

## **Not all dependencies are impaired in Syntactic-SLI: Binding in children with a deficit in Wh-movement**

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Are all syntactic dependencies impaired in SLI? Whereas children with (syntactic-)SLI have difficulties in the comprehension of sentences derived by Wh movement, it is not clear whether they are impaired in other types of dependency. To explore the general question of whether all types of dependencies are impaired in SLI, this study tested the dependency between pronominal elements and their antecedents. We used a picture selection task to test the comprehension of pronouns and reflexives in 12 Hebrew-speakers with Syntactic SLI aged 9;3-13;10. Whereas the participants with syntactic SLI were very impaired in the comprehension and production of sentences derived by Wh-movement, they showed intact performance in the interpretation of pronouns and reflexives. No significant difference was found between the SLI and the control group, and no significant difference was found between pronouns and reflexives. These results suggest that the difficulty in syntactic-SLI is specific to a certain type of dependency, Wh-movement, and does not extend to all types of dependencies. The results further indicate that syntactic SLI is not a general syntactic delay, because Hebrew-speaking 5-year-olds have difficulties in the comprehension of both Wh-movement and pronouns, whereas school-aged children with syntactic SLI encounter difficulties only in Wh-movement, and show good comprehension of pronouns.

Whereas it is widely agreed that children with SLI have difficulties in the comprehension of sentences derived by syntactic movement (Adams, 1990; Bishop, 1979; Ebbels & van der Lely, 2001; Friedmann & Novogrodsky, 2004, 2007, in press; Roeper, 2004; van der Lely & Harris, 1990), researchers are still in search of the characterization of this deficit and its underlying causes.

One open question regards the extent of this deficit with respect to various types of dependency. Some researchers suggested that all kinds of syntactic dependencies are impaired in SLI. According to the CGC (van der Lely, 2005) and its previous version, RDDR (van der Lely, 1996) the grammatical deficit in SLI can be explained as a deficit in dependent relationships, hence predicting a deficit both in pronominal binding and in Wh-movement. Data on pronoun comprehension in SLI, however, are mixed. van der Lely and Stollwerck (1997) reported a group of English-speaking children with what they termed grammatical SLI, who showed difficulties in pronoun interpretation in a judgment task, whereas Hestvik et al. (2007) found good

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comprehension of pronouns in an online priming study, for children with SLI who were impaired in Wh-movement.

In the current study we tested the comprehension of third person object pronouns and reflexives in SLI children who had difficulty in the comprehension and production of sentences derived by Wh-movement.

Hebrew-speaking typically-developing children show a delay in the acquisition of pronoun interpretation, and allow the local antecedent for pronouns until age 6 (Ruigendijk, Friedmann, Novogrodsky, & Balaban, in press; Friedmann, Novogrodsky, & Balaban, in press), similarly to results from other languages (Chien & Wexler, 1990; Conroy et al., 2009; Jakubowicz, 1984; Koster, 1993; Philip & Coopmans, 1996; Sigurjónsdóttir & Hyams, 1992; Wexler & Chien, 1985). They show mastery of reflexive interpretation around age four (Friedmann, Novogrodsky, & Balaban, in press; Grodzinsky & Kave, 1994; Ruigendijk et al., in press). If school-aged children with syntactic SLI show a comprehension pattern that is similar to much younger children, we would expect them to fail on both Wh-movement and pronoun interpretation. If all dependencies are impaired, we would expect, again, not only Wh-movement to be impaired, but also the interpretation of pronouns. Because reflexives also form a dependency between the reflexive and an antecedent, they would also be predicted to be impaired, in case all dependencies are impaired. If, however, the deficit in SLI is restricted to movement (possibly, to Wh-movement, or to movement of one argument over another), then we would not expect a deficit in the interpretation of pronouns and reflexives, even for children with severe deficits in the comprehension of relative clauses, topicalized sentences, and Wh questions.

### ***Participants***

The participants were 12 Hebrew-speaking children with syntactic SLI aged 9;3-13;10 (mean = 11;1, SD = 1;8), in 4th-8th grade. All of them attended regular classes in regular schools, in 4th to 8th grade. All the participants met all the exclusionary criteria for SLI (Leonard, 1998): They had no hearing impairment and no recent episodes of Otitis Media, no abnormalities of oral structure or problems in oral function; they showed no evidence of obvious neurological impairment or impaired neurological development; they had no symptoms of impaired reciprocal social interaction or restriction of activities that are typical of Autistic Spectrum Disorder. Their nonverbal intellectual functioning was within the age-appropriate level, as

indicated by their score on the Raven's Matrices (Raven, 1965), in which they performed within 1 SD from the average of their age. Five of the participants were also tested using the Wechsler Intelligence Scale for Children (WISC-R95, Hebrew adaptation, Cahan, 1998), with scores of 92-106.

*Performance in Wh-movement tasks*

To assess the syntactic abilities of the children with syntactic SLI, and compare their performance in sentences derived by Wh-movement to sentences with pronominal dependencies, we thoroughly assessed their syntax using six syntactic tests of Wh-movement, and compared their performance to control groups. The tests included three tests of relative clause comprehension, one test of wh-question comprehension, and two tests of relative clause production.

In the *comprehension of object relative clauses in a binary sentence-picture matching task* (Bambi ZTI) each participant heard 40 subject- and object- right-branching relative clauses and was asked to choose the picture corresponding to the sentence, from a picture matching the sentence and a picture with reversed roles. (For detailed method, results, and discussion, see Friedmann & Novogrodsky, 2004). In the *comprehension questions task* (Bambi ZIKA MEGUVANA), each participant heard 90 center-embedded and right-branching subject and object relatives and answered questions that required the comprehension of the thematic roles in the relative clauses ("who kissed?"). The *reading and paraphrasing task* (Bambi ZIKRIA) included center-embedded object relative clauses and control sentences of the same length, which the participants were required to read and paraphrase (for detailed method, results, and discussion, see Friedmann & Novogrodsky, 2007). The test for *comprehension of wh-questions* used a binary sentence-picture matching task, in which each participant heard 40 *which* subject- and object-questions and was asked to choose the picture corresponding to the sentence, from a matching picture and a picture with reversed roles (for detailed method, results, and discussion, see Friedmann & Novogrodsky, in press). The production of relative clauses was assessed using two elicitation tasks: *picture description task and a preference task* (Bambi ZIBUV and Bambi ADIF, for detailed method and results, see Novogrodsky & Friedmann, 2006).

Children were included in the syntactic SLI group if they failed in at least 2 of the 4 comprehension tasks and one of 2 production tasks of Wh-movement structures (Tables 1 and 2). Failure in a test was defined as performance significantly poorer than the performance of typically developing control group in 4<sup>th</sup> grade using the Crawford and Howell (1998) t-test for the comparison of a single participant to a group, with an alpha level of 0.05. Group results of the syntactic SLI and the control participants are presented in Table 1, the number of syntactic SLI participants who failed in each Wh-movement task is presented in Table 2.

**Table 1. Percentage correct in various tasks of comprehension and production of Wh-movement structures:**

Task	Syntactic SLI	Control
Object relative comprehension: sentence-picture matching	66	95
Object relative comprehension: comprehension questions	65	91
Object relative comprehension: reading and paraphrasing	54	92
Object <i>Which</i> question comprehension: sentence-picture matching	70	89
Object relative production: picture description	42	94
Object relative production: preference elicitation	70	94

**Table 2. Number of SySLI participants who failed in each Wh-movement task out of the number of SySLI participants tested in that task**

Task	Syntactic SLI
Object relative comprehension: sentence-picture matching	10/12
Object relative comprehension: comprehension questions	10/11
Object relative comprehension: reading and paraphrasing	8/8
Object <i>Which</i> question comprehension: sentence-picture matching	11/12
Object relative production: picture description	9/11
Object relative production: preference elicitation	11/11

For the binding test, 10 Hebrew-speaking children without language impairment aged 6;6-7;8 participated as a control group.

### *Method*

To assess the participants' comprehension of pronominal elements, each participant heard 24 Hebrew sentences with pronominal elements: half included a reflexive pronoun and half included an object pronoun. Half of the sentences in each condition included a first sentence that introduced the NPs, followed by a SVO sentence (1), and the other half were embedded sentences that included a sentential complement of a verb (2).

- (1) Ze ha-yeled ve-ze ha-pinguin. Ha-yeled raxac **et acmo/oto**  
 this the-boy and-this the-penguin. The-boy washed **acc himself/him**  
 This is the boy and this is the penguin. The boy washed **himself/him**.
- (2) ha-pinguin siper she-ha-yeled raxac et acmo/oto  
 the-penguin said that-the-boy washed **acc himself/him**  
 The penguin said that the boy washed **himself/him**.

For each sentence, the participants were asked to choose one of two pictures (see Figure 1): one depicted a transitive action (matching the sentences with pronouns), the other depicted a reflexive action (for the reflexive anaphors). Each of the participants was tested individually in a quiet room. No time limit was imposed during testing, and no response-contingent feedback was given by the experimenter. The experimenter repeated every item as many times as the participant requested.



Figure 1. An example of a picture pair used in the sentence-picture matching binding task

### Results

The results of the pronominal dependencies comprehension showed a marked difference from the Wh-movement structures. Whereas the participants with syntactic-SLI showed severe impairments in the comprehension and production of sentences derived by Wh-movement: object relatives and object questions, they showed intact performance in the interpretation of pronouns and reflexives. There was no significant difference between groups in pronoun and reflexive comprehension (Figure 2); no significant difference between sentence types (Figure 3), and no significant difference between pronominal elements.

The control group was tested only on the embedded sentence conditions. The performance on reflexives in embedded sentences was 98% in both the SLI and control groups, and the performance on pronouns in the embedded sentences was 99% correct in the SLI group, and 98% correct in the control group, again, without a significant difference between the groups, using Mann-Whitney test,  $z = 0.36, p = .35$ . Another comparison was made, within the syntactic SLI group, between the performance on pronoun comprehension and on Wh-movement structure comprehension in similar tasks: sentence-picture matching. As can be seen in Figure 2, the children with syntactic SLI performed only 65% correct in the object relatives, a performance that was significantly poorer than the performance on pronouns in embedded sentences ( $z = 3.04, p < .01$ ), and significantly poorer than the performance on pronouns in simple coordinated sentences ( $w = 45, p < .05$ ). Their performance on object *which* questions was 70%, again, a performance that was significantly poorer than the performance on pronouns in embedded sentences ( $z = 2.91, p < .01$ ) and in simple coordinated sentences ( $w = 36, p < .01$ ).

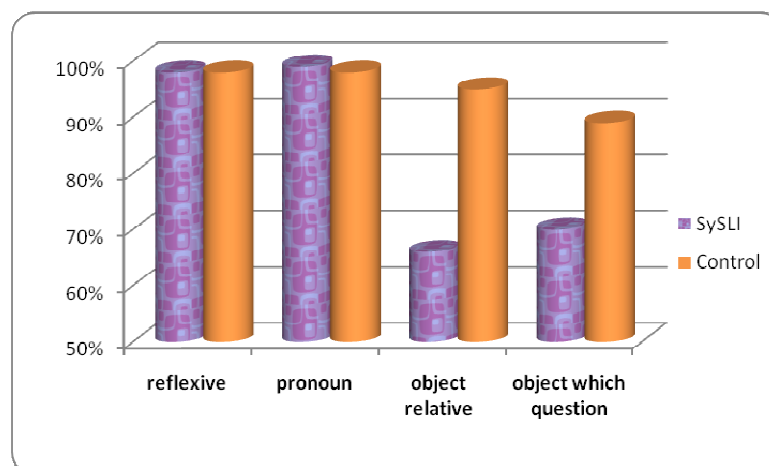


Figure 2. %correct on binding comprehension and on the comprehension of wh-movement in the binary picture selection tasks

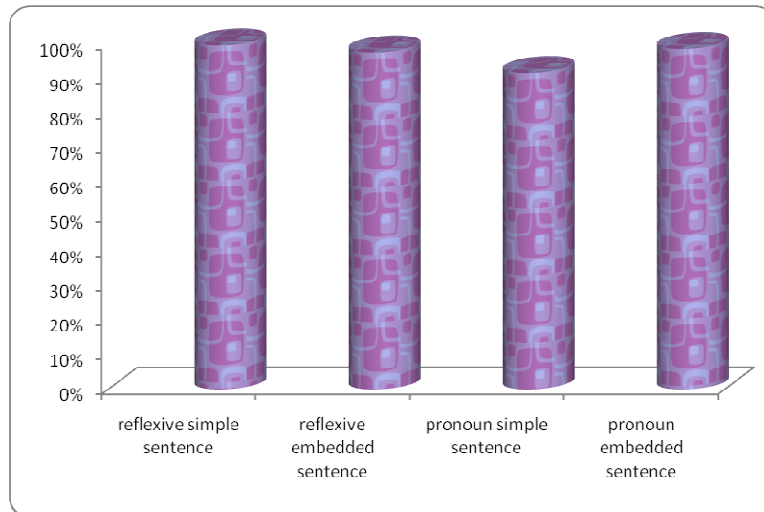


Figure 3. %correct in the various comprehension conditions of pronouns and reflexives

Namely, whereas the participants with syntactic-SLI were very impaired in the comprehension and production of Wh-movement, they showed intact performance in pronoun interpretation, although young Hebrew-speaking children show the classical delay of pronoun interpretation.

### Conclusion

The results suggest that the deficit in syntactic SLI is not general to all types of dependencies. Whereas a certain type of dependency, the one that is involved in Wh-movement, is impaired, another type of dependency, the one formed between a pronominal element and its antecedent, is intact.

The results further indicate that SLI is not a general syntactic delay, as Hebrew-speaking 5-year-olds have difficulties in the comprehension of both Wh-movement and pronouns (Friedmann, Belletti, & Rizzi, 2009; Ruigendijk et al., in press), whereas older SLI children only encounter difficulties in Wh-movement.

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