recent diagnosis, only one study was found that compares SPCD with SLI and ASD.

This literature review allowed a better comprehension of language characteristics and dynamics in autistic individuals and individuals with SLI and SPCD. This comprehension is central to the development of effective intervention programs by speech and language therapists. No studies were identified that analysed language skills through spontaneous speech, the best way to assess language development (Lopes-Herrera & Almeida, 2008). Most of the studies are based on standardised tests or subtests pulled out from different assessments. However, there are discourse impairments that may not be identified by measures that focus on individual words and sentences (Volden et al., 2017).

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