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Receptive language skills in Slovak-speaking children with Intellectual Disability:

Understanding words, sentences and stories

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Abstract

Purpose: The study aims to describe receptive language skills in children with intellectual disability (ID) and to contribute to the debate on deviant vs. delayed language development. This is the first study of receptive skills in children with ID who speak a Slavic language, providing insight into how language development is affected by disability and also language typology.

Method: Twenty-eight Slovak-speaking children participated in the study (14 children with ID and 14 typically developing (TD) children matched on non-verbal reasoning abilities). The children were assessed by receptive language tasks targeting words, sentences and stories, and the groups were compared quantitatively and qualitatively.

Results: The groups showed similar language profiles, with a better understanding of words, followed by sentences, with the poorest comprehension for stories. Nouns were comprehended better than verbs; sentence constructions also showed a qualitatively similar picture, although some dissimilarities emerged. Verb comprehension was strongly related to sentence comprehension in both groups, and related to story comprehension in the TD group only.

Conclusions: The findings appear to support the view that receptive language skills follow the same developmental route in children with ID as seen in younger TD children, suggesting that language development is a robust process and does not seem to be differentially affected by ID even when delayed.

1. Introduction

Language is a fundamental skill which influences various aspects of cognitive development and social interaction. Children with intellectual disability (ID) often experience severe language learning difficulties (Facon, Facon-Bollengier & Grubar, 2002), but their development across different language domains is not well understood. According to a recent study by McKenzie, Milton, Smith, and Ouellette-Kuntz (2016) estimates of the prevalence of ID ranges between 0.05 and 1.55 %, and across studies prevalence is often quoted at 1 %. ID is characterized by significant deficits in general mental abilities, significant limitations in adaptive behaviour and onset in childhood (DMS-5, 2013). Although the condition is relatively common, children with ID are often excluded from language research or only included as a control group, and there is limited knowledge about their language skills. The current study explored language comprehension in a cohort of 14 children with ID, compared to a group of 14 typically developing (TD) control children matched for level of non-verbal reasoning abilities.

Successful language comprehension involves processing of information at different levels. Communication rarely takes place through single words, and comprehension of combinations of words in phrases and sentences is necessary for successful comprehension. Additionally, understanding discourse relies on integrating language knowledge and general knowledge/context in addition to the vocabulary and syntactic knowledge that are known to be essential for listening comprehension (Lepola, Lynch, Laakkonen, Silven, & Niemi, 2012). As a result, successful comprehension will be determined by multiple factors (e.g. Kim, 2016), including language knowledge, working memory and general knowledge that the listener will bring to the conversation. Comprehension skills are well described at a word level, both in typical and clinical populations, but sentence level comprehension skills are less well understood, particularly in children with ID. Similarly, listening comprehension has been extensively studied in young children (e.g., Florit, Roch, Altoe, & Levorato, 2009; Lepola et al., 2012), but it is less well understood in children with ID. Studies systematically assessing oral comprehension at all three levels (word, sentence and story) are lacking in children with ID and the language skills of children with low non-verbal IQ scores are often overlooked in the literature. Language comprehension can also develop in non-verbal children, and it is important to know how much non-speaking children can understand as underestimation can lead to under stimulation and, in turn, social isolation that can have negative impact on a child's well-being (Emerson, 2003). In addition,

children with ID can make use of augmentative and alternative communication (AAC) systems to enhance communication. However, it is essential to understand children's language profile in order to adjust these systems to their individual language skills in order to maximise the benefit of the AAC. This study aims to provide a more complete picture of spoken receptive language skills in Slovak-speaking children with ID by examining their word, sentence and story comprehension to determine if performance shows comparable patterns in children with equivalent non-verbal mental ability. Slovak is a language with a rich morphology¹ and thus provides an opportunity to evaluate if morphology affects lexical and sentence comprehension differently than previously reported for English, a language with a sparse morphology.

1.1. Three levels of comprehension in children with intellectual disability: word, sentence and story

As studies focusing on language skills in children with ID outside of recognised syndromes are rare, studies with populations known to have ID that are included in our sample (children with Down Syndrome (DS) and Cerebral Palsy (CP)) are presented here (see section on Participants for further details). These studies will be reviewed to establish if the language profile for children with ID is similar to what has been described for individuals with DS and CP. Our focus is on lexical and grammatical development as we aim to shed more light onto the discussion on whether children with DS, CP and ID have delayed lexical and/or grammatical development while still following the same developmental trajectory or if their language development is deviant rather than just delayed. We start with children with DS, as more findings are available, followed by children with non-specific ID and finally children with CP.

Lexical and grammatical skills in Down Syndrome: Studies found mixed results on receptive vocabulary skills in children and young adults with DS. For example, Miller (1999), and more recently Ypsilanti, Grouios, Alevriadou, and Tsapkini (2005), reported that the receptive language of children with DS appears to be less impaired than in mental-age matched samples. In contrast, Price, Roberts, Vandergrift and Martin

¹ Slovak word forms typically consist of a stem + an ending that can mark multiple grammatical categories and relations. All nouns carry grammatical gender (masculine, feminine, or neuter), and are declined for both number (singular, plural) and case (nominative, genitive, dative, accusative, locative, and instrumental). In addition, masculine paradigms are marked for animacy. Verbs are conjugated according to person, number, tense and aspect (Kesselová & Slančová, 2010).

(2007) found that boys with DS showed lower performance on receptive vocabulary compared to TD children at similar non-verbal developmental levels. In Slovak, Polišenská and Kapalková (2014) showed that the vocabulary composition of young children with DS did not differ qualitatively compared to TD children provided they were matched on vocabulary size. Miolo, Chapman and Sindberg (2005) pointed out that differences between clinical and typical populations are strongly influenced by the type of receptive vocabulary assessment used. While assessments focusing on vocabulary breadth (number of known words) found that children with DS scored similarly or higher than control groups, measures assessing vocabulary depth (how well those words are known) found no such advantage (Chapman, 2006; Miolo et al., 2005). Vocabulary depth and breadth were also found to relate to different comprehension abilities in TD children (Cain & Oakhill, 2014). It appears that the differences between groups on vocabulary breadth are related to participants' age, this might be because older children have longer exposure and may be able to acquire larger vocabularies even if they are matched on non-verbal cognitive abilities.

Grammar has been reported to be a particular weakness in individuals with DS relative to their strength in vocabulary (e.g. Fowler, 1990; Laws & Bishop, 2003). Individuals with DS have been found to perform significantly worse than TD children, particularly on comprehension of anaphors (Perovic, 2006) and passives (Ring & Clahsen, 2005), leading researchers to suggest that the language of children with DS is qualitatively different. Oakes, Kover and Abbeduto (2013) investigated the sentence comprehension of young adolescents with DS and reported that they performed significantly worse than TD children who were matched on non-verbal IQ scores. Similar findings were reported for Italian-speaking children with DS who performed significantly worse on sentence comprehension compared to TD children matched for receptive vocabulary skills (Roch, Florit & Levorato, 2013). Levorato, Roch and Beltrame (2009) investigated comprehension in Italian-speaking children with DS and TD children. They found that when groups were matched on a story-level comprehension, children with DS performed as well as TD children on a receptive vocabulary test, but performed significantly worse at a sentence level as measured by a traditional picture matching task. Levorato et al. (2009) then modified the sentence comprehension task by providing contexts for the sentences tested. This modification produced changes in the findings: children with DS benefited from the context, and the difference between the TD and DS groups ceased to be significant. The authors suggested that providing context enhances comprehension for individuals with DS and allows them to

understand sentences they might otherwise struggle with. Findings from Slovak-speaking children with DS showed that their grammatical skills were commensurate with lexical skills. The Slovak data from Polišenská and Kapalková (2014) suggest that there is a close relationship between vocabulary size and the emergence of grammar, in line with the hypothesis of Bates and Goodman (1999) that the language of children with DS more likely to be delayed than following a different developmental path.

Lexical and grammatical skills in non-specific ID: The finding that receptive vocabulary knowledge is linked to chronological age-related experience was also supported by data from adolescents with ID (Facon et al., 2002) and this finding held even after cognitive ability was controlled. More recently, Facon, Courbois and Magis (2016) showed that children with and without ID had similar developmental trajectories in receptive vocabulary. Their study made a distinction between general vocabulary (words referring to objects, persons, actions, events) and relational vocabulary (abstract words indicating relationships between persons, objects, or events) and found that children with ID of undifferentiated aetiology performed better on general vocabulary compared to a group of TD children matched on non-verbal ability. However, performance on relational vocabulary was similar for both groups. This echoes the findings for children with DS that general vocabulary is often strength relative to their developmental level. Facon et al. (2002) showed that when controlling for non-verbal IQ, chronological age was related to receptive vocabulary skills, explaining 55% of variance, while it only explained 29% of the variance when accounting for syntactic scores. In addition, syntactic scores of children with ID were not significantly correlated to their chronological age but were related to receptive vocabulary skills.

In a similar vein, a recent study by Loveall, Channell, Phillips, Abbeduto and Connors (2016) compared receptive knowledge of nouns and verbs in a group of children with DS, a group of children with ID, and a control group of TD children. Loveall et al. (2016) reported that groups with DS and TD showed a noun advantage, but the group with ID had similar scores for nouns and verbs. This suggests that children with ID might not only be delayed, but might also show a different profile compared to children with DS or TD younger controls.

Lexical and grammatical skills in Cerebral Palsy: Pirila and colleagues (2007) studied expressive and receptive language skills of children with CP and reported that 13 out of 14 children showed immature/deviant comprehension skills in the group with IQs below 70, commenting that individual

children had delays requiring language intervention. Geytenbeek, Heim, Knol, Vermeulen and Oostrom (2015) investigated sentence comprehension in non-verbal children with CP. They reported that language development followed the same trajectory as in TD children, but at a much slower rate. Comprehension decreased with an increased level of complexity and showed large variability between children with CP. Interestingly, the syntactic hierarchy of comprehension was found to be the same across children with CP as in the typical sample, suggesting delayed rather than deviant development.

These studies collectively suggest that the language profile for children with ID is similar to what has been described for individuals with DS and CP: 1) General receptive vocabulary skills are commensurate with developmental level. 2) Syntactic comprehension in children with non-specific ID is not well understood and the results are also mixed regarding morphosyntactic development in other populations with ID. While some studies of children with DS and all studies with CP discussed above suggest delayed development while still following the same developmental trajectory and acquiring syntactic structures in the same order of hierarchy, other studies suggest that syntactic development in DS is deviant rather than just delayed.

1.3. The current study

There are several novel aspects in the design of the current study. The children in our sample were assessed on all three levels of comprehension: words, sentences and stories. This provided an opportunity to assess not just the differences between groups, but also the differences between the three levels of comprehension within each group of participants and to evaluate if the same pattern emerges in both groups in an attempt clarify whether language development is delayed or deviant in children with ID. Here we present the four hypotheses of our study, accompanied with research questions:

1. Given the natural progress from words, sentences and then stories in typical development and findings in Slovak-speaking children with DS, we hypothesized that the development of receptive language skills in both the ID group and the TD group in our study will perform best at word level, followed by sentence level and finally story level.

Research question (RQ) 1: Do children in both the ID group and the TD group perform best on word level, followed by sentence level and worst at story level?

2. We were also interested in the relationship between levels of comprehension and if these would be identical across our ID and TD groups. We hypothesized that children with ID would show a delayed development and a weak relationship with chronological age, particularly where sentence level comprehension is involved. On the other hand, we expected significant correlations between nouns, verbs, sentences and stories, suggesting that although the group with ID is delayed, the same pathways are involved as with the TD group.

RQ 2: Do chronological age, noun, verb, sentence and story scores show the same relations with each other in both groups?

3. The studies reviewed above presented a total vocabulary score without analysing subgroups of words (with the recent exception of Loveall et al., 2016). Research into differences between nouns vs. verbs in acquisition and/or processing has predominantly focused on production rather than comprehension and the majority of studies report a noun bias, but the opposite pattern has also been reported. Several reasons have been suggested for the noun bias and discrepancies between findings are often explained by differences in the methodology used and/or typological differences between languages (for discussions see Stoll & Lieven, 2014). Based on findings from previous studies and general properties of verbs (a crucial role in syntactic processing, determining the number and type of arguments for a sentence), our hypothesis was that both our groups with ID and TD children would indicate that verbs are more challenging than nouns due to their special role in sentence processing.

RQ 3: Do children in both groups show better comprehension of nouns compared to verbs?

4. Based on the grammatical development of Slovak-speaking children with DS and findings for children with ID due to cerebral palsy, we hypothesised that the children with ID would show the same order of difficulty within the comprehension of different types of structures. We also expected group differences as syntactic skills appear to benefit less from chronological age advantage compared to vocabulary skills.

RQ 4: Do children with ID show the same ranking of difficulty within comprehension of different types of structures as TD children?

RQ 5: Does the group with ID perform significantly worse on comprehension of any specific structures compared to the TD sample?

No previous study has investigated syntactic comprehension in children with ID who speak a language with a morphology as rich as Slovak. Recently, several authors have emphasized that it is essential to study typologically different languages in order to gain a better insight in human language processing and language development (e.g. Stoll & Lieven, 2014; Norcliffe, Harris & Jaeger, 2015) and this is the first study to provide a detailed investigation of receptive language skills in atypically developing children speaking a Slavic language. Abbeduto and Murphy (2004) proposed that a better knowledge of the unique linguistic profiles in children with language difficulties would allow clinicians to tailor maximally effective intervention strategies for individual children. Our study works towards this aim by investigating language comprehension skills in groups matched on non-verbal reasoning abilities. If the profiles are the same, it would suggest that comprehension skills develop in a similar manner, even in children with ID and it may be possible to use one intervention program for all children with language delay (a non-etiological approach, e.g. Greenspan, Wieder, & Simons, 1998). Theoretically, such findings will add new cross-linguistic evidence to the understanding of the language acquisition process.

2. Method

2.1. Participants

Twenty-eight children participated in the study: 14 children with ID in the clinical sample and 14 TD children matched on non-verbal reasoning abilities in the control group (see Table 1 for details). The mean chronological age was 72.21 months ($SD = 6.4$) in the group with ID and 42.93 ($SD = 6.72$) in the TD group. The mean raw score on the non-verbal measure was 9.93 ($SD = 1$) in the group with ID and 10 ($SD = 1.11$) in the TD group. The children with ID were recruited via a school for children with ID in Bratislava. All of the children attended this school daily, met the criteria for the diagnosis of ID with a non-verbal IQ below 70 as assessed by a clinical psychologist and were receiving speech and language therapy. The clinical sample included children with different etiologies, but none of these children had visual or hearing difficulties; children with Autism Spectrum Disorder were not included. The children in the control groups were recruited from two nurseries in Bratislava. The control group was matched on the raw score of the CPM and children were selected from a larger sample of 48 children aged 3;0 – 7;0. 14 children whose non-verbal

scores matched the children with ID were selected and only this sub-sample was tested on further language comprehension measures. Parents and teachers reported no known oral-motor deficits, hearing impairment, or language and communication impairments for children in the control group. Written informed consent forms for all of the participating children were obtained from parents/guardians prior to the research commencing.

Table 1. Overview of participants' characteristics and individual scores in the clinical group

Participants information			Raven's CPM	Language production	Language comprehension Percentage task correct				
Gender	Age	Etiology	Raw Score	Verbal/non-verbal	Noun	Verb	Word	Sentence	Story
F	5;6	Non-specific ID + ADHD, epilepsy	10	Yes	87.5	62.5	75	31.25	35
M	5;4	Down Syndrome	10	No	59.38	40.63	50	37.5	20
M	6;3	Non-specific ID	10	Yes	93.75	71.88	82.81	48.75	45
M	5;9	Non-specific ID	11	Yes	87.5	68.75	78.13	48.75	30
M	5;9	Non-specific ID + ADHD	11	Yes	75	46.88	60.94	36.25	40
M	6;0	Non-specific ID	9	Yes	87.5	68.75	78.13	35	10
M	6;11	Non-specific ID	9	No	56.25	37.5	46.88	35	30
F	6;11	Down Syndrome	11	Yes	68.75	40.63	54.69	31.25	15
F	5;3	Non-specific ID	10	Yes	100	71.88	85.94	56.25	35
M	6;8	ID + Cerebral Palsy (hypotonic syndrome)	8	No	43.75	28.13	35.94	27.5	20
M	5;10	Non-specific ID + ADHD	11	Yes	96.88	68.75	82.81	47.5	10
M	5;9	Non-specific ID + ADHD	9	Yes	90.63	65.63	78.13	30	25
F	6;2	Non-specific ID	11	Yes	90.63	71.88	81.25	56.25	40
M	6;2	Non-specific ID	9	Yes	100	78.13	89.06	61.25	40

2. 2. Materials

The Children were tested with the following tests (one non-verbal and three verbal, assessing language comprehension either at a word, sentence or story level):

Raven's Colored Progressive Matrices (CPM; Ferjenčík, 1985)

Raven's CPM measures non-verbal reasoning ability. The version used was a Slovak standardized adaptation of the CPM with 36 items in 3 sets (A, Ab, B) with 12 items per set. Children are shown incomplete pictures and asked to identify the missing item that completes a pattern for each test item. Internal consistency reported by the manual is $r = 0.64 - 0.82$, and test – retest reliability based on 100 children is $r = .847$. Raw scores have been used in other studies using the design of matched groups (e.g. Facon et al., 2016; Michael, Ratner & Newman, 2012; Næss, Lervåg, Lyster, & Hulme, 2015).

Lexical task – Slovak version, part of LITMUS COST IS0804 Battery (Kapalková, Slančová, Luniewska, Haman, unpublished). The test assesses comprehension of concrete objects (nouns) and familiar activities (verbs). There are 32 target items for nouns and 32 for verbs, with each set presented independently. In this picture-matching task children are shown four pictures and hear one target word with the task of pointing to the correct item. Two types of scores were calculated for the lexical task: percentage of correctly identified nouns (out of 32) and percentage of correctly identified verbs (out of 32).

Test for Reception of Grammar (TROG-2; Bishop, 2003) - Experimental version adapted for Slovak (Kapalková, Slančová, Polišenská, unpublished). The test consists of 20 blocks, with each block testing a specific grammatical structure. There are 4 items within each block and 80 items in total. The lexical items used in the test were early acquired items, in order to avoid confounding lexical and grammatical comprehension. In this picture-matching task, a child is presented with four pictures and one sentence and is asked to choose the picture that matches the meaning of the sentence. Responses were scored as correct if the child chose the matching picture. In the original English version, the order of blocks reflects the order of difficulty, but this is not necessarily the case in the adaptation as the test was not specifically developed to reflect the morphosyntactic properties of Slovak. As a result, all blocks were administered and the

discontinue criterion normally applied in English was not employed. Similarly to Oakes et al. (2013), the number of items answered correctly was used instead of whether a block was failed or passed.

In order to shed more light on the delayed vs deviant syntactic development debate, a more in-depth analysis of syntactic comprehension was carried out. For this purpose, the items from TROG-2 were grouped into categories created by the authors of the present study based on syntactic complexity and order of acquisition of these structures in Slovak in typically developing children (Kapalková, 2016; Slančová & Kapalková, 2017). The easiest were i) *SVO (Subject Verb Object) active sentences*, followed by ii) *negation*, iii) *function words* and finally most complex iv) *relative clauses*. The category of *SVO active sentences* (20 items) included sentences with Subject and Verb; Subject, Verb and Object/Adverbial; Reversible Subject, Verb and Object. The category of *negation* (16 items) included simple SVO sentences with a negative particle which is attached as a prefix to Slovak verbs; sentences with construction ‘not only X but also Y’; sentences with construction ‘neither nor’; sentences with construction ‘X but not Y’. The category of *function words* (20 items) included sentences assessing understanding of Personal Pronouns and Prepositions. The category of *relative clauses* (16 items) included sentences with subject relative clauses and object relative clauses. A further 8 items did not fit into these categories and were not analyzed; these included Comparative sentences (4 items) and Reversible passive sentences (4 items).

Test for Listening Comprehension - (Kapalková & Slováčková, 2013) - an experimental version adapted to Slovak based on the original Italian task *TOR 3-8 (Valutazione della comprensione del testo orale*, Levorato & Roch, 2007); the Slovak version was created for children aged 3;0 – 5;11 and assesses story comprehension. In this test, children were read two stories which were paused at two points to reduce the memory load and children’s comprehension was then assessed at these points. There were 34 sentences in total (15 in the first story and 19 in the second story); the average length of a sentence was 9.32 words (SD = 4.64). There were 10 questions per story: half of the questions asked about information explicitly presented in the story and the other half asked about information that required the children to make an inference. The average sentence length for the questions was 5.15 words (SD = 2.06). Responses were provided by pointing at a matching picture chosen from a set of four pictures; children did not have to produce expressive language in order to provide answers. The score was a percentage of correct answers out of 20 questions.

2. 3. Procedure

The battery of tests was administered by a qualified speech and language therapist at the school and nurseries. TD children were assessed during two sessions: 1) CPM testing only, lasting about 20 minutes 2) Language assessments, lasting between 45-60 minutes with breaks between assessments. Children with ID were assessed across four sessions, with the whole battery of tests completed within 2 weeks for each child. The tests were administered in the following order: CPM, lexical comprehension, sentence comprehension and story comprehension.

3. Results

Descriptive statistics are presented to describe the main characteristics of children with ID and the percentage of correct answers for each child with ID for the main comprehension categories is provided in Table 1. Each of the four hypotheses presented in section 1.3. were further addressed: Hypotheses 1, 3 and 4 were analyzed with mixed ANOVAs to address between group differences while analyzing and contrasting performance on various comprehension tasks. Hypothesis 2 was addressed with Pearson's correlation to analyze the relationship between the levels of comprehension and chronological age. All analyses were repeated without three children with specific etiology (two with DS, one with CP) to check if the findings could reflect phenotypic differences that could be masked in a broader group study of children with ID. These repeated analyses produced the same findings and are not reported here.

3.1. The relations between the levels of comprehension

The first set of analyses was carried out to establish if the patterns of comprehension were similar across different groups. Figure 1 shows the boxplots as percentages of correct answers at a word, sentence and story level. It suggests that all three groups performed the best at the word level, followed by sentence and finally story level. A mixed ANOVA with *Linguistic level* (3 levels: word, sentence, story) as a within-subject factor and *Group* as a between-subject factor (2 levels: children with ID vs TD children) confirmed a significant main effect of the *Linguistic level* ($F(2, 52) = 143.91, p < .001, \eta_p^2 = .847$). The Post hoc analyses showed that performance on word level ($M = 73.10, SD = 15.04$) was significantly better than on sentence level ($M = 45.98, SD = 10.40$), $p < .001$, and also significantly better than on story level ($M = 32.68, SD =$

14.81), $p < .001$. Performance on word level was also significantly better compared to performance on story level, $p < .001$. The effect of *Group* was approaching significance ($F(1, 26) = 3.74$, $p = .064$, $\eta_p^2 = .126$), with the group of children with ID scoring lower ($M = 46.60$, $SD = 10.88$) than the group of TD children ($M = 54.58$, $SD = 10.95$). The *Linguistic level*Group* interaction was not significant ($F(2, 52) = .19$, $p = .827$, $\eta_p^2 = .007$).

Figure 1. Percentages of correct responses for word, sentence and story levels across two participant groups.

3.2. Relationship between comprehension of nouns, verbs, sentences and stories

As can be seen from Table 2, age does not correlate with language scores in the group of children with ID, but does correlate significantly with comprehension of nouns, verbs, sentences and stories for the TD group, despite both groups having a similar SD for age (6.41 months vs 6.72 months). While the tasks appear to be developmentally sensitive in the TD group, the lack of correlation in the group with ID suggests that chronological age and associated life experience are not responsible for language profiles of young children with ID as previously suggested. Verbs were found to strongly correlate with sentence scores in both ID and TD groups, suggesting a close relationship between verbs and grammar skills. Verbs correlated

with comprehension of stories in the TD group only; the lack of correlation in the group of children with ID likely appeared due to low performance on stories in some children. In the TD group, story comprehension correlated with both sentence comprehension and verb score, while there was no correlation between these factors in the group with ID. All of the tasks correlated in the TD group, indicating that the various domains of linguistic comprehension develop in accord. The results showed that the relation between receptive vocabulary (nouns and verbs) and sentence comprehension was mirrored in both groups, while the relations involving story level were different, most likely due to low performance of the ID group.

Table 2. Correlations among the language comprehension tests and age in the two groups

Children with ID		Age	Nouns	Verbs	Sentence	Story
	Age	1	-.479	-.446	-.245	-.128
	Nouns		1	.970**	.672**	.306
	Verbs			1	.718**	.328
	Sentence				1	.485
	Story					1
TD children		Age	Nouns	Verbs	Sentence	Story
	Age	1	.730**	.746**	.567*	.612*
	Nouns		1	.742**	.602*	.434
	Verbs			1	.824**	.794**
	Sentence				1	.614*
	Story					1

**Correlation is significant at the 0.01 level (2-tailed), * correlation is significant at the 0.05 level (2-tailed).

3.3. Comprehension of Nouns vs. Verbs

Both groups showed significantly better performance for nouns compared to verbs: 81% vs. 59% correct answers for the ID group, compared to 88% vs. 65% for the TD group. Interestingly, the size of the gap between nouns and verbs was similar for both the ID group and the TD group (22% and 23% respectively). As can be seen from Table 1, the level of hierarchy (Nouns > Verbs) was present in each child with ID, regardless of etiology, age or non-verbal IQ. Also children that were described by their teachers and speech language therapists as non-verbal, i.e. not having any productive language, also presented this kind of profile. A mixed ANOVA with *Word class* (2 levels: Nouns vs Verbs) as a within-subject factor and *Group* as a between factor (2 levels: children with ID vs TD children) confirmed a significant main effect of the *Word class* ($F(1, 26) = 252.83, p < .001, \eta_p^2 = .907$). The Post hoc analyses showed that performance on Nouns ($M = 84.60, SD = 16.07$) was significantly better than on Verbs ($M = 61.61, SD = 14.92$). The effect of *Group* was not significant ($F(1, 26) = 1.22, p = .280, \eta_p^2 = .045$); the group of children with ID scored similarly to ($M = 69.98, SD = 16.88$) the control group of TD children ($M = 76.23, SD = 12.80$). The *Linguistic level*Group* interaction was not significant ($F(1, 26) = .095, p = .760, \eta_p^2 = .004$). Again, these findings suggest that the ID group does not differ qualitatively from the TD group.

3.4. Comprehension of sentence structures

Sentence-level comprehension skills were assessed through the experimental version of the TROG-2 with items divided into four categories (see Materials for details). Figure 2 highlights relatively large variability and suggests that the order of difficulty for particular structures was similar across the groups, with simple SVO active sentences producing the best performance while comprehension of relative clauses caused the most difficulty. A mixed ANOVA with *Structure* (4 levels: SVO active sentences, function words, negation, relative clauses) as a within-subject factor and *Group* as a between-subject factor (2 levels: children with ID vs TD children) confirmed a significant main effect of *Group* ($F(1, 26) = 8.02, p = .009, \eta_p^2 = .236$), with the TD control group showing better performance overall. The effect of *Structure* was significant ($F(3, 78) = 34.50, p < .001, \eta_p^2 = .570$), showing the following pattern: SVO active sentences > function words = negation > relative clauses. Importantly, the effect of *Structure* was modified by a significant interaction ($F(3, 78) = 2.90, p = .04, \eta_p^2 = .100$). The interaction was followed up by independent

samples t-tests, with the alpha-value set to .0125 due to Bonferroni correction. The analyses revealed no significant difference between the groups on function words ($p = .363$) and relative clauses ($p = .397$), but there were significant differences on negation ($p = .003$) and the SVO category ($p = .006$). This pattern of results is mirrored in Figure 2, highlighting different performance on negation and SVO structures across the groups, with the group of children with ID finding those structures more difficult.

Figure 2. Percentages of correct responses for specific syntactic constructions across two participant groups.

4. Discussion

The aim of the study was to provide language profiles of children with ID and to contribute to the debate on qualitatively different vs. delayed language development in clinical populations. This was achieved by quantitatively comparing groups with and without ID which were matched on non-verbal reasoning abilities and, crucially, by observing if the groups differed qualitatively on the word categories they knew (verb vs nouns) and sentence structures they understood. The study is the first detailed description of receptive skills in children with ID speaking a Slavic language and contributes to the growing cross-linguistic evidence in this area.

The present findings appear to support the view that receptive language skills, although delayed in the clinical group, follow the same developmental route as seen in younger TD children. Our findings highlight the similarities across the groups and a general progress of language development: the group of clinical and TD children demonstrated the best performance on a word picture-matching task, followed by a sentence comprehension task and finally assessment of story comprehension.

Regarding the relationship between levels of comprehension, our hypothesis was only partially confirmed. The relationships within the groups were similar, but not identical. As predicted, we found a strong link with chronological age and all levels of comprehension in the TD group, but such a relationship was absent in the group with ID. There was also no link with chronological age at the word level, a finding at odds with some previous studies. This could be because the children in our study were relatively young and therefore had less opportunity to accumulate lexical knowledge, as is often reported for older participants with DS or ID. We also expected significant correlations between word, sentence and story levels in both groups. There were strong relationships between verbs, nouns and sentences in both groups, as expected, showing close ties between lexicon and grammar and providing further support for Bates and Goodman's (1999) hypothesis of language as a single system where words and structures are processed by similar cognitive systems (e.g. Christiansen & Chater, 2016). However, differences emerged at a story level. While the TD children showed relationships between knowledge of verbs, sentence and story levels, the group of children with ID lacked this relationship. This might suggest that in addition to the group with ID being delayed, different pathways are involved in processing stories. This finding needs to be interpreted with caution. Although both groups performed similarly on the story level (the most challenging level for both groups), some children scored below the chance level, particularly in the group with ID. It is therefore possible that the lack of the relationship between verbs, sentences and stories in the group with ID could be due to poor performance rather than a different developmental trajectory. The poor performance on stories comprehension is unlikely to be related to the structure of the questions as these were relatively short (5.15 words on average) and were simple clauses (75%) in the majority of cases. However, the sentences in the story were longer (9.32 words on average) and more complex, including many coordinate and subordinate clauses. Therefore it is likely that the poor performance on this task is related to comprehension of the story. As discussed in the Introduction, listening comprehension taps vocabulary and grammar as well as memory

skills and as such may be particularly sensitive to broader cognitive deficits, thus putting the group with ID at disadvantage. Similar findings have been reported for Italian (Roch et al., 2013), with story comprehension significantly correlated with sentence comprehension and lexical comprehension in a group of TD children, while children with ID only showed a significant correlation between lexical and story comprehension but not between sentence and story comprehension. This finding from a typologically different language corroborates our interpretation that different pathways are involved at higher-level processing of stories in TD children and in children with ID.

Lexical development appears to follow the same trajectory in both groups, with nouns yielding better comprehension scores than verbs. This pattern emerged for all children (see Table 1), including children without productive language. It also mirrors findings from previous studies that nouns are easier to process in TD children, but also in atypical populations (e.g. Kapalková & Slančová, 2017). In contrast to our study, Loveall et al. (2016) found no differences between performance on nouns vs. verbs either within their TD group or within the group with ID. The differences found between studies could be due to particular noun and verb items or may be related to the age of the participants (Loveall et al.: group with ID was 10-21 years). Importantly, both the children with ID in Loveall et al. (2016) and in our study did not differ from a TD sample, highlighting the similarities in processing whether they are acquiring a language with a sparse morphology like English or a rich morphology such as Slovak.

However, some dissimilarities were found in sentence-level understanding based on performance on four groups of syntactic structures that differed in the level of complexity and the order of acquisition. Both typical and clinical groups showed the clear benefit of a simple SVO structure and struggled with relative clauses, a pattern expected developmentally (Marková & Mikulajová, 2012). Structures with negations in particular caused more difficulties in the group with ID. Negation in everyday conversation is often highlighted by prosody (e.g. in Slovak emphatic stress of the negative prefix), it is pragmatically linked to a context and it is not unusual to be accompanied by a non-verbal gesture such as shaking one's head. These cues are missing from the picture-matching task. It seems that younger TD children understand sentences with negation even in this deprived context, relying instead on their knowledge of syntax, while children with ID might have more limited syntactic abilities to successfully decode the meaning of a sentence with negation. Differences also emerged in the SVO category. A closer look revealed that the difference was

driven by semantically reversible SVO sentences (e.g. ‘the man is chasing the dog’), again suggesting that children with ID struggle to rely entirely on the syntactic structure to map the arguments onto semantic roles. This is even more surprising in Slovak where semantic roles are marked with case in addition to word order, yet this did not seem to provide sufficient cues for the thematic roles assignment. Analyses also showed that performance on other categories of sentence comprehension (function words and relative clauses) did not differ from the younger TD children. Interestingly, children with ID did not show a lower performance on relative clauses compared to TD children, although this group of syntactic structures was the most challenging for both groups. The lack of difference could be due to overt case marking and grammatical gender on the relative pronoun in Slovak which makes it easier to determine which noun phrase is being modified.

Clinical implications

Comprehension often comes before production and this means that it can be assessed in a clinical setting even before a child produces their first words. When working clinically with children with ID it is important to understand what patterns of comprehension can be expected on the basis of both chronological age and mental age. Our findings on the word level suggested that children with ID showed the same pattern as younger TD children of the same mental age, with nouns being easier than verbs. In children with a small vocabulary size, this knowledge has been described and utilized, for example in children with Developmental Language Disorder (Kapalková & Slančová, 2017), when the disproportional difficulty with understanding verbs could point to language impairment early on, even before production can be assessed. Our study showed that a similar clinical picture was found in children with ID. Assessing receptive knowledge of nouns and verbs using the lexical task based on picture matching can be valuable for speech and language therapists as a large discrepancy between nouns and verbs can provide early indication of an atypical pattern. It appears that children with ID can compensate for the poorer sentence level knowledge (see section 3.4. and Figure 2) when performing on the story level and this is possibly due to contextual information as suggested by a study by Levorato et al. (2009). If this is the case, it could lead to new priorities for speech and language therapy as it may not be necessary to focus on sentence comprehension in isolation. Instead, the main priority could be developing story level comprehension and providing strategies

for picking up on the contextual cues that could compensate for the poorer performance on specific morphosyntactic structures, e.g. negation. The delayed rather than deviant language profile also suggests that knowledge of typical language development can be utilized when designing AAC support for children with ID.

Limitations and future research

There are several limitations to the present study. The small sample size limits the extent to which the findings can be generalized to a wider population and does not allow for more detailed investigation of individual differences and other factors that may contribute to differential performance. The sample was also very heterogeneous, representing the range of children with ID who clinicians work with, and there might have been large individual differences due to the range of etiologies likely represented in the non-specific ID population. Future studies should include a larger sample to check if the results can be replicated and investigate other factors that may contribute to the results such as working memory. It would also be useful to replicate the results in other languages to further examine whether the profile we described is language-specific, or if it is universal as our research further suggests.

Another limitation is the choice of tasks, which necessarily only provide limited information about a child's deeper knowledge of words and language structures. For example, the picture-matching nature of the word task does not provide information about a child's understanding of the word in various linguistic or social contexts. Having said that, picture identification is the most common way of assessing children's understanding of single words and other researchers have recently argued for use of picture-matching tasks in research studies with atypical populations (e.g. Loveall et al., 2016). Future research could provide more information about understanding in a broader linguistic/social context by analyzing types of errors on vocabulary tests that allow for this. Similarly, sentence-level understanding in our study was assessed by an adaptation of TROG-2, a test that relies on understanding of grammatical relations in a sentence and minimizes the effects of other factors, such as semantics, prosody or context that would contribute to understanding in everyday communication. It should be noted that our study investigated comprehension as assessed by language tests that aim to analyze comprehension with a greater focus on language rather than context or communicative input and this led to the tests we chose. Future studies could compare

comprehension on words, sentences and stories, both with and without extra-linguistic cues, which would provide a more complete picture of comprehension in children with ID.

Conclusions

Results of our study suggest that linguistic profiles of children with ID are similar to TD children, providing support to the delayed rather than deviant view of language development. Similar patterns within the various levels of comprehension were found, i.e. nouns were easier than verbs in both groups and both groups showed the same superior performance on active phrases relative to other morphosyntactic structures, suggesting that acquisition is a robust and universal process and while the process may be delayed, it does not seem to be fundamentally affected by developmental disability, as previously shown in studies of children with Down Syndrome (e.g. Zampini & D’Odorico, 2011, Polišíenská & Kapalková, 2014; Berglund, Eriksson, & Johansson, 2001) and similarly for children with cerebral palsy (Geytenbeek et al., 2015). The results of this first study with Slovak-speaking children with ID extend findings from typologically different languages with less rich morphology (Italian, Dutch and English) and provide new evidence for the view that the linguistic profiles of children with ID are more universal rather than language specific.

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