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Developmental pathways of language and social communication problems in 9-11 year olds: Unpicking the heterogeneity

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Abstract

This paper addressed relations between language, social communication and behaviour, and their trajectories, in a sample of 9-11-year-olds (n=91) who had been referred to clinical services with concerns about language as pre-schoolers. Children were first assessed at 2½-4 years, and again 18 months later.

Results revealed increasing differentiation of profiles across time. By 9-11 years, 11% of the sample had social communication deficits, 27% language impairment, 20% both, and 42% neither. The size of group differences on key language and social communication measures was striking (2-3 standard deviations). Social communication deficits included autistic mannerisms and were associated with social, emotional and behavioural difficulties (SEBDs); in contrast, language impairment was associated with hyperactivity only. Children with both language and social communication problems had the most severe difficulties on all measures.

These distinct school-age profiles emerged gradually. Investigation of developmental trajectories revealed that the three impaired groups did not differ significantly on language or SEBD measures when the children were first seen. Only low performance on the Early Sociocognitive Battery, a new measure of social responsiveness, joint attention and symbolic understanding, differentiated the children with and without social communication problems at 9-11 years. These findings suggest that some children who first present with language delay or difficulties have undetected Autism Spectrum Disorders which may or may not be accompanied by language impairment in the longer term. This new evidence of developmental trajectories starting in the preschool years throws further light on the nature of social communication and language problems in school-age children, relations between language impairment and SEBDs, and on the nature of early language development.

1. Introduction

This study addressed ongoing debate about the overlaps and relations between specific language impairment (SLI) and autistic spectrum disorders (ASD), two distinctive childhood diagnoses that nevertheless share common features (Bishop, 2000; Bishop & Norbury, 2002; Leyfer, Tager-Flusberg, Dowd, Tomblin, & Folstein, 2008; Williams, Botting, & Boucher, 2008). According to diagnostic criteria for SLI (ICD-10, WHO, 1993; DSM-IV, APA, 2000) there should be no overlap, since children are only diagnosed with SLI if they have deficits in receptive and/or expressive language in the absence of other developmental or neurological disorders. However, it is well recognized that profiles of children diagnosed with SLI are heterogeneous and may change across the age range, and in the course of development, some present with pragmatic language impairment (PLI) and social communication difficulties that border on ASD (Bishop, 1998, 2000; Bishop, Chan, Adams, Hartley, & Weir, 2000; Bishop & Norbury, 2002; Botting & Conti-Ramsden, 1999). Children and young people with SLI are also known to be at increased risk of a range of social, emotional and behavioural difficulties (SEBDs) (Yew & O'Kearney, 2013), and such difficulties are known to be strongly associated with social communication problems in children with ASD (Hus, Bishop, Gotham, Huerta, & Lord, 2013). The absence of wider developmental disorders in SLI is therefore far from clear, and the presence of social communication difficulties in particular raises questions about relations with ASD. Are these difficulties a mild version of the deficits present in ASD that only become apparent in the school years? Or do they have their origins in distinct deficits that give rise to overlapping profiles of social communication in middle childhood? Or are they a secondary product of language deficits? Whilst social communication difficulties in SLI may fall short of a clinical diagnosis of ASD, there is general agreement that they need recognition and treatment in their own right, and it is important to understand the nature of these problems if intervention is to be appropriate and timely.

Most evidence to date stems from cross-sectional comparisons of children with SLI and ASD, and investigations of the heterogeneous outcomes observed in longitudinal studies of children first diagnosed with language delay or SLI. Given the criteria for diagnosis, it is perhaps unsurprising that cross-sectional studies of SLI find little evidence of co-occurring ASD at a group level. Loucas et al. (2008), for example, compared groups of children aged 9-14 years who had SLI, ASD with normal language, or ASD with co-occurring language problems, all with nonverbal IQ≥80. Although everyday social functioning and communication in the SLI group was impaired (their mean Social score on the Vineland Adaptive Behaviour Scales (Sparrow, Balla, & Cichetti, 1984) was nearly 2 SDs below the normative population mean), their mean scores on all diagnostic measures of ASD were substantially less impaired than those of the two ASD groups. Leyfer et al. (2008)'s comparison of children with SLI and ASD produced similar results at a group level. However, their within-sample analyses revealed that 41% of the SLI group had scores above the autism cut-offs for social or communication domains on gold standard diagnostic measures for ASD (either the Autism Diagnostic Interview Revised (ADI-R; Lord, Rutter, & Le Couteur, 1994) or the Autism Diagnostic Observation Schedule (ADOS; Lord et al., 2000) or both). This accords with the known heterogeneity in SLI samples, and demonstrates that analysis at group level may not be sufficiently sensitive to identify subsamples of children with different profiles of difficulties, particularly if samples are small and lack power.

Moreover, Leyfer et al.'s findings are in line with increasing evidence from longitudinal studies of preschoolers and school-aged children with SLI. A significant proportion of children with earlier diagnoses of language impairment have been found subsequently to have difficulties in social relationships and to develop autistic-like symptomatology across time which in some cases meets clinical criteria for ASD (Clegg, Hollis, Mawhood, & Rutter, 2005; Conti-Ramsden, Simkin, & Botting, 2006; Durkin, Conti-Ramsden, & Simkin, 2012). Miniscalco, Nygren, Hagberg, Kadesjö, & Gillberg (2006) found that about a quarter (23.8%) of a small community sample of Swedish children who had screened positive for speech and language problems at 30 months had ASD at 7 years. More recently Ek et al. (2012) carried out a small follow-up study of Swedish preschoolers (5-7 years) with moderate or severe speech and language problems and concluded that LI in young children is a marker for several developmental disorders including ASD. After 10 years, over a third (39.1%) of the adolescents had ASD symptoms, and over half of these had a clinical diagnosis of ASD. Findings from our follow-up study of 108 UK preschoolers referred to services with concerns about their language and communication development when they were 2½-4 years old were strikingly similar (Chiat & Roy, 2013). At 9-11 years, about a third of the sample had social communication problems according to the Social Responsiveness Scales (Constantino & Gruber, 2005) and over half of these children (about a sixth of the total sample) had clinical diagnoses of social communication problems, ASD, or both. As in the Miniscalo et al. study, none of the preschoolers had a diagnosis of ASD when first assessed.

To date, the focus of research on the SLI-ASD ‘borderlands’ (Bishop & Norbury, 2002) has been on social communication outcomes, with a dearth of research on developmental trajectories leading up to these. As Durkin et al. (2012) have recently argued, citing Sroufe (2009), ‘there is a need to examine in more depth and detail the role of development in developmental disorders’ (p.135). In our longitudinal study (Chiat & Roy, 2013), measures of language were administered at three time points: T1, when children were first referred, at age 2½-4 years; T2, roughly 18 months later, at age 4-5 years; and T3, roughly 5 years later, at age 9-11 years. In addition, social cognition was assessed at T1 and social communication at T3, and social, emotional and behavioural difficulties (SEBD) at all three time points. These data allow examination of the distribution and nature of profiles at school age and the developmental trajectories behind these profiles. This paper reports language and social communication profiles at T3, and evaluates performance at T1 and T2 to investigate whether children with different T3 profiles were differentiated at earlier stages. The aim is to determine the extent to which school age outcomes may be predicted, and what this reveals about the nature of children's problems, with implications for early identification of children needing support.

2. Method

2.1 Participants

The sample under consideration in this paper comprised 91 children with a mean age of 10;5, SD 6.74 months, who had been referred to speech and language therapy (SLT) services at age 2;6-3;6. Three-quarters of the sample (74%) were boys. The sample was recruited from 7 London Primary Healthcare Trusts and 2 private clinics. Reason for their early referral was concern about language development (not speech), with no report of congenital problems, hearing loss, or oro-motor difficulties; no diagnosis of autism or ASD; no concerns about nonverbal ability; and English as first/main language. The study was approved by the Research Ethics Committee of the School of Health Sciences at City University London, and children were only included if they and their parents gave informed consent.

These children comprised the subsample of children seen at T1 (aged 2;6-4) and T2 (aged 4-5) who could be contacted at T3 (aged 9-11 years), whose parents were willing to participate, and who met nonverbal criteria. Four children who were accessed at T3 were excluded from analyses because their nonverbal IQ scores were below the 5th percentile at

T3 and at both earlier time points, and 11 because their parents did not return questionnaires required for the analyses reported here. Two further children did not complete the morphosyntax battery. Of the 91 children included, 94.5% had nonverbal IQ scores in the normal range (≥85) at T3. The remaining six children were included because they had scores close to normal at one or more time points, and all had scores ≥80 at T3.

This subsample represented just over half the original T1 sample, and just under three-fifths of the sample retained at T2. Given the level of attrition, the T3 sample cannot be assumed to be fully representative of the original sample. Comparison between the T1 children who did and did not participate at T3 revealed significant differences in T1 nonverbal IQ (means of 92.29 vs. 87.85) and T1 receptive language (means of 88.61 vs. 83.64), but T1 measures of expressive language, sociocognition and phonology did not differ significantly. The observed differences indicate that as a group the 'retained' sample were less severely impaired at the time of referral, but were equally at risk on our key research measure of sociocognition at T1. Furthermore, since analyses at all time points reported in this paper refer to the T3 sample, inferences about relations across time are valid for this sample, albeit with less power than analyses conducted at T2.

Parents completed a short questionnaire at all three time points. At T1 questions on family income level, parental occupation and educational qualification of the primary carer were included, and at T2 and T3 parents were asked about any diagnoses their child had received, including social communication and ASD, contact with SLT services and support at school for reading or speech/language. At T1 just under a quarter of the current sample (22%) had family incomes in the lowest category (<£20k), with just over a third (39%) in both the middle (£20k-£40k) and high (>£40k) income ranges. The original sample at T1 had been equally distributed across the income groups, but attrition rate across time was higher in the lowest income group. This bias in attrition was reflected in the educational levels of the children's primary carer, and fathers' occupational status. Over two fifths (44%) of primary carers were educated to at least graduate level and over a half of the fathers were in professional occupations (56%) at T1. In terms of ethnicity, just under three quarters (73%) of the sample were white, just over a tenth (12%) Afro Caribbean, 3% were Asian and the remaining 12% of mixed origin.

2.2 Measures

2.2.1 Nonverbal abilities

Children's nonverbal performance at all time points was measured using nonverbal subscales of the British Ability Scales II (BAS; Elliott, 1996): at T1 and T2, the subscales that constitute the nonverbal composites, and at T3, the average of Pattern Construction and Matrices.

2.2.2 Language

At T3, children were assessed on a standard measure of receptive language, and a new battery of tasks measuring morphosyntactic skills known to be vulnerable in language impairment.

For receptive language, children were tested on the two subtests making up the receptive subscale of the Clinical Evaluation of Language Fundamentals – 4th edition UK (CELF-4, UK, Semel, Wiig, & Secord, 2006). Performance was classified as 'low' if children scored below -1 SD. Ideally, the expressive subscales of the CELF-4 would have been administered as well, but these were not included due to limits on testing time for each child.

The morphosyntactic battery comprised three tasks. The first was a sentence imitation test which requires children to repeat 32 sentences targeting a range of morphosyntactic and syntactic structures, and is scored for number of content words and number of function words repeated correctly. The second was a grammaticality judgement task in which children had to say whether 20 grammatical/ungrammatical sentences 'sounded right or not'. Full protocols for both tests are available at: http://www.city.ac.uk/health/research/research-areas/lcs/veps-very-early-processing-skills/veps-assessments. The final test of morphosyntax was a past tense elicitation task adapted from the Past Tense Task-20 (PTT-20; Conti-Ramsden et al., 2011). A Morphosyntax composite was created by combining content word scores and function word scores on the sentence imitation task with total scores on the grammatical judgement and past tense tasks (see Chiat & Roy, 2013 for details). Performance on the whole morphosyntactic battery was classified as 'low' if children scored in the low category on at least two of the four measures; 'normal' if they scored in the normal category on at least three; and borderline in all other cases. A cut-off between 'low' and 'borderline/normal' was used for categorical analyses.

At T1 and T2, language had been assessed on the auditory (receptive) and expressive subscales of the Preschool Language Scale -3(UK) (PLS, Boucher & Lewis, 1997).

2.2.3 Social communication and sociocognition

At T3, social communication was assessed using parent ratings on the Social Responsiveness Scale (SRS, Constantino & Gruber, 2005). The SRS assesses autistic impairment across a range of severity, is standardized for the age range 4-18 years, and yields T scores (mean 50, SD 10). Total T scores in the severe range (at or above 76T) are 'strongly associated' with clinically diagnosable ASD, while those in the mild/moderate range (60T to 75T) typify children with less severe forms of SC problems – those with 'mild or "high functioning" autistic spectrum conditions' (pp.15-16). Specificity and positive predictive value of the SRS have been found to be higher in children with higher IQ ($\geq$70) (Charman & Gotham, 2013), a criterion met by children in our sample. The SRS is divided into five clinically driven Treatment subscales of Social Awareness, Social

Cognition, Social Communication, Social Motivation and Autistic Mannerisms. Clinical diagnosis of social communication and/or ASD according to parental reports was used in a ROC analysis to identify an optimal cut-off for low social communication. This yielded a cut-off of ≥63 (Total T score). Just under a third of children (30.1%) fell in the low category at T3.

At T1, children had been assessed on the Early Sociocognitive Battery (ESB, Chiat & Roy, 2008). This was designed as a measure of sociocognition and was a hypothesized predictor of social communication outcome. The ESB comprises three tests. The social responsiveness task assesses children's response to an adult's expression of feeling such as hurt and surprise; the joint attention task assesses children's gaze alternation and gaze- or point-following; and the symbolic comprehension task assesses children's ability to identify the 'best match' out of six objects that correspond to six gestures, six miniature objects and six pretend objects demonstrated consecutively by the tester. Full protocols are available at http://www.city.ac.uk/__data/assets/pdf_file/0006/72807/web-sociocog-protocols-may-09-Version-2.pdf

Based on normative data from typically developing samples, scores on the joint attention and symbolic comprehension tasks were 'low' if they fell below -1.5 SD, 'borderline' between -1.5 SD and -1 SD, and 'normal' if ≥-1SD for their age band. Social responsiveness scores were not correlated with age, and in the absence of normative data, cut-offs were derived from the distribution of scores in the clinic sample. For the composite ESB scores, children were classified as 'low' if they achieved low scores on at least two of the ESB subtests, 'normal' if at least two subtest scores were in the average range, and the remaining scores were classified as 'borderline'.

2.2.4 Social, emotional and behavioural difficulties

Parents completed the Strength and Difficulties Questionnaire (SDQ, Goodman, 1997) at all three time points, and teachers at T2 and T3 only. The SDQ is a widely used well-established rating scale that comprises a total problem score and five subscale scores (Emotional Symptoms, Conduct Problems, Hyperactivity, Peer Problems and Prosocial Behavior). Cut-offs for categorical scores (abnormal, borderline and normal) are provided (see sdqinfo.com).

The standardized assessments of language, social communication and SEBDs were well established, psychometrically robust measures (see test manuals for details of reliability and validity). Reliability measures of the ESB and morphosyntactic tasks were reported in previous papers (Chiat & Roy, 2008, 2013), which also demonstrated the concurrent and predictive validity of the ESB.

2.3 Definition of language/social communication profiles at T3

In order to investigate relations between language and social communication problems at T3 and their developmental trajectories, four profiles of language and social communication performance were distinguished:

(i) Language impairment (LI): scores in the low category on receptive language and/or morphosyntax

(ii) Social communication impairment (SCI): scores in the low category on the SRS

(iii) Combined language and social communication impairment (SCI-LI): scores in the low category on the SRS and on one or both language measures

(iv) Unimpaired/normal group (NSC-NL): scores in the normal range for all measures of social communication and language.

2.4 Procedure

At T1 children were seen mainly at home, and T2 and T3 mainly at school, unless parents requested a home visit. Children were seen on one or two occasions and individual sessions lasted about one hour, depending on age of the child and levels of fatigue. The tests were administered by trained research assistants experienced in assessing young children. The three qualified Speech and Language Therapists who carried out the testing at T3 had not been involved in the previous phases of the study and were blind to the performance of the children at T1 and T2. The order of tests was fixed and was designed to vary activities across the sessions and maximize children's level of engagement. Questionnaires were sent to parents and teachers to be returned in a stamped addressed envelope.

3. Results

3.1 T3 outcomes

Of the 91 children, a fifth had combined social communication and language problems (SCI-LI: 20%, n=18), just over a tenth had social communication deficits (SCI: 11%, n=10), just over a quarter had language impairment (LI: 27%, n=25) and two fifths had neither problem (NSC-NL: 42%, n=38). Table 1 shows the distribution of child and demographic factors across the four social communication-language (SC-L) groups in terms of percentages per category and number of cases in each subgroup. Descriptive data on diagnoses at T2 and T3, SLT contact and extra help at school are also included. Age at T3 and number of SLT sessions the child attended at T2 were continuous variables for which the means and SDs are reported. Fisher's exact test (or chi squared where assumptions were met) were used to analyze the categorical data, and univariate ANOVAs were run to test the significance of the between group differences in continuous data. Significance levels of these analyses are reported in the final column.

Table 1

Participant characteristics according to SC-L group, including their clinical diagnoses and use of clinical and educational services

	SCI-LI N=18 % (n)	SCI only N=10 % (n)	LI N=25 % (n)	NSC-NL N=38 % (n)	p value N=91 (N=53)*
Boys	77.8 (14)	80 (8)	80 (20)	68.4 (26)	.78 (1.0)
Ethnicity: White	77.8 (14)	70 (7)	68 (17)	73.7 (28)	
Black	11.1 (2)	10 (1)	20 (5)	7.9 (3)	
Asian/mixed	11.1 (2)	20 (2)	12 (3)	18.4 (7)	.85 (.88)
Income: Low	23.5 (4)	30 (3)	29.2 (7)	16.2 (6)	
Middle	58.8 (10)	30 (3)	33.3 (8)	35.2 (13)	
High	17.6 (3)	40 (4)	37.5 (9)	48.6 (8)	.35 (.47)
Education: None/min	16.7 (3)	20 (2)	4 (1)	5.3 (2)	
GCSE/A	55.6 (10)	40 (4)	56 (14)	39.5 (15)	
Grad/PG	27.6 (5)	40 (4)	40 (10)	55.3 (21)	.25 (.5)
Diagnoses: T3 any	88.9 (16)	60 (6)	40 (10)	10.5 (4)	<.001 (.005)
T3ASD/SC	61.1 (11)	50 (5)	8 (2)	0 (0)	<.001 (<.001)
T2 ASD	18.8 (3)	22.2 (2)	0 (0)	0 (0)	.002 (.08)
SLT T3	55.6 (10)	20 (2)	12 (3)	0 (0)	<.001 (.007)
SLT since 5 at T3	77.8 (14)	60 (6)	44 (11)	23.7 (9)	.001 (.08)
Help reading T3	83.3 (15)	0 (0)	44 (11)	13.2 (5)	<.001 (<.001)
Help speech/language	72.2 (13)	30 (3)	20 (5)	2.6 (1)	<.001 (.002)
	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	
Age (months) at T3	124.39 (7.85)	129.4 (4.72)	124.96 (7.23)	125.05 (6.14)	.25 (.17)
SLT sessions at T2	2.27 (1.03)	2.67 (0.5)	1.79 (1.22)	1.47 (1.16)	.01 (.1)

*p values: without brackets for all 4 groups; with brackets for 3 problem groups only (SCI-LI, SCI, LI)

As can be seen in table 1, T3 SC-L groups taking all 4 groups (including the NSC-NL group with no problems) or the 3 problems groups only did not differ in terms of either their mean age at T3, or in the distributions of gender, ethnicity, family income or education level of their primary carer. Accordingly these factors were not taken into account in subsequent between group analyses.

In contrast, the associations between SC-L profiles and diagnoses (any) and diagnoses (ASD/social communication) at T3, diagnosis of ASD at T2, ongoing SLT at T3, SLT since 5, number of SLT sessions at T2, and additional help with reading and additional help with speech/language at school were all significant. Taking the three problems groups only (SC-LI, SC and LI) the majority of associations remained significant with the exception of SLT since 5 at T3, number of SLT sessions at T2 and diagnosis of ASD at T2. Interestingly at T3 those with language problems had less contact with the SLT services than children with SC problems, and were more likely to have received extra help with reading than with their language problems. Almost all the children with combined problems, the SCI-LI group, had a diagnosis/diagnoses of some kind by T3, and these children were the highest users of clinical and educational services. The two children in the LI group with an ASD/Social Communication diagnosis were diagnosed with Social Communication only as were three of the eleven children in the SCI-LI group. The remaining children were diagnosed with ASD with or without an additional diagnosis of Social Communication. At T2 about a fifth of the SCI-LI group and the SCI group had a diagnosis of ASD; considerably lower than those with a diagnosis by T3 (see table1). We now turn from their clinical and diagnostic history according to parental report to a dimensional analysis of their problems at T3 and across time.

Table 2 shows the means and standard deviations for social communication, language and social, emotional and behavioural outcomes at T3 for each of the four SC-L profiles. Results of a series of univariate ANOVAs are also presented, including effect sizes (partial eta square) and post hoc SC-L group comparisons, with a Bonferroni correction for multiple comparisons applied. As overall group differences were large and highly significant (p<.001) with the majority of effect sizes large (η^2: ≥0.14, according to Cohen.1988), results of ANOVAs are not reported in full but are available on request from the authors.

Table 2

Comparison of SC-L groups' social communication, language and SEBD scores at T3[1]

T3 outcomes	SCI-LI N=18 Mean (SD)	SC N=10 Mean (SD)	LI N=25 Mean (SD)	NSC-NL N=38 Mean (SD)	η^2	Post hoc Compari -sons[2]
Social communication (SRS)						
SRS T total	82.17 (12.8)	72.4 (7.26)	48.6 (7.59)	44.34 (5.57)	.79	a, b, c
Social Awareness	66.89 (12.25)	66.8 (9.64)	48.1 (11.88)	43.78 (8.34)	.5	b, c
Social Cognition	79.44 (12.9)	66.2 (12.71)	47.46 (9.8)	43.27 (5.8)	.71	a, b, c
Social Communication	80.44 (13.27)	69.5 (8.55)	47.21 (7.49)	44.41 (5.89)	.76	a, b, c
Social Motivation	71.72 (13.4)	72.2 (8.56)	51.67 (9.92)	46.32 (8.44)	.56	b, c
Autistic Mannerisms	88.06 (17.23)	71.2 (14.74)	49.5 (6.36)	48.27 (6.96)	.71	a, b, c
Language						
Receptive CELF-4	72.89 (12.12)	100.7 (14.5)	84.0 (8.31)	102.79 (14.9)	.48	a; b; c
SASIT (max. 32)	18.28 (7.32)	28.6 (2.76)	22.36 (4.86)	28.76 (2.51)	.48	a; b; c
PTT20 (max. 20)	11.5 (5.34)	18.3 (1.42)	16.04 (3.01)	18.58 (2.46)	.41	a; b
Nonverbal	93.44 (9.48)	106.3 (9.44)	100.04 (7.37)	110.87 (9.34)	.38	a
Social, emotional and behavioural difficulties (SEBDs)						
	n=17	n=10	n=24	n=37	η^2	
SDQ total	18.71 (6.88)	13.7(5.01)	9.75 (4.33)	6.03 (4.92)	.47	b***

Emotional	3.41 (2.35)	4.2 (2.74)	2.42 (1.72)	1.81 (1.91)	.15	
Conduct	3.29 (2.42)	1.5 (1.78)	1.67 (1.55)	.84 (1.28)	.23	a+; b*
Hyperactivity	7.76 (2.17)	4.6 (3.03)	4.37 (2.32)	2.43 (2.47)	.4	a*; b***
Peer Problems	4.24 (2.49)	3.4 (2.27)	1.29 (1.78)	.92 (1.26)	.37	b***; c*
Prosocial	5.71 (2.09)	6.6 (2.5)	8.54 (1.35)	8.97 (1.55)	.37	b***; c*

[1]SC-L groups. SCI-LI: Social communication and language problems; SCI: Social communication problems only; LI: Language problems only; NSC-NLI: No social communication or language problems

[2]Comparisons of 3 problems groups: a: SCI-LI vs. SC; b: SCI-LI vs. LI c: SC vs. LI; p value: *<.05, **<.01, ***<.001, +borderline

3.1.1 Social communication

Group differences on the SRS total score and subscale scores were significant and the effect sizes large. Post hoc analyses confirmed that the two groups with social communication problems (SCI and SCI-LI) had total and subscale mean scores significantly below the two groups without social communication problems (LI and NSC-NL), whose scores were in the average range and did not differ from each other (see table 1). While significant differences between groups defined by presence/absence of SC problems were expected, the size of the difference (nearly 3 SDs) was striking.

Turning to the two groups that had SC problems, significant differences were found between those with and without co-occurring language problems on means for total T score and three of the five subscale T scores of the SRS. While all SRS scores of the SCI group were in the mild-moderate range (60-75), in the SCI-LI group total T scores and subscale T scores for Social Cognition, Social Communication, and Autistic Mannerisms fell in the severe range (≥76), with only Social Awareness and Social Motivation in the moderate range.

3.1.2 Language

A similar picture emerged when we compared language performance across the four SC-L groups. Univariate ANOVAs taking language scores as the dependent variable revealed significant differences across the four SC-L groups. All the effect sizes, although smaller than for social communication, were once again large (see table 2). Given that groups were defined by presence or absence of language problems, it is unsurprising that they differed significantly, but the size of the difference is again striking. On receptive language, the SCI-LI group scored nearly 2 SDs below the SCI group, and an ANCOVA, taking nonverbal scores as the covariate, showed that this difference was not explained by their lower nonverbal performance ($F(3,86)=7.69$, $p<.001$, $\eta^2=.21$; post hoc comparison SCI-LI vs. SCI, $p=.001$). The SCI group scored in the normal range on all T3 language measures and did not differ from the NSC-NL group, with morphosyntactic scores close to ceiling in both.

Comparing the two groups with language impairment (SCI-LI and LI) revealed that the impairment was more severe and pervasive in the group with combined problems. Receptive language and morphosyntactic scores were significantly lower in the SCI-LI group (see table 2). Their performance on the morphosyntactic past tense task was particularly weak. Turning to pervasiveness, 72.2% of the SCI-LI group were in the low band on both receptive language and morphosyntactic measures, compared with just 20% of the LI group who were more likely to be impaired on just receptive language (36% vs.18.2%) or just morphosyntax (44% vs. 21.4%).

3.1.3 Social, emotional and behavioural difficulties (SEBDs)

Overall the ANOVA results taking total problem and subscale scores according to parent SDQ parent ratings at T3 as dependent variables revealed significant differences across the four SC-L groups. Post hoc analysis showed a trend for all children with social communication problems (SCI-LI and SCI groups) to have more severe total problem scores according to parental SDQ ratings than those without social communication difficulties (LI and NSC-NL groups), and problems were again most marked in the SCI-LI group. However, in this case, the difference between the SCI-LI and SCI groups did not reach significance. Whilst total problem scores of the LI group were somewhat higher than the group with neither problem (p=.05), their scores were strikingly lower than the group with combined problems (SCI-LI) (see table 2).

Turning to the SDQ subscales, both groups with social communication problems showed an increased risk on the Peer Problems, Prosocial, and Hyperactivity subscales. However, in the SCI-LI group, the risk of abnormal hyperactivity ratings was more than three times that of the SCI group (70% vs. 20%), with only a tenth of scores in the normal range (11.8% vs. 70%). The two groups were also differentiated by conduct ratings: these were more than three times greater in the SCI-LI than the SCI only group (35% vs. 10% with abnormal ratings), who were at no greater risk than the NSC-NL group. In fact only the SCI-LI group had conduct scores that differed significantly from the NSC-NL group (p=.04). The higher total problem score of the SCI-LI group at T3 was due to their relatively high ratings on the Hyperactivity and Conduct subscales. Although the trend for higher Emotional scores in the SC groups was not significant, a much higher proportion had abnormal ratings compared with the LI group (SCI-LI: 35%, SCI: 40%, LI: 4%).

Strikingly, the LI group was at increased risk of Hyperactivity which, in the absence of other SEBDs measured by the SDQ, largely accounted for their inflated total problem scores. The rate of abnormal Hyperactivity in the LI group was almost identical to that of the SCI group, nearly four times that of the NSC-NL group (20.8%, 5.4%), and like the SCI group, was less than a third of the rate of the SCI-LI group.

The correlation between SRS scores and SDQ scores was high (r=.78, p<.001). Hus et al. (2013) argued that high scores on the SRS are not only indicative of social communication problems that characterize ASD, but may reflect other factors and co-occurring SEBDs that are not specific to ASD. To investigate this possibility further, a logistic regression analysis was carried out, taking the SRS binary variable as the outcome measure and T3 nonverbal, receptive language and SDQ subscale scores as predictors. Predictors were entered simultaneously (all continuous scores, see table 2). The amount of change accounted for in SRS scores by receptive language was of borderline significance only. Externalizing problems (Conduct and Hyperactivity) did not add significantly to the model. Peer Problems and Prosocial Behaviour, and to a lesser extent Emotional problems emerged as the strongest predictors (see table 3). The overall model was significant and accounted for just over 70% of the variance in SRS outcome. The goodness of fit was acceptable (Hosmer & Lemeshow, p=.14). However, this was substantially improved if only the SDQ subscales were entered. A step-wise (forward conditional) analysis revealed that prosocial scores accounted for 45% of the variance in SRS outcome, peer problems an additional 14% and emotional problems a further 5%. Overall the model was a better fit (with Hosmer & Lemeshow, p=.92-.53) and accounted for 64% of the variance in SRS outcome, only 6% less than the model including nonverbal and receptive language scores.

Table 3

Summary of logistic regression model predicting social communication problems at T3

T3 Predictors	T3: Social Communication problems (SRS binary)			
	B	SE	OR	OR 95% CI
Constant	-7.05	3.61^{+}		
Nonverbal	-.02	.03	.98	.93-1.03
CELF-4 receptive language	.07	.04^{+}	1.07	.99-1.15

SDQ Emotional	-.43	.2*	.65	.44-.96
SDQ Conduct	.05	.25	1.05	.64-1.72
SDQ Hyperactivity	-.11	.17	.9	.65-1.25
SDQ Peer Problems	-.6	.21**	.55	.36-.84
SDQ Prosocial	.77	.25**	2.16	1.32-3.54
		$X^2(7)=61.91$, p<.001, Nagelkerke R Square=70.5%		

*<.05, **<.01, ***<.001, $^+$borderline

3.2 Developmental trajectories of SC-L profiles

How predictable were the SC-L outcome profiles from the groups' performance at T1 and T2? In the following section, we consider first the language trajectories culminating in T3 profiles of language impairment, and then the social, emotional and behavioural trajectories culminating in social communication impairment.

Table 4 shows the performance of our T3 profile groups on language and nonverbal measures administered approximately 5-6 years earlier, at T2, and 7-8 years earlier, at T1, together with their SDQ ratings according to parent reports made at the two earlier time points. The table includes the means, SDs, and effect sizes from univariate ANOVAs, and post hoc comparisons with Bonferroni corrections for multiple comparisons applied.

Table 4

Comparison of SC-L groups' language scores and parent SEBD ratings at T1 and T2[1]

Language and SEBD measures	SCI-LI n=18 Mean (SD)	SCI n=10 Mean (SD)	LI n=25 Mean (SD)	NSC-NL n=38 Mean (SD)	Effect size[3] η^2	Post hoc comparisons[2]
Language performance at T2						
Auditory PLS	76.78 (14.25)	88 (14.58)	87.96 (15.89)	103 (14.02)	.34	
Expressive PLS	69.22 (16.42)	83 (15.9)	86.54 (20.08)	101.76 (20.37)	.29	b*
ROWPVT	85 (12.77)	104.6 (12.82)	94.72 (14.68)	106.2 (11.04)	.31	a**
EOWPVT	82.81 (12.86)	104.3 (10.77)	91.96 (14.17)	103.1 (16.12)	.24	a**
Nonverbal	83.61 (17.78)	99.1 (12.53)	90.92 (15.57)	105.6 (15.12)	.25	
Language performance at T1						
Auditory PLS	71.44 (14.4)	83.6 (15.07)	85.78 (14.3)	94.29 (15.57)	.25	b*
Expressive PLS	74.67 (9.36)	83.2 (8.99)	83 (13.42)	88.08 (16.52)	.12	
Nonverbal	76.5 (12.22)	89.3 (11.92)	87.6 (13.45)	96.29 (16.39)	.21	
SDQ at T2						
T2: SDQ total	16.94 (5.84)	14.89 (5.47)	8.75 (4.52)	7.51 (5.65)	.34	b***; c*
Emotional	2.88 (2.03)	3 (1.58)	1.71 (1.49)	1.78 (2.1)	.08	
Conduct	3.69 (2.24)	3.44 (2.96)	1.92 (1.98)	1.84 (2.13)	.12	b^+
Hyperactivity	6.56 (2.22)	5.78 (1.86)	3.46 (2.28)	2.54 (2.34)	.34	b***; c^+
Peer Problems	3.81 (2.29)	2.67 (1.94)	1.67 (1.63)	1.35 (1.16)	.26	b**
Prosocial	5.56 (3.16)	6.44 (2.88)	7.83 (1.69)	8.08 (1.71)	.18	b*
SDQ at T1						
T1: SDQ total	12.89 (5.74)	12.22 (3.67)	11.56 (7.21)	7.76 (5.34)	.13	

Emotional	1.61 (1.72))	1.78 (1.39)	2.08 (2)	1.81 (1.97)	.008
Conduct	2.72 (2.27)	2.78 (1.86)	2.92 (2.58)	1.92 (1.66)	.05
Hyperactivity	5.33 (2.72)	5.44 (3.43)	4.16 (2.85)	2.49 (2.02)	.19
Peer problems	3.22 (1.99)	2.22 (1.56)	2.4 (3.11)	1.54 (1.89)	.07
Prosocial	6.72 (3.12)	6.89 (2.09)	7.44 (2.2)	8.54 (1.52)	.11
ESB at T1 (number in each category)					
Low	11	5	3	4	***
Borderline	4	1	6	4	
Normal	3	4	16	30	

[1]SC-L groups. SCI-LI: Social communication and language problems; SCI: Social communication problems only; LI: Language problems only; NSC-NLI: No social communication or language problems

[2]Group comparisons. a: SCI-LI vs. SCI; b: SCI-LI vs. LI c: SCI vs. LI; p value *<.05, **<.01, ***<.001, [+]borderline

[3]Italicised effect sizes η^2 indicate non-significant result

3.2.1 Developmental trajectories of language

The results of a mixed design ANOVA, taking receptive language scores at the three assessment points as the within factor, and the T3 SC-L groups (4 levels) as the between factor, showed significant main effects for SC-L groups [F (3, 86) = 22.49, p<.001, η^2=.45] and time of assessment (F (1.87, 156.89) = 7, p=.002, η^2=.08, Greenhouse-Geisser). The interaction time*group was also significant [F (5.6, 156.89) = 3.67, p=.002, η^2=.12]. This reflects distinct trajectories in the SCI, LI and NSC-NL groups, as can be seen in figure 1A.

A B

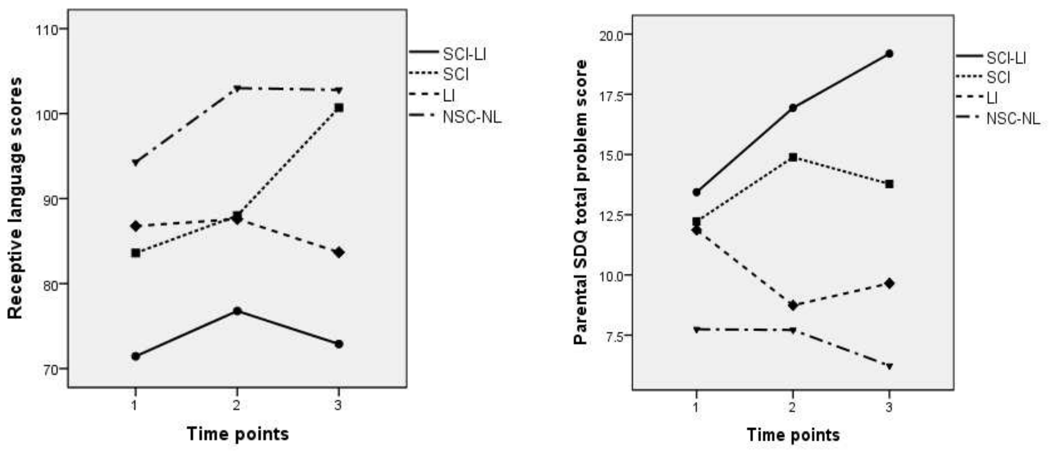

Figure 1

Graphs showing (A) receptive language performance and (B) total SDQ problem scores according to SC-L group across three time points

SCI-LI: Social communication impairment and language problems; SCI: Social communication problems only; LI: Language problems only; NSC-NL: No social communication and language problems.

At T1, the SCI and LI groups both had below-average receptive language scores (on Auditory PLS) which did not differ significantly from each other; nor did they differ from the mean score of the NSC-NL group although this was higher. The main change at T2 was in the performance of the NSC-NL group, whose mean score was now significantly higher than the mean score of the other groups; the SCI group showed a marginal gain but this did not distinguish them from the LI group and was not indicative of the gain they would make in the following 5-6 years. By T3, the SCI group had overtaken the LI group and caught up with the NSC-NL group, performing in line with the normative population and nearly 2SDs above the mean score of the combined SCI-LI group. This dramatic improvement in the receptive scores of the SCI group was not predictable, given that their receptive language performance was on a par with the performance of the LI group at both the previous assessment points, and is the most striking finding to emerge from our comparison of group trajectories. In contrast to this change in the SCI group, receptive language performance in the SCI-LI group was consistently poor across time, and this was the only SC-L group to have a significantly lower score than the NSC-NL group at all three time points.

Interestingly, the T2 receptive and expressive vocabulary scores tell a different story. In contrast to their below-average receptive and expressive language performance at T2, but in line with their T3 results, the mean vocabulary scores of the SCI group were marginally above average and significantly higher than the combined SCI-LI group (see table 4). We explore possible reasons for these disparate results in the discussion.

Overall, we can conclude that the SCI profile of social communication problems without language problems was not predictable from early receptive and expressive language performance. However, vocabulary performance by 4-5 years might be more indicative of the striking change observed in this group.

3.2.2 Developmental trajectories of social, emotional and behavioral problems

Table 4 shows the SEBDs and sociocognitive performance of our T3 profile groups approximately 5-6 years earlier, at T2, and 7-8 years earlier, at T1. This includes parental ratings for the SDQ total problem and subscales at both assessment points, and scores on our direct measure of sociocognition, the Early Sociocognitive Battery (ESB), at T1.

Given the high correlation between SRS and SDQ scores, it is possible that early ratings of children's SEBDs might be more predictive of SC-L outcomes at T3 than language. We conducted a mixed design ANOVA taking total parent SDQ scores at the three assessment points as the within factor, and the T3 SC-L groups (4 levels) as the between factor. This yielded a significant main effect of SC-L groups and interaction time*group [F (3, 80) = 24.05, p<.001, η^2=.47; F (5,48,146.18) = 3.33, p=.005, η^2=.11] but the main effect of time of assessment was not significant (F(1.83,146.18)= .64, p=.52, η^2=.008; and see figure 1b). The interaction reflects the distinct trajectories of the T3 profile groups. As can be seen in figure 1B, at T1 there was no difference between the mean SDQ total problem scores of the three groups with language and/or social communication problems at T3 (SCI-LI, SCI and LI). T2 was the turning point: by this time, the difference in mean total problem scores between those with and without social communication problems at T3 was marked: the mean ratings of the T3 group with language problems only (LI) had improved and did not differ from the NSC-NL group (post hoc, p=1), whilst those of children with social communication problems (SCI-LI and SCI) had deteriorated. As shown above, these differences remained at T3, with a trend for total problem ratings to worsen in the SCI-LI group. In contrast to the other three groups, the group with neither social communication nor language problems at outcome (NSC-NL) started with a mean total problem score only marginally lower than the general population (mean=8.6, SD=5.7 for 5-11 year olds), and this changed little across time. At T1, they had a lower total problem score than the other three groups, though given the relatively small subsample sizes and lack of power, only the comparison with the SCI-LI group reached significance. By T2, their scores were significantly lower than scores in the two groups with social communication problems (SCI-LI and SCI), and as seen above and in figure 1B, these differences remained at T3. We can conclude that, while T1 SDQ ratings to some extent differentiated the NSC-NL group (with neither social communication nor language problems at T3), they did not distinguish the remaining three groups with long term problems of some kind.

However, the Early Sociocognitive Battery (ESB), measuring social responsiveness, joint attention, and symbolic understanding at T1, was more discriminating. As can be seen in table 4, children with poor social communication at T3 (SCI-LI and SCI groups) were more likely to have low ESB scores at T1 than those without social communication problems (LI and NSC-NL groups) ($\chi^2(6)=27.72$, $p<.001$). Nearly two thirds of the SCI-LI group and a half of the SCI group had low scores. Indeed, the likelihood of low ESB performance in children with only language problems at T3 (LI) was no greater than for children who had problems on neither measure at T3 (NSC-NL)(12% and 10.5% respectively).

4. Discussion

This paper capitalizes on a unique dataset arising from a follow-up study of children first referred to clinical services with language problems at 2½-3½ years, assessed at 2½-4 years, and again at 4-5 and 9-11 years. These data afforded the opportunity to investigate whether profiles and developmental trajectories of language, social communication and behavior problems observed in the late primary school years throw new light on much debated relations between language impairment, social communication problems, and ASD.

Unsurprisingly, and in line with previous research on clinical samples, our sample at T3 was heterogeneous. Focusing on social communication and language (SC-L) profiles, we found children with social communication problems only (just over a tenth of the sample with SCI), language problems only (just over a quarter with LI), and both (just under a fifth with SCI-LI), leaving just over two-fifths with neither problem (NSC-NL). Given that children were assigned to the impairment subgroups when performance fell below cut-off scores, group differences on the key social communication and receptive language measures were expected. However, the size of the differences at T3 was striking.

Children with SCI had receptive language performance in the average range, 20-30 standard points higher than children with LI and SCI-LI. Likewise, their morphosyntactic scores were close to ceiling and they did not differ from children with no problems on either measure. Conversely, children with LI had social communication scores that were not only in the normal range, but substantially better (3SDs, 30 T points) than those with social communication problems at outcome (SCI and SCI-LI). It is likely that the distinctness of the SCI and LI profiles in our sample arose in part from our selection of the SRS as the T3 measure of social communication, since items in the SRS make very little direct reference to language. Even though social communication problems were twice as likely to co-occur with LI as on their own, findings from our regression analysis confirmed the minimal role of language. In contrast, a validation study of the Children's Communication Checklist-2 (Bishop, 2003), a widely used standardised measure of pragmatic language ability, found substantial overlaps between their SLI and PLI diagnostic groups (Norbury, Nash, Baird, & Bishop, 2004).

Our groups with and without social communication problems were also differentiated by social, emotional and behavioral difficulties as evidenced by parental ratings on the SDQ. Our findings on SEBDs in these groups add to current understanding about relations between SLI and SEBDs. Previous research indicates that severity of language and mixed language problems increase the risk of SEBDs in children with SLI (Conti-Ramsden, 2013; Yew & O'Kearney, 2013). Our findings supported this, but also showed the key role of social communication difficulties. Severity and mixed expressive/receptive language problems were much more common in the SCI-LI group, and this group was at particular risk of Conduct problems and Hyperactivity. The SCI and SLI-LI groups, but not the group with only LI, were at risk of Peer Problems and Prosocial difficulties, with those in the SCI-LI at no greater risk than those in the SCI group. On the other hand, the SEBD profile of the LI group was much more in line with the NSC-NLI group, with the only raised risk of SEBDs for Hyperactivity.

Children in the combined SCI-LI group emerged as the most vulnerable. Nearly 90% had a diagnosis of some kind at T3, and they were the highest users of SLT and educational services. In our sample not only were both skills impaired, but both skills were more impaired at outcome than in children with stand-alone problems (SCI and LI). The SRS scores of the SCI-LI group were in the 'severe range', which is strongly associated with a diagnosis of ASD, compared with the mild to moderate ratings of the SCI children indicative of less severe but nevertheless clinically significant deficits in social reciprocity. Furthermore, our findings suggest that previously reported associations between social communication problems and conduct disorders (Oliver, Barker, Mandy, Skuse, & Maughan, 2011) are confined to children who have additional language impairment. Those with social communication problems only were at no greater risk of conduct problems than those with neither problem.

By 9-11 years, then, we observe clear dissociations between language and social communication in the SCI and LI groups, with the SCI group further distinguished by more pervasive SEBDs, and the SCI-LI group not only combining the two profiles but more severely affected in both domains. Given the extent of group differences at T3, the degree to which they overlapped at T1 and even T2 is surprising and striking. Most notably, despite widely discrepant language skills and distinct SEBDs at T3, the SCI and LI groups showed no difference on our measure of receptive language at T1 and T2, and did not differ in SEBDs until T2. The only measure that differentiated these groups at T1 was the Early Sociocognitive Battery: the two groups with social communication problems at T3 performed more poorly than the LI group, who did not differ from the NSC-NL group on this measure.

What are the implications of these profiles and trajectories for this sample of children who were originally referred with concerns about language? It should be recalled that none of the children in our study had been diagnosed with ASD at T1, and only 5% at T2. The profiles and trajectories we have observed point to the possibility that some children had ASD, and that this was previously present but undetected. First, the mean total scores of the SCI-LI group fell in the severe range of the SRS indicative of ASD, and were of a similar order to the mean reported from a large sample of 2,368 ASD probands (Hus et al., 2013); 61% of the children in the SCI-LI group scored in this range, as did 20% in the SCI group. Second, the SRS subscale Autistic Mannerisms, which includes restricted and repetitive interests and behaviours (RRIBs), was significantly impaired in both groups with SCI, though particularly marked in the SCI-LI group (all had scores ≥60T indicative of a clinically significant deficit (Constantino & Gruber, 2005), as did 80% of the SCI group. According to the DSM-5 classification of disorders (American Psychiatric Association, 2013) the presence of RRIBs is critical for a differential diagnosis of ASD, setting it apart from the newly identified disorder, Social (Pragmatic) Communication Disorder (SPCD) (Lord & Jones, 2012). Third, about half the children with social communication problems, prior to the introduction of the DSM-5, had received a clinical diagnosis of autism (44% of SCI-LI group and 50% of the SCI group). Finally, and most importantly for the proposal that ASD was present but previously undetected, the majority of the children in the SCI groups had tested positive on the Early Sociocognitive Battery. The ESB probes very early sociocognitive deficits, including social responsiveness and joint attention, which are known to be impaired in children with autism (Charman et al., 2005; Sigman & Ruskin, 1999) and are unlikely to occur as secondary effects of language or other problems.

Further evidence for this position is the finding, noted above, that the SCI group had marked language difficulties at T1 which resolved by T3, whereas their difficulties with sociocognition and social communication persisted. It has been argued elsewhere (Roy & Chiat, 2013) that the skills required for competent performance on receptive language tasks in the school years are complex and may involve higher cognitive functions and executive control including inferencing, selective and sustained attention, working memory and inhibitory control. We have also argued that early sociocognitive skills are crucial for working out meaning intentions behind people's utterances, and hence for early language acquisition (Baldwin, 1995; Chiat & Roy, 2008; Tomasello, 1995 and see Chiat, 2001's mapping theory). Based on these two arguments, if preschoolers' weak receptive skills are due primarily to deficits in early sociocognitive skills and other non-linguistic processes and skills are relatively intact, their receptive vocabulary may improve, albeit at a slower rate. If and when they 'break into' language (accessing meanings behind at least some words and sentence structures), they have the possibility of using language they have acquired, together with higher order reasoning, to learn further meanings and may in this way 'catch up' with peers. However, if higher order executive functions are implicated, with or without co-occurring sociocognitive deficits, the impact on receptive language skills may be more pervasive and long-lasting. Two findings support this argument. First, by T2, the vocabulary scores of the SCI group were average, significantly higher than the SCI-LI group, and higher than their own general language scores. Second, the receptive skills of the SCI-LI group were particularly impaired both at outcome and as pre-schoolers at T1. Arguably, additional sociocognitive impairments alongside weak receptive language and higher order skills in the SCI-LI group left these pre-schoolers with limited strategies to support language. This inconsistent pattern of change in receptive language skills across our SC-L groups suggests the marked change we found in the SCI group only is unlikely to be due in any simple way to differences in test requirements across time (see Yang et al., 2010). In contrast, like Yang and colleagues, all of our four SC-L groups referred as pre-schoolers with concerns about their language development made significant gains in nonverbal cognitive performance across time. In this case, changes in test demands and children's capacity to engage in the assessment process are likely to have played a role in the cognitive gains observed.

Our interpretation of the developmental trajectories of social cognition and social communication we have observed might help to explain the substantial individual differences in language outcomes consistently found in children with ASD (Magiati, Moss, Charman & Howlin, 2011), with those children who improve having early sociocognitive impairments (affecting early language acquisition) but relatively strong executive function skills. It might also help to explain the relative success of early interventions targeting sociocognitive skills in children with ASD in effecting change in structural language (Kasari, Gulsrud, Freeman, Paparella, & Hellemann, 2012) compared with later interventions targeting social skills in children with pragmatic and social communication difficulties that led to improved social behaviour but did not impact on language (Adams et al., 2012).

We have argued that most of our children with social communication problems would meet criteria for ASD as defined by DSM-5. However, we did not administer gold standard diagnostic measures of ASD such as the ADOS, and in the absence of an agreed threshold for RRIBs in the DSM-5, we cannot assume that all the children with clinically significant RRIBs in our SCI groups would be diagnosed with ASD. Whilst some of the children in the SCI-LI group might well now be diagnosed with both ASD and LI, relatively few children in our sample would match the DSM-5 category of Social Pragmatic Communication Disorder (SPCD) since this requires impairment in the social use of both verbal and nonverbal communication in the absence of RRBIs. In our sample four children might qualify: the only two children in the SCI group who did not have clinically significant levels of autistic mannerisms, and the only two children in the LI group who had received clinical diagnoses of Social Communication despite SRS scores well below the cut-off. These children had exceptionally weak scores (2 SDs below the mean) on one of the two receptive subscales (Concepts and Following Directions, CFD), a task that draws on higher order skills and executive functions (Roy & Chiat, 2013). Such deficits are likely to impact on the social use of language. Their profile is similar to children with a diagnosis of PLI in a recent study who were considered to meet criteria for SPCD (Gibson, Adams, Lockton, & Green, 2013; Norbury, 2014).

4.1 Limitations, clinical implications and future directions

In considering the outcomes of our study, a number of limitations need to be borne in mind. First, in common with many longitudinal studies, we lost participants across time, and attrition was biased: our retained sample had higher receptive language and nonverbal scores at T1, and were of higher SES. Nevertheless, our final sample retained sufficient power to carry out our intended analyses. Second, although the co-occurrence of clinical diagnoses of ASD in our SCI groups and profile of SRS scores in terms of severity and nature vindicate a high rate of ASD symptomatology in the SCI groups, our lack of 'gold-standard' diagnostic measures of ASD means the actual incidence of ASD remains uncertain. Third, although our cut-offs were supported by ROC analyses (Chiat & Roy, 2013), as critics of a categorical approach to psychopathology have argued, there is inevitably a degree of arbitrariness attached to such decisions. However, our categories were theoretically motivated and based on predictions about relations between early profiles of processing skills, including sociocognitive skills, and later profiles of language and social communication. Further, we selected relatively 'pure' measures of social communication and language to support our aim of ‘unpicking’ the heterogeneity in outcomes. We believe, like others (Pickles & Angold, 2003; Rutter, 2011), that the combination of a categorical and dimensional approach to developmental psychopathology capitalizes on the strength of each approach taken on its own. The combined approach was key to our analyses. It was essential to our identification of developmental trajectories underpinning the T3 SC-L profiles and to ‘looking at the interrelatedness of children’s abilities across domains of functioning’ (Jansen et al., 2013, p.4122) and their distinctness, both concurrently and across time. Finally, our study was not designed to assess the efficacy of interventions and our measures were limited to contact with services and frequency of SLT sessions rather than the type and nature of interventions. However, it is notable that the exceptionally high level of clinical need of the SCI-LI group (nearly 90% had a diagnosis of some kind) and their use of clinical and educational services, compared with the SCI or LI groups, was not fully evident until T3.

The high level of clinical diagnoses at 9-11 years in children with social communication problems, particularly those with SCI-LI, highlights the need for early identification and appropriately targeted interventions. We have shown that neither receptive language nor SEBDs as measured by the SDQ distinguished these children at T1 from those with longer term LI only. In contrast, performance on the Early Sociocognitive Battery did discriminate children who would go on to social communication or language problems only. Additionally the composite measure informs intervention by identifying deficits in social responsiveness, joint attention and symbolic comprehension, which are known to be associated with language development and intentional communication in typically developing children and affected in children with ASD, and are potentially responsive to early interventions (Kasari et al., 2012). The test is quick to use and the need for such an assessment targeting prelinguistic skills was identified by Jansen and colleagues (2012). Further, noncompliance, which is an issue in the direct assessment of verbal and nonverbal skills in young preschool children, is informative in the case of the ESB whose main purpose is to measure children's social engagement. Children with the lowest ESB scores at T1 all had problems seven to eight years later: the majority were in the SCI-LI group at T3 and had a diagnosis of ASD.

Finally, although we have previously found the ESB to the best predictor of social communication at 4-5 years as measured by subscales of the SDQ, the amount of variance explained at this age was relatively small (Chiat & Roy, 2008) compared to T3 (Chiat & Roy, 2013). Future research using the SRS rather than subscales of the SDQ , might clarify whether this relatively small amount of change in social communication explained was due to measurement issues or reflected real differences in the rate of social communication problems as suggested by the low rate of clinically diagnosed ASD reported by parents at this age.

4.2 Summary

Our findings point to increasing differentiation of deficits in children first referred with concerns about language as they move through the primary school years. By 9-11 years, social communication and receptive language problems may occur separately or together. Our evidence of the developmental trajectories leading to these different outcomes throws more light on the nature of later-identified social communication problems in children whose early language problems are the reason for clinical referral, and how these differ from children whose language problems persist.

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