

Jana Marková<sup>1</sup>, Marína Mikulajová<sup>2</sup>

## **Oral Sentence Comprehension in Slovak-Speaking, Typically Developing Children, in Children with a Specific Language Impairment, and in Children with Dyslexia**

**Abstract:** Slovak is an inflective language and its properties enable the study of the process of sentence interpretation through morphology. The aim of the study is to map oral sentence comprehension in three groups of children: 120 with typical development (TD), 30 with specific language impairment (SLI) and 30 with dyslexia, further divided into three age categories. Our sentence comprehension test explores the influence of four separate linguistic factors (syntactic type, length, order of thematic roles and presence of the morphological cue at the beginning of the sentence). The task of the child is to choose one of two pictures depicting the same action but with the roles of the main actors changed. Children with SLI and dyslexia were significantly worse in the process of sentence interpretation in comparison to TD children. The two clinical groups, however, did not significantly differ in the performance. These results have been interpreted from a point of view of some of the current theories of dyslexia and specific language impairment.

**Key words:** sentence comprehension, linguistic factors, typically developing children, specific language impairment, dyslexia, Slovak language .

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**Abstrakt:** Język słowacki jest językiem flekcyjnym a jego właściwości umożliwiają badanie procesu interpretacji zdań poprzez morfologię. Celem niniejszych badań jest ustalenie stopnia zrozumienia zdań w trzech grupach: 120 dzieci rozwijających się typowo, 30 dzieci z określonym upośledzeniem językowym, oraz 30 dzieci dyslektycznych. Dodatkowo, grupy te zostały przypisane trzem odrębnym kategoriom wiekowym. Nasz test rozumienia zdania bada wpływ czterech odrębnych lingwistycznych czynników (typ składni, długość, szyk ról tematycznych oraz obecność morfologicznego wyznacznika na początku zdania). Zadaniem ucznia jest wybór jednego z dwóch obrazków ilustrujących tę samą czynność ze zmienionymi rolami podmiotu i dopełnienia. Dzieci z określonym upośledzeniem językowym oraz dzieci dyslektyczne wypadły znacznie gorzej w procesie interpretacji zdania w porównaniu z dziećmi rozwijającymi się poprawnie. Te dwie grupy kliniczne są podane interpretacji pod kątem obecnych teorii dotyczących dysleksji i określonego upośledzenia językowego.

**Słowa kluczowe:** rozumienie zdania, czynniki językowe, poprawnie rozwijające się dzieci, określone upośledzenie językowe, dysleksja, język słowacki.

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<sup>1</sup> **Jana Marková**, PaedDr., PhD., Department of Communication Disorders, Comenius University in Bratislava, Slovakia.

<sup>2</sup> **Marína Mikulajová**, doc. PhDr., PhD., Department of Communication Disorders, Comenius University in Bratislava, Slovakia.

## 1. Introduction

Sentence comprehension is a very complex process that includes many levels of processing (Levitt, 1993, Cutler & Clifton, 2000). It is a substantial part of our everyday communication and discourse comprehension not only in the auditory, but also in the written form. There are only a few studies aimed at this process in children with a specific language impairment and children with dyslexia (Leonard, 2000) and their results do not agree: according to some studies children with a specific language impairment and dyslexia manifest deficits in sentence decoding and their performance is significantly worse in reversible sentences with non-canonical word order, whilst according to other studies, they do not reveal any apparent difference in comprehension compared to their typically developing peers.

In Slovak, this process has not been studied so far in either typically developing children or in children from clinical populations. The aim of our study is to map sentence comprehension in typically developing Slovak-speaking children, in children with a specific language impairment and in children with dyslexia, and to explore whether there are any differences among these groups.

Firstly, we will describe the properties and features of the Slovak language that are relevant to sentence comprehension and to our research.

## 2. The Slovak language

The Slovak language belongs to a group of West-Slavic languages together with for example Czech and Polish. Generally speaking, we have a relatively free word order in sentences (Mistrik, 1966; Oravec & Bajžíková, 1982) and a very rich system of overtly expressed, bound grammatical morphemes (Oravec, Bajžíková & Furdík, 1984). This system of morphemes enables the reader to decide "who is doing what to whom". It is particularly important in reversible sentences in which the main participants can exchange their thematic roles and the sentence retains its meaning. This holds for the next two sentences (examples 1 and 2):

- Mam-a bozkáva dcér-u.*  
(1) Mother-NOM kisses daughter-ACC.  
"The mother is kissing the daughter".

Because the nouns have different forms in the nominative and the accusative, their functions in the sentence are unambiguously expressed. This is also the reason why it is possible to change the word order in the sentence without changing the thematic roles of nouns. We can express the same meaning in the following way:

- (2) *Dcér-u bozkáva mam-a.*  
Daughter-ACC kisses mother-NOM.

It is fair to say, however, that there are two kinds of nouns in the Slovak language. Nouns that formally distinguish the nominative and the accusative, as in the previous examples, and nouns that formally have the same form in these two cases, for example the noun *dieťa* "the child" and *dievča* "the girl". If both participants were expressed by these nouns, the sentence would be ambiguous in Slovak, as in the following example:

- Dieťa bozkáva dievča*  
(3) Child-NOM/ACC kisses girl-NOM/ACC.  
"The child is kissing the girl" or "The girl is kissing the child".

If we use such a noun to describe the action, another noun should distinguish formally the nominative and the accusative, in order to unequivocally assign the thematic roles to the actors:

- Dieťa bozkáva mam-a.*  
(4) Child-NOM/ACC kisses mother-NOM.  
"The mother is kissing the child".

Even though the first noun has the same form in both cases, the second noun takes the nominative form. In the process of sentence comprehension, the accusative has to be assigned to the first noun.

These properties are also relevant for relative clauses as is shown in the following examples:

- Mam-a, ktor-á bozkáva dcér-u, je milá.*  
(5) Mother-NOM, that-NOM kisses daughter-ACC, is kind.  
"The mother that is kissing the daughter is kind".
- Mam-a, ktor-ú bozkáva dcér-a, je milá.*  
(6) Mother-NOM, that-ACC kisses daughter-NOM, is kind.  
"The mother that the daughter is kissing is kind".
- Dieťa, ktor-é ťahá otec-0, je malé.*  
(7) Child-NOM/ACC, that-NOM/ACC pulls father-NOM, is small.  
"The child that the father is pulling is small".

In examples 5 and 6, the relative pronouns clearly indicate the role of the nouns in the sentence. In example 7, the situation is similar to example 4. The relative pronoun does not have different forms for the nominative and the accusative, so it does not help in the process of role assignment and the listener has to wait for the other noun in the sentence.

Morphology plays a role in the decoding of passive sentences as well (Example 8).

*Otec je ťaha-n-ý.*

- (8) Father-NOM is pull-ed-PASTPCPL- MASC, SG, NOM  
"The father is pulled".

We used these properties of the Slovak language in the construction of the sentence-comprehension test which was administered to our research groups.

### 3. Method

We used the method of sentence-picture matching task. As we do not have standardized tests for the assessment of language comprehension in Slovak, a custom-made test was created by the first author of this study.

Our test consists of two parts. The first part is lexical and its aim is to evaluate the comprehension of individual words with high frequency in the language (10 nouns and 6 verbs) from which the test sentences are formed. The child matches one of four pictures to a heard word. The correct comprehension of isolated words constitutes a criterion for the sentence testing. To avoid lexical overloading, each ten sentences in the test are formed from the same words.

The second part of the test includes 60 semantically reversible sentences with transitive verbs and two nominal animate phrases. This test enables the analysis of different linguistic factors and their influence on sentence comprehension. We analyzed the influence of the following factors:

#### **Syntactic construction**

Our test consists of five kinds of syntactic constructions, which are active sentences with the word order subject-verb-object, active sentences with the word order object-verb-subject, passive sentences, and two kinds of mid-position relative clauses: subject relatives, and object relatives. Each syntactic construction occurs in the test 12 times.

#### **Order of thematic roles**

In analyzing this factor, the order of the main actors in the sentence is taken into account. In sentences with canonical order of thematic roles, the first noun in the sentence was assigned the role of an agent. In sentences with non-canonical order of thematic roles, the first noun in the sentence takes the role of the theme/patient. We compared the comprehension of 24 sentences with canonical order of thematic roles (sentences with SVO word order and subject relative clauses) and 36 sentences with

non-canonical order of thematic roles (sentences with OVS word order, passive sentences and object relative clauses).

### Length of the sentence

Our test consists of 30 short and 30 long sentences. One half of each syntactic construction falls into the category of short sentences (the sentence only consists of main words which are necessary for the interpretation of the sentence), as shown in example 9.

- (9) *Dievča bije chlapca.*  
Girl-NOM/ACC beats boy-NOM.  
"The boy is beating the girl".

The second group of sentences falls in the category of long sentences (there are other words in the sentence – mostly adjectives and adverbs, which have the function of fillers, and which do not help in the interpretation of the sentence), for example:

- (10) *Malé dievča často bije vysokého chlapca.*  
Small-NOM/ACC girl-NOM/ACC often beats big-ACC boy-ACC.  
"The small girl often beats the big boy".

### Morphological cue in the first noun / at the beginning of the sentence

The last factor is related to the bound grammatical morpheme of the first noun (or the appropriate relative pronoun in relative clauses) and its ability to distinguish the nominative and the accusative case. The group of sentences with a morphological cue consisted of constructions in which the first noun differentiated these two cases. In sentences without a morphological cue, the first noun does not formally distinguish these two cases. In the test, each syntactic construction, except for the passive ones, both short and long, has three examples with a morphological cue at the beginning of the sentence and three examples without a morphological cue.

An overview of the test sentences is shown in Table 1.

Table 1. Number of tested sentences according to various linguistic variables

Length	Passive	Morphological cue	Svo	Ovs	Subject relative	Object relative
short	6	present	3	3	3	3
		missing	3	3	3	3
long	6	present	3	3	3	3
		missing	3	3	3	3

The sentences were divided into two blocks of 30 sentences each and their presentation was balanced. We started with simple short sentences, then we presented simple long sentences. These were followed by complex sentences – at first short and then long ones.

Within each group, there were no two consecutive sentences with the same factors.

#### 4. Procedure

The paradigm uses two drawings that express the same action, but with reversible roles of the main actors. The child hears a target sentence and is asked to choose the target drawing from two drawings on the page. An example of two drawings that are shown together with a sentence can be seen in Picture 1.



Picture 1. Example of drawings used in the test.

The correct picture in each pair is varied. It is not always the same picture from the pair. The pictures are arranged vertically, and the position of the correct picture on the page is varied as well. Prior to testing, we used two sample sentences. If the child asked during the testing for a sentence to be repeated, the sentence was read again. Children were tested in one session. If it was necessary, a pause was given. All children were assessed over a period of three consecutive months.

#### 5. Participants

The sentence comprehension was administered to 180 Slovak-speaking children from the age of 7 to 9 years and 11 months. Children were divided into three age categories and three groups (typically developing children – TD, children with dyslexia and children with specific lan-

guage impairment – SLI). The number and average age of subjects in the age categories is presented in Table 2.

Table 2. Number (n) and average age (with SD) of participants (TD – typically developing children, SLI – children with specific language impairment, children with dyslexia) in different age categories

Age range	TD			SLI			Dyslexia		
	n	mean age	SD (month s)	n	mean age	SD (month s)	n	mean age	SD (month s)
7;0-7;11	40	7;6	3,1	11	7;6	3,2	9	7;10	1,8
8;0-8;11	40	8;4	2,8	10	8;5	3,1	10	8;6	2,7
9;0-9;11	40	9;5	3,3	9	9;5	2,8	11	9;7	1,9

In the entire research sample, there were no children with any sensory or motor deficits and all had a normal range of non-verbal IQ. Clinical groups of children consisted of children diagnosed prior to the study as having SLI or dyslexia, according to standard clinical procedures and criteria used by practitioners in the country. All children attended regular classes in primary schools.

## 6. Results

In this part, we will present the results of our research.

Figures 1, 2 and 3 show the average percentage of typically interpreted syntactic constructions and sentences divided into groups, according to the various linguistic factors, in TD children, children with SLI, and children with dyslexia, belonging to the same age category.

*Oral Sentence Comprehension in Slovak-Speaking, Typically Developing Children, in Children with a Specific Language Impairment, and in Children with Dyslexia*

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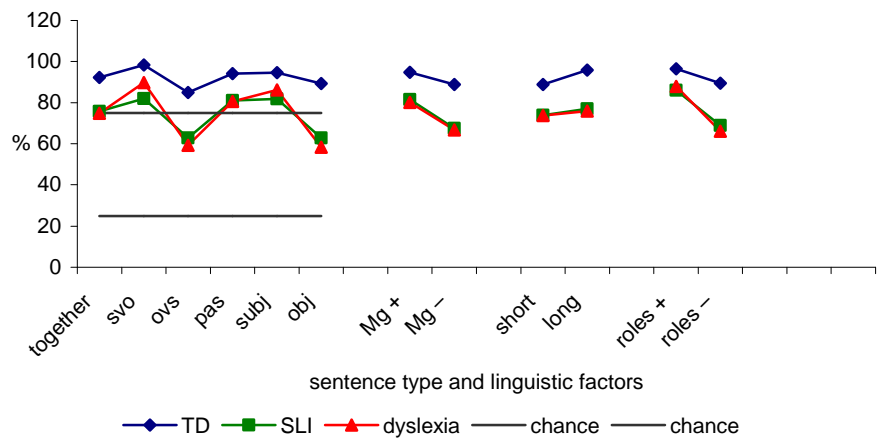


Figure 1. The average percentage of all correctly interpreted sentences, sentences of different syntactic kinds and with various linguistic factors in correctly developing children (TD), children with SLI and dyslexia from the age of 7 to 7 years and 11 months.

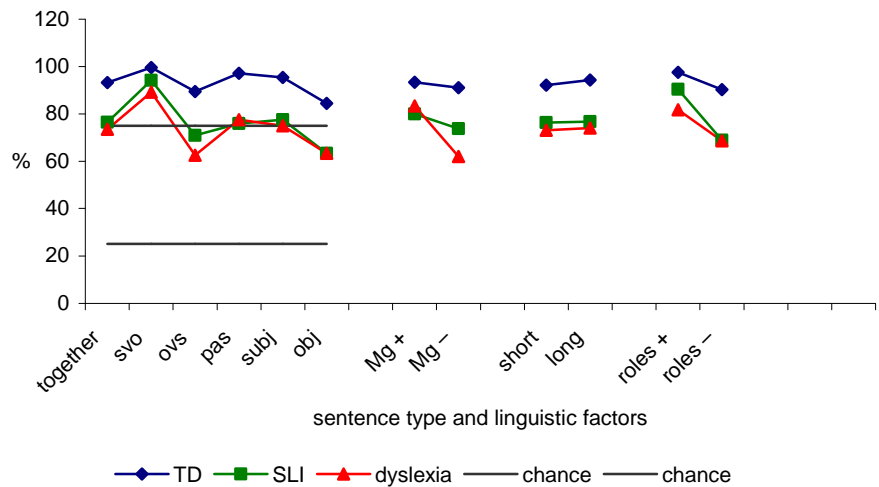


Figure 2. The average percentage of all correctly interpreted sentences, sentences of different syntactic kinds and with various linguistic factors in typically developing children (TD), children with SLI and dyslexia from the age of 8 to 8 years and 11 months.



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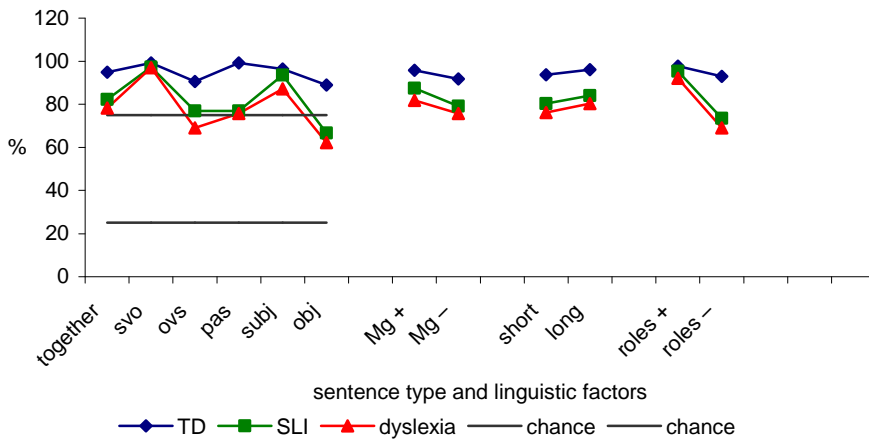


Figure 3. The average percentage of all correctly interpreted sentences, sentences of different syntactic kinds and with various linguistic factors in typically developing children (TD), children with SLI and dyslexia from the age of 9 to 9 years and 11 months.

### Comprehension of syntactic constructions

On the left hand side of the figures presented above, we can see the relative frequency of all correctly interpreted sentences and according to the syntactic kind of the sentence.

The horizontal lines in the figures mark the borderline of the random level of response according to the Binomial test. For 12 trials, the random level of performance means the proportion of correct answers from 0.25 to 0.75 (from 25% to 75%). If the performance of the subject falls within these parameters, we can assume that he/she achieved this level by guessing and does not really process the syntactic construction. This approach is sometimes applied in studies about sentence comprehension in patients with aphasia (Grodzinsky, 1995a, 1995b) and in children with a specific language impairment (Friedmann & Novogradsky, 2004). Table 3 shows the average performance and standard deviations of the groups in the comprehension of each and every kind of sentence.

Table 3. The average comprehension (in %) of all sentences and of individual syntactic constructions

Groups	Statistics	Overall	Svo	Ovs	Pas	Subj	Obj
TD 7;0-7;11	mean	92,3	98,3	85,0	94,2	94,6	89,4
	SD	5,3	3,4	13,6	7,8	7,4	10,7
SLI 7;0-7;11	mean	75,8	82,0	62,9	81,1	81,8	62,9
	SD	5,4	28,6	6,9	11,9	19,7	13,6
Dyslexia 7;0-7;11	mean	74,8	89,8	59,3	80,6	86,1	58,3
	SD	6,4	10,0	13,5	17,2	11,8	13,2
TD 8;0-8;11	mean	93,2	99,6	89,4	97,1	95,4	84,4
	SD	5,7	1,8	12,8	6,9	5,6	14,0
SLI 8;0-8;11	mean	76,5	94,2	70,8	75,8	77,5	63,3
	SD	10,6	8,8	20,5	16,9	22,2	11,9
Dyslexia 8;0-8;11	mean	73,5	89,2	62,5	77,5	75,0	63,3
	SD	7,0	7,9	13,2	16,2	14,2	13,1
TD 9;0-9;11	mean	94,8	99,2	90,6	99,2	96,3	89,0
	SD	5,0	3,2	11,8	3,7	5,3	13,0
SLI 9;0-9;11	mean	82,2	97,2	76,9	76,9	93,5	66,7
	SD	10,3	4,2	20,3	28,2	8,1	18,6
Dyslexia 9;0-9;11	mean	78,2	97,0	68,9	75,8	87,1	62,1
	SD	8,0	5,6	13,0	16,9	11,4	12,6

In each age category, the performance of children with SLI and dyslexia is below the performance of TD children, especially in active sentences with the word order object-verb-subject, passive sentences, and object relative clauses. In the case of constructions with the OVS word order and object relatives, the level of understanding in children with either SLI or dyslexia is random.

According to the Kolmogorov-Smirnov test, the distribution of the scores in TD children was not normal, except for some kinds of sentences amongst children from the youngest age category. Because the number of participants in the groups of children with SLI and dyslexia ranged from 9 to 11, we used non-parametric tests in the mutual comparison of these groups.

The Mann-Whitney U-test was used to compare the performance of TD children with children with SLI / dyslexia and the performance of children with SLI and dyslexia only, in each age category. The results are presented in Table 4.

Table 4. Differences in the comprehension of all sentences and of individual syntactic constructions

Age	Compared groups	Overall	Svo	Ovs	Pas	Subj	Obj
7;0 – 7;11	SLI – TD	-5,036***	-3,319*	-4,230***	-3,600***	-1,940	-4,335***
	dyslexia - TD	-4,643***	-3,594*	-3,742***	-2,334*	-2,259*	-4,447***
	dyslexia - SLI	-,305	-,277	-,668	-,078	-,194	-,581
8;0 – 8;11	SLI – TD	-4,386***	-3,096	-2,906*	-4,493***	-2,816*	-3,651***
	dyslexia - TD	-4,727***	-5,318***	-4,159***	-4,518***	-4,892***	-3,751***
	dyslexia - SLI	-1,255	-1,424	-1,362	-,231	-,961	-,272
9;0 – 9;11	SLI – TD	-3,884***	-2,044	-2,249*	-4,536*	-1,008	-3,510***
	dyslexia - TD	-4,568***	-1,782	-3,841***	-5,543***	-2,738*	-4,358***
	dyslexia - SLI	-1,335	-,142	-1,400	-,581	-1,313	-,619

\*  $p < .05$ ; \*\*\*  $p < .001$

Significant differences appeared between the groups of TD children and children with SLI / dyslexia in nearly all syntactic constructions. The non-significant difference is apparent only in the comprehension of subject relative clauses between the TD children and children with SLI from the age of 7 to 7 years and 11 months and from 9 to 9 years and 11 months. We did not find a difference in the comprehension of SVO-sentences between the TD children and children with SLI from the age of 8 to 8 years and 11 months and between the TD children and both clinical groups from the age of 9 to 9 years and 11 months either.

The statistical tests did not show any significant differences in the comprehension of syntactic constructions between children with SLI and dyslexia in each age category.

### **Influence of other linguistic factors**

Figures 1, 2, and 3 present the influence of various linguistic factors concerning the comprehension of TD children, children with SLI, and dyslexia. We can visually compare the comprehension of short and long sentences, sentences with and without the morphological cue at the beginning of the sentence, and sentences with canonical and non-canonical order of thematic roles. Table 5 derives means and standard deviations for each explored factor in each group of subjects.

Table 5. The comprehension of sentences (in %) according to the linguistic factor

<b>Groups</b>	<b>Statistics</b>	<b>Mg +</b>	<b>Mg –</b>	<b>Short</b>	<b>Long</b>	<b>Roles +</b>	<b>Roles –</b>
TD 7;0 – 7;11	mean	94,8	88,9	88,8	95,8	96,5	89,5
	SD	5,8	8,5	8,0	3,7	4,5	7,6
SLI 7;0 – 7;11	mean	81,5	67,4	73,9	77,0	86,0	68,9
	SD	11,9	9,5	5,1	6,6	13,9	4,8
Dyslexia 7;0 – 7;11	mean	80,1	66,7	73,7	75,9	88,0	66,1
	SD	10,2	7,2	8,1	7,8	8,2	9,6
TD 8;0 – 8;11	mean	93,4	91,0	92,1	94,3	97,5	90,3
	SD	5,1	9,9	7,0	5,1	3,0	9,1
SLI 8;0 – 8;11	mean	80,0	73,8	76,3	76,7	90,4	68,9
	SD	10,2	13,2	12,4	10,3	8,3	11,3
Dyslexia 8;0 – 8;11	mean	83,3	62,0	73,0	74,0	81,7	68,6
	SD	11,8	5,2	7,5	8,1	6,3	9,2
TD 9;0 – 9;11	mean	95,7	91,8	93,7	96,0	97,7	92,9
	SD	4,2	9,3	5,8	5,5	3,4	7,7
SLI 9;0 – 9;11	mean	87,5	79,2	80,4	84,1	95,4	73,5
	SD	6,3	8,3	12,3	9,4	5,3	17,4
Dyslexia 9;0 – 9;11	mean	81,8	75,8	76,1	80,3	92,0	68,9
	SD	8,6	10,3	9,8	8,5	6,6	10,9

Again, the performance of children with SLI and dyslexia is below the performance of TD children in each age category. Using the non-parametrical Mann-Whitney U-test, we compared the performance of TD children with children with SLI / dyslexia and the performance of children with SLI and dyslexia only, in each age category. The results are shown in Table 6.

Table 6. Differences in the comprehension of sentences with an individual linguistic factor

Age	Compared groups	Mg +	Mg -	Short	Long	Roles +	Roles -
7;0-7;11	SLI – TD	-3,783***	-4,531***	-4,446***	-5,142***	-2,708*	-4,990***
	dysl – TD	-3,951***	-4,485***	-3,728***	-4,675***	-3,284*	-4,591***
	dysl – SLI	-,464	-,116	-,310	-,350	-,039	-,732
8;0-8;11	SLI – TD	-4,038***	-3,778***	-3,932***	-4,606***	-2,854*	-4,206***
	dysl – TD	-2,761*	-4,687***	-4,446***	-4,884***	-5,106***	-4,304***
	dysl – SLI	-,914	-2,895*	-1,219	-,989	-2,103*	-,266
9;0-9;11	SLI – TD	-3,413*	-3,539***	-3,329*	-3,957***	-1,532	-3,688***
	dysl – TD	-4,538***	-3,938***	-4,148***	-4,568***	-3,096*	-4,601***
	dysl – SLI	-1,480	-,656	-,884	-1,151	-1,297	-1,185

There is a significant difference between the group of TD children and children with either SLI or dyslexia for each factor in all age categories, except for the sentences with canonical order of thematic roles (roles +), between TD children and children with SLI in the oldest category.

On the other hand, differences between children with SLI and dyslexia occurred only in children from the age of 8 to 8 years and 11 months, and only in the comprehension of sentences without a morphological cue in the first noun/at the beginning of the sentence and with canonical order of thematic roles (roles +).

### Comparison of sentences differing in their linguistic factor

Table 7 presents the results (z-values) of the comparison of the comprehension of sentences differing in a certain linguistic factor. For this comparison, we used the Wilcoxon signed-rank test. Significantly higher scores are not always to be "expected". In groups of typically developing children, sentences with a morphological cue at the beginning are easier compared to sentences without a morphological cue. Also, sentences with canonical order of thematic roles are easier than sentences with non-canonical order of thematic roles. On the other hand, for these children shorter sentences are more difficult than long constructions in each age category. This is also true for the group of children with SLI in the youngest age category. It may be caused by the fact that the long sentences do not exceed these children's working memory and the information is expressed in a larger space, which makes these sentences easier to process.

Table 7. Differences in the comprehension of sentences differing in the linguistic factor

Age	Groups	Mg - - mg +	Long-short	Roles- - roles+
7;0 – 7;11	TD	-4,032***	-4,634***	-4,539***
	SLI	-2,185*	-2,041*	-2,491*
	dyslexia	-1,972*	-,561	-2,670*
8;0 – 8;11	TD	-1,157	-2,616*	-4,299***
	SLI	-2,030*	-,155	-2,805*
	dyslexia	-2,654*	-,141	-2,803*
9;0 – 9;11	TD	-2,696*	-2,851*	-3,621***
	SLI	-2,420*	-1,513	-2,437*
	dyslexia	-1,509	-1,523	-2,934*

The length of the sentence seems to be a relevant variable only for TD children and for children with SLI in the youngest age category.

The presence of a morphological cue in the first noun and the order of thematic roles are the main factors influencing sentence comprehension in children with SLI and dyslexia. Children better understand sentences in which the first noun differentiates the nominative and the accusative and that plays the role of the agent. These factors are relevant in the comprehension of TD children as well. Comprehension was not influenced by the presence of a morphological cue in TD children at the age from 8 to 8 years and 11 months.

In order to reveal the role of morphology in sentences with a different order of thematic roles, we analyzed the number of errors children made in the comprehension of sentences with and without the morphological cue within the constructions with a canonical and non-canonical order of thematic roles (except for passive sentences). Table 8 shows the average number of errors per child. The presence of the morphological cue influences the interpretation of sentences with a canonical order of thematic roles in some groups of children, in which the number of errors slightly increased when the cue was not present. In sentences with a non-canonical order of thematic roles, however, the presence of the morphological cue at the beginning of the sentence highly influenced the interpretation of the sentence (the number of incorrectly interpreted sentences substantially increased in sentences with a non-canonical order of thematic roles and without the morphological cue at the beginning of the sentence).

Table 8. The average number of errors per child in the comprehension of sentences with a canonical (R+) and non-canonical (R-) order of thematic roles with a morphological cue (Mg+) at the beginning of the sentence and without it (Mg-)

Age	Groups	R+/mg+	R+/mg-	R-/mg+	R-/mg-
7 - 7;11	TD	0,4	0,5	0,9	2,2
	SLI	1,8	1,6	2,6	6,3
	dyslexia	1,9	1,0	2,9	7,0
8 - 8;11	TD	0,3	0,4	1,3	1,8
	SLI	1,2	2,3	3,6	4,1
	dyslexia	1,3	3,0	2,8	6,1
9 - 9;11	TD	0,2	0,3	0,8	1,7
	SLI	0,4	0,7	2,4	4,3
	dyslexia	0,5	1,4	3,8	4,5

## 7. Discussion

In our research we compared oral comprehension of sentences in three groups of Slovak-speaking children: TD children, children with SLI and children with dyslexia. We explored the influence of various linguistic factors on comprehension. Namely, the syntactic kind of the sentence, the order of thematic roles, the presence of the morphological cue in the first noun or at the beginning of the sentence, and the length of the sentence.

Our results reveal that children from both clinical groups process the sentences presented on a substantially lower level than TD children of the same age. This is especially true for sentences with verb-subject-object word order, passive sentences and complex sentences with object relative clauses. While TD children comprehend these kinds of sentences better than merely randomly, children with SLI and dyslexia "guess". The significant difference between TD children and children with SLI or dyslexia did not occur in sentences with SVO word order and subject relative clauses in some age categories. The reason for this lies in the similarity of the level of comprehension of these constructions in all children in the youngest age category, and the higher scores in their processing in the clinical groups of children in the oldest age category.

TD children in all age categories process the syntactic constructions very well, either at ceiling level or near to it. Comprehension in clinical groups slightly increases as well, but it remains significantly below the average performance of TD children even amongst the nine-year-olds (mainly OVS sentences and object relatives).

Similar results in sentence comprehension in children with SLI were found in other languages, for example, in Greek (Stavarakaki, 2001) and in

Hebrew (Friedmann & Novogradsky, 2004). Greek children with SLI processed the object relatives significantly worse than their age-matched controls and language-matched controls. Moreover, they predominantly made a certain kind of errors, i.e. the reversal of thematic roles. In the study of Friedmann and Novogradsky (2004), Hebrew children with SLI with an average age of 9.0 were comparable in the comprehension of object-relatives with four-year TD children. In the comprehension of sentences with a canonical order of thematic roles they did not show a significantly different performance in the comparison with their age-peers and younger children, but performed significantly worse on object-relatives than six-year old children. Children in these studies had, according to the authors, syntactic deficits. The authors postulate that the children are not able to interpret moved arguments and elements in the sentence. If the agent of the action is not the first noun in the sentence, the child guesses. The non-significant difference in the comprehension of SVO-sentences and subject relatives is explained by the position of the agent: if it is the first noun in the sentence, and even though it is not co-indexed with its trace in the case of subject relatives, the responses of children are correct.

Our children with SLI and children with dyslexia and their age TD controls, however, differed significantly in some age categories, not only in the comprehension of sentences with a non-canonical order of thematic roles, but also in sentences in which the agent is in the first position (SVO-sentences and subject relatives; see Table 4). If our children used the aforementioned strategy in the assignment of thematic roles, there should be no observable difference. However, its existence indicates that the children cannot apply the strategy consistently.

From a syntactic perspective, the position of passive sentences is very interesting. Their comprehension is already near to ceiling level in TD children in the youngest age category. This is surprising, because passive sentences are not frequently used in the Slovak language, and children can hear them in colloquial speech very rarely.

One theoretical conception about the comprehension of passive sentences states that the interpretation of passive sentences is similar to the interpretation of adjective constructions (Friedmann & Shapiro, 2003). Even though this account was primarily related to the comprehension patterns of aphasic patients, this explanation is applicable to the Slovak language, as well. This could explain their relatively very good comprehension.

In the next part of our research, we analyzed the influence of various linguistic factors on comprehension. We observed that some factors cause more difficulties in sentence processing. This holds especially for sentences with a non-canonical order of thematic roles. For the comprehension of these sentences, it is necessary to find the relation between the subject and object of the sentence on the one hand, and the thematic roles such as the agent and the patient/theme on the other hand. To per-



form these operations in Slovak, the child has to perceive and consider the bound grammatical morphemes of words. From this point of view, the process of role assignment and the morphological factors are closely interconnected. If the child does not "hear" the morphemes or does not process them, he/she cannot properly assign the thematic roles and decide "who is doing what to whom". The comprehension of these kinds of sentences is better than random already evident in TD seven-year-old children, but at or near the random level in each age category of children with SLI and dyslexia. Children probably do not really process some (or all) grammatical morphemes and they (inconsistently) apply some strategies. The use of one such simpler strategy – the reliance on the word order in the process of the role assignment – was described in detail in early language acquisition literature (e.g. Lahey, 1988).

The comprehension of syntactic constructions in children with SLI and dyslexia at each age category did not show significant differences. This leads to a rethinking of our current views on, and understanding of these disorders, at least in the Slovak language.

The "specifics" of dyslexia and specific language impairment is an interesting topic of scientific debate indicating that about 50% of children from both categories could be equally classified as having one or other diagnosis (McArthur, et al., 2000). There are at least two theoretical models of how the underpinnings of SLI and dyslexia are interpreted.

The first theoretical account (Bishop, Snowling, 2004) postulates that these are two developmental disorders, in spite of the fact that they have similar and overlapping behavioral signs. According to this account, children with SLI are characterized by an impairment in the phonological and also non-phonological domains. Their symptoms typically relate different aspects of morphosyntax, lexical meaning, and language comprehension, which is later reflected in their poor reading skills. On the other hand children with dyslexia are characterized by poor phonological processes predominantly in the area of phonological awareness, which cause difficulties with decoding written words and non-words. These children – unlike poor comprehenders – do not primarily manifest deficiencies in other areas of cognitive skills and linguistic operations. Some authors (e.g. Catts, Adlof, Hogan & Weismer, 2005) support the view that SLI and dyslexia are distinct but potentially comorbid developmental language disorders. According to Stanovich (1993) oral language comprehension is among the criteria to be applied in decision-making about whether the school age child with reading difficulty is or is not dyslexic.

The second account (Scarborough, 1990a, 1990b) acknowledges the primary existence of phonological deficits in children with dyslexia but at the same time underlines other facts, namely that the risk of developing dyslexia is as great for pre-schoolers with nonphonological language impairments as it is for those with impairments in phonological skills. According to this view the phonological model does not fully explain the

development of dyslexia outside the primary grades. Language domains are developmentally interrelated and the quality of phonological processes influences other linguistic domains and functions (semantics, vocabulary, syntax...). This means that even children with dyslexia can have problems with different levels of language, which can have detrimental effects on oral and reading comprehension. The transparency of orthography in different languages probably also plays a role in the symptoms and mechanisms of dyslexia: in the regular Slovak orthography decoding – reading of words and non-words – is a relatively simple task and children are often identified as reading disabled (with dyslexia) only after several years of school attendance when they begin to fail in reading comprehension and learning. In the framework of "The simple view of reading" (Gough, Tunmer, 1986) these kind of difficulties would be explained by insufficient oral language comprehension skills. A high degree of interdependence between listening comprehension, reading comprehension and decoding was found by Hagtvet (2003) in nine-year-old good and poor readers speaking/reading Norwegian, which has a regular orthography. Although the results of this study are interpreted in favour of "the phonological deficit hypothesis", evidence for the importance of syntactic and semantic skills as well, is emphasized.

In the Slovak language, the morphological system is closely interconnected with the phonological system and sentence (speech) comprehension is based on the perception of especially bound grammatical morphemes which are phonetically realized. If the child has to analyze for example, the sentence *Mamu bozkáva dcéra.*, (Mother-ACC kisses daughter-NOM.), he/she must perceive the bound grammatical morpheme *-u* in the form *mamu* which indicates the accusative, and the bound grammatical morpheme *-a* in the form *dcéra* which indicates the nominative. If the child does not hear or "feel" them, the sentence decoding fails, especially in sentences without contextual cues. In addition it should be mentioned that Slovak has longer words compared to English: approximately one third of all words are three-syllabic or longer and the stress in the case of two- and more-syllabic words always falls on the first syllable. We can assume that Slovak-speaking children cannot fully acquire morphological skills without a well developed phonology. If the child does not perceive the endings of the words, he/she probably applies the cues, which are less relevant and valid for the interpretation of sentences: in Slovak, it would be the word-order and the syntactic strategy.

The language processes in Slovak are probably not directed with the rule "all or nothing". The impairment can have more degrees and different levels of processing can be interconnected. This probably holds even for the phonological level and phonological processes. Some morphemes can be more "salient" and their processing requires fewer resources, some can be more difficult to perceive. These concepts of "cue cost" and "cue validity" (Bates, Wulfeck & MacWhinney, 1991) were described pri-

marily for people with aphasia but we can apply them here. The processing of sentences without morphological cues in the first noun or at the beginning of the sentence is much more difficult and source-consuming than the processing of nouns with morphological cues.

In the last part of our research, we compared the processing of linguistic factors within each category of children at the given age. If we arrange the factors in rank order according to their relative significance in the compared groups of children (see Table 7), the most difficult factor appears to be the order of thematic roles, followed by the presence of a morphological cue in the first noun or at the beginning of the sentence. Moreover, the combination of the order of thematic roles and the presence of the morphological cue at the beginning of the sentence seem to be the most relevant aspects in the process of sentence comprehension (see Table 8).

We assume that the assignment of thematic roles in Slovak sentences is primarily based on morphology. As was documented by our previous research, the process of early language acquisition in Slovak, unlike in English, starts in the morphological, not syntactic domain, and after the first varied forms of different words appear in children's utterances they begin to produce their first syntactic structures (Kapalková, et. al., 2010). The first grammatical form of nouns produced between 18 and 24 months of age is the accusative singular, and what is interesting, is that such very young children are sensitive towards the presence/absence of morphological markers: e.g. if a parent asks "What do you want (to drink)?" the child answers *čaj-O*, *vod-u* (tea-NOM/ACC, water-ACC). In the normal course of language acquisition this seems not to be a problematic "area of expertise".

## 8. Conclusion

In our research, we studied sentence comprehension in Slovak-speaking, typically developing children, children with a specific language impairment, and children with dyslexia, in the 7-9 years and 11 months age range. There are significant differences between typically developing children in each age category and their peers with specific language impairment and with dyslexia. On the other hand, the differences did not occur between two clinical groups of children at any age. This points to the fact that both clinical groups of children manifest substantial deficits in oral comprehension. Our current findings will be followed by further investigation, but they allow us to make a conclusion that the comprehension of sentences in the Slovak language is a very complex process which requires not only an adequate amount of processing resources, but also the cooperation of different levels of language information processing.

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