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Phonology and syntax in French children with SLI: a longitudinal study

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Summary :

Maillart and Parisse (2006) found out that French children with specific language impairment (SLI) presented strong difficulties in phonology when compared with normally-developing children matched by MLU (NLD). Some of the youngest children from this study were followed to provide developmental information about their language deficit. Children were tested again in the same way as before (free spontaneous production) and matched by MLU against other NLD children.

The previous phonological analysis was extended to include syntax as well as phonology. Percentage of words correct was computed for both phonology and syntax. An analysis of covariance (ANCOVA) was performed with children's age as covariate. Results showed a significant difference between SLI and NLD children for phonology but not for syntax. There was a trend that showed that the difference between SLI and NLD children tended to increase with age.

The same analysis was performed separately for nine frequent syntactic categories for phonology and for syntax. A significant difference was found for prepositions, nouns, subject pronouns, and verbs in phonology. Effects were found for determiners, and prepositions in syntax.

As well as confirming the importance of phonological difficulties in SLI, our results present a case for a developmental theory of phonological and syntactic deficits in SLI, where differences between SLI and NLD grow with age and where there is a timing difference between phonology (earlier) and syntax (later).

Introduction

Several studies have shown that children with SLI displayed special difficulties with phonology, even when compared with normally-developing children matched by MLU (Bortolini & Leonard, 2000; Owen, Dromi & Leonard, 2001; Aguilar-Mediavilla, Sanz-Torrent & Serra-Raventos, 2002). This was confirmed for French-speaking children by Maillart and Parisse (2006), but only for the oldest children of the study. No significant difference was found for the youngest children. Unfortunately, as the older and younger children were different, the existence of a developmental effect could only be hypothesized.

The goal of the present study was to confirm the results of Maillart and Parisse (2006) with a developmental study. It was also to check syntactic performances to see whether the specific difficulties with phonology (in comparison with language-matched controls) were also present with syntax. Another important result which could be confirmed by the current study is that weak performances with vowels appeared to be a better pathological indicator than problems with consonants.

Four of the children with SLI from the previous study were followed up. New analyses were performed, for phonology as well as for syntax, and the existence of a developmental trend was tested. Results of children with SLI were checked against results of control children matched by MLU for all age points.

Methods

Subjects

Eighteen children participated in the study: four children with SLI and fourteen NLD control children. All participants were French native speakers. The four children with SLI took part in Maillart and Parisse (2006)'s study. They were followed up in order to achieve the present developmental study of children with SLI. All four children had been diagnosed as language impaired by a multidisciplinary team. The diagnosis included a medical exam (audition and vision), as well as neuropsychological and language investigations. All of them satisfied the classical exclusion criteria for an SLI diagnosis (Stark & Tallal, 1981). They scored within the average range on the Leiter International Performance Scale (Roid & Miller, 1993) and the non-verbal scale of the Wechsler Intelligence Scale for Children WISC III (Wechsler, 1996) and they also demonstrated hearing and oral motor functioning within normal limits and no signs of emotional disturbance. Three of the children were seen four times and one two times. This made a total of fourteen observations. For each observation, the mean length of utterances (MLU) was computed and control children were chosen on the basis of the MLU value.

The control children (CTR) were fourteen different children, which allowed to find a very precise match between children with SLI and controls. All control children had a typical rate of language development. A full description of the children's characteristics is presented in Table 1. The control children were recruited at kindergartens. An analysis of variance was carried out with MLU as dependant variable and with type (SLI vs. Controls) as between-subjects independent variable to check the group matching. No effect of type was found for

MLU, $F(1,26) = 0.14$, $p = .70$. These results confirmed that there was no difference between the groups of SLI and control children as regards their language level (in as far as MLU is a good indicator of language level).

	Children with SLI		Language-matched controls	
	Age	MLU	Age	MLU
SLI_1	36	1.943	27	1.845
	42	3.114	27	2.196
	54	2.702	27	2.314
	66	4.275	27	2.756
SLI_2	42	2.041	27	3.51
	60	3.007	27	3.772
	66	4.531	36	3.123
	72	6.408	36	3.252
SLI_3	48	2.279	36	3.522
	54	2.372	48	2.015
	72	3.333	48	2.893
	84	4.202	48	3.101
SLI_4	54	3.241	48	4.248
	66	2.885	48	5.585
Mean (S.D)	58.3 (13.6)	3.30 (1.20)	36.4 (9.6)	3.15 (0.98)

Table 1: Characteristics of the children

Procedure

The aim of the recording procedure was to obtain spontaneous language production. All data gatherings used the same principle: an adult observer asked the child questions to stimulate language production. The procedure used is a play situation (Le Normand, 1986). Whenever children are speaking, they are never interrupted and may speak for as long as they want. A familiar adult observer (usually one of the parents) is present and plays with the child. The role of the adult observer is to ask the children questions if they are not producing much language. The length of the recording is standardized to 20 minutes.

Most of the transcriptions were done by the two authors of the paper. For some recordings, the transcription was first done by trained specialists and later extensively checked by the two authors. All cases of disagreement between transcriptions were discussed until full agreement was reached. After phonemic transcription, a phonological model line (%mod tier in the CHAT format) was added for each phonemic line transcribed that contained the correct phonemic target. This model line allowed to compute automatically phonological errors by using the difference between the phonological line and the phonological model line. A syntactic model line was added which contained the ‘correct’ adult syntactic target. When

more than one adult target was possible, the chosen target was always the one with the minimal number of changes from child to adult forms. Syntactic errors were computed automatically using the difference between the phonological model line and the syntactic model line.

Analyses

Phonological analysis in Maillart and Parisse (2006) were quite extensive. As several analysis did not provide highly significant results, only the most useful analyses were used in the current study: percentage of words phonetically correct (PWPC), percentage of phonemes correct (PPC), percentage of consonants correct (PCC), and percentage of vowels correct (PVC) – see Maillart and Parisse (2006) for more details.

Syntactic analysis was done by computing the percentage of words syntactically correct (PWSC), comparing the syntactic model line and the phonological model line. This means that syntactic errors did not include mispronunciation of words.

All the previous analyses were realized on all uttered words. Separate analyses of PWPC and PSC were also performed for seven specific syntactic categories: adverbs, determiners, nouns, prepositions, strong pronouns, subject pronouns, base form of verbs (thereafter called simply verbs), auxiliaries, modified verbs (includes part participles and infinitives). These categories are the most frequently used by young children. They represents around half of French children's production (see Parisse & Le Normand, 2006).

Results

Percentage of words phonetically correct (PWPC)

An analysis of variance was carried out with PWPC as dependant variable and with type (SLI vs. Controls) as between-subjects independent variable. No effect was found, $F(1,26) = 0.85$, $p = .36$, $\eta^2 = .04$. An analysis of covariance was carried out with PWPC as dependant variable and with type (SLI vs. Controls) as between-subjects independent variable, and with Age as covariate. An effect of PWPC was found, $F(1,25) = 8.01$, $p = .009$, $\eta^2 = .28$.

A plot of the distribution of children's performances vs. children's age presents a visual explanation of the results obtained (see Figure 1). The two groups presented quite different profiles. A minimum square analysis of the two groups showed that they presented a different developmental profile (SLI: Ratio = $.567 + .003 * \text{Age}$; $R^2 = .276$; Controls: Ratio = $.421 + .01 * \text{Age}$; $R^2 = .484$). The difference between controls and children with SLI tended to grow with age.

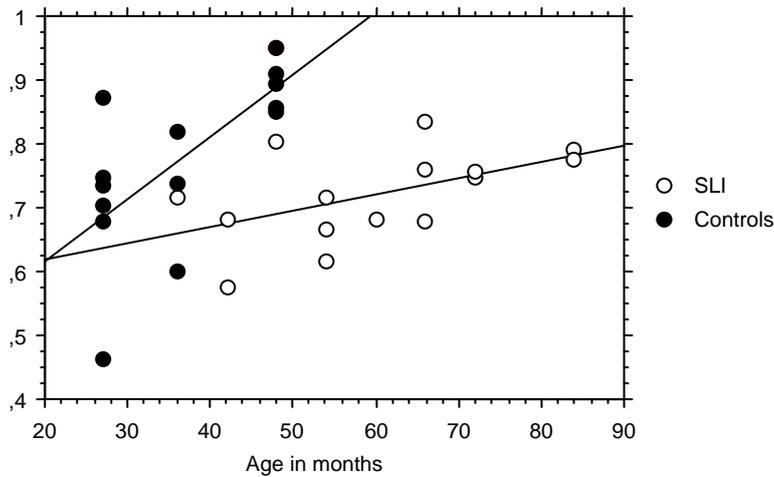


Figure 1: Percentage of words phonetically correct per children group

Other results

The same type of analysis (ANOVA and ANCOVA) was carried with all other variables, including phonological and syntactical analyses. ANOVAs did not provide significant results for the other variables. Results for ANCOVAs were often significant and are summed up (including results for PWPC) in Table 2. The first five results (see Table 2) were computed for all words. They include results at word level for phonology (PWPC) and syntax (PSPC), and results at phoneme level for phonology (PPC, PCC, PVC). The second part of Table 2 includes computation at word level performed separately for seven categories for phonology and for syntax.

Categories	Phono vs. Syntax	Measure	%correct SLI	%correct CTR	ANCOVA F (1,25)	p	η^2
All words	Phono	PWPC	78	75	8.01	.009**	.23
		PPC	81	83	17.79	.0005***	.42
		PCC	75	79	10.79	.003**	.30
		PVC	87	89	25.95	.00003***	.51
	Syntax	PSPC	91	93	4.11	.053	.14
Adverbs	Phono	PWPC	59	57	1.23	.27	.05
	Syntax	PSPC	100	99	1.99	.17	.07
Determiners	Phono	PWPC	84	81	3.29	.081	.12
	Syntax	PSPC	73	83	16.62	.0004**	.40
Nouns	Phono	PWPC	56	65	11.26	.0025**	.31
	Syntax	PSPC	99	100	0.40	.53	.02
Prepositions	Phono	PWPC	63	73	4.57	.042*	.16
	Syntax	PSPC	73	86	4.97	.035*	.18

Strong pronouns	Phono	PWPC	78	68	0.53	.39	.02
	Syntax	PSPC	99	95	5.64	.027 ^{*R}	.18
Subject pronouns	Phono	PWPC	54	78	7.61	.011 [*]	.23
	Syntax	PSPC	60	60	1.34	.25	.05
Verbs	Phono	PWPC	57	64	6.56	.016 [*]	.21
	Syntax	PSPC	96	98	1.83	.18	.07
Auxiliaries	Phono	PWPC	84	96	3.11	.089	.11
	Syntax	PSPC	93	99	1.13	.29	.04
Marked verbs	Phono	PWPC	48	53	3.83	.061	.13
	Syntax	PSPC	89	96	0.00	.99	.00

Table 2: ANCOVA results (phonology and syntax) on all words and for specific categories. Notes: *** means that $p < .0001$, ** $p < .001$, * $p < .05$. ^R means that controls have more errors than children with SLI.

Discussion

Maillart and Parisse (2006)'s prediction was confirmed. In this previous study, the youngest group of children with SLI did not present differences with language-matched controls in their phonological performances, although the oldest group of children did. Maillart and Parisse (2006) hypothesized that the children that did not present differences with language-matched controls will present differences when they would become older. This is what was obtained in the present results. The same children, followed several years later, did present the predicted behaviour.

More specifically, they presented the same pattern of differences with language-matched controls. They presented more phonological errors as measured on whole words, and their presented lower levels of PPC, PCC, and PVC. As in Maillart and Parisse (2006), PPC, and especially PVC, presented the most significant differences, which stressed out the importance of looking at vowel development in French children with SLI. The development of vowels appeared to be the most efficient indicator of a pathological development in French children.

The current study included data about syntactic performance and about specific syntactic categories, where Maillart and Parisse (2006) did not. It appeared that the difference between children with SLI and language-matched controls was smaller with syntax than with phonology. There was a global significant difference in phonology which was not found in syntax. Absence of significant results was explained by a very large variability in syntactic results in the children with SLI, contrary to controls and to the results for phonology.

At the level of individual syntactic categories, significant differences were found in both phonology and syntax. In phonology, some categories such as verbs and preverbal pronouns were difficult for the children with SLI, which concurs with results in the literature. Problems were found also with nouns and prepositions which is rather specific of French children. For syntax, determiners were a major source of difficulties, which reproduced Parisse and Maillart (2005) results. One surprising result was the absence of difference for preverbal pronouns, which could be explained by the relatively small size of the corpus. Another surprising result was that for strong pronouns children with SLI produced less errors than controls and that this difference was significant. A close look at strong pronoun errors explained this result and helped to characterize one of the major differences between children with SLI and normally-developing children (NLD). Both types of children produced some omission errors, but the rest of their errors were very different in nature. Where children with SLI produced some gender errors, NLD children produced over-generalisation errors. The errors produced by NLD children attested a constructional behaviour which was not found in children with SLI. This difficulty with new constructions is probably one of the characteristic features of children with SLI. However, it remains to demonstrate whether this behaviour is a cause or a consequence of their problems.

Perspectives

The current study raised the question of the disharmony between language components during development in children with SLI. Phonology appeared to be a area of special difficulties for the children with SLI in this study and the gap between controls and children with SLI appeared to be keep on widening. Their difficulties were strongest with categories that are phonologically complex (see Parisse & Maillart, 2005). On the opposite, syntax was not a special area of weakness for these children, as their syntactic performances were at the level of those of their language-matched controls. Also, few syntactic categories were the source of special problems. These results suggested that phonological difficulties could have been at the source of syntactic problems, at least for the type of dysphasic children studied here.

How do these difficulties with phonology relate to syntax? Two important points are worth mentioning. The children of this study all presented the same type of difficulties with phonology but had various difficulties with syntax and they were usually able to improve their phonological production with the help of speech therapists without parallel improvements in syntax. The existence of discrepancies between parts of the system could suggest that the

origin of difficulties in phonology and syntax are unrelated. At least, this shows that the relation between phonology and syntax is not straightforward. Another important point is that this relation may change during the course of children's development (see also Bishop & McArthur, 2005).

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