Word order and information structure in Czech 3-and 4-year-olds' comprehension

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Abstract

An experiment examined the comprehension of transitive sentences in Czech children and its relationship to case marking, word order and information structure. A total of 107 Czech children aged 2;9 to 4;5 were tested for comprehension of noun-verb-noun sentences in which word order and given-new status of individual nouns were manipulated. The results confirmed that noncanonical, object-initial sentences are generally more difficult to comprehend than sentences with the standard word order, but that many children can interpret noncanonical sentences before 4 years of age. Information structure did not have any clear effect on sentence comprehension. Overall, the results indicate that children have some abstract knowledge of word order and case marking when they first show evidence of transitive sentence comprehension, but initially they cannot use this knowledge when word order and case marking signal conflicting interpretations. Information structure is not a major factor in early sentence comprehension.

In order to understand sentences in an adult-like manner, children must know the grammatical regularities concerning the way in which words and morphemes combine to express particular meanings and relationships. Simple transitive sentences are often used to study the acquisition of such regularities, because a reliable interpretation of such sentences requires the use of grammatical knowledge. In the sentence *The boy is kissing the girl*, either boy or girl might be the acting participant (the agent), and the other the affected participant, (the patient). The grammar of English, however, dictates that the boy is the agent because it is positioned pre-verbally. In other languages, such as Czech or German, the case forms of nouns, determiners or other elements are the key markers of the agent or patient status, even though the position of the noun phrase also plays a role. One of the important questions in early language acquisition research is how children acquire the specific way their language assigns the agent or patient roles.

While expressing the agent and patient roles is one of the important functions of word order, it also has a different role in many languages. The position of nouns may be used to mark which referents are known and which are new in the context, i. e. the topic and focus, or the information structure. The existing research on children's comprehension of transitive sentences sometimes disregarded the information structure functions of word order, but it should be taken into account. The present study explored the comprehension of transitive sentences in children acquiring Czech, and examined the role of word order, case marking and information structure in this process. The goal was to examine the role of case marking and word order in early sentence comprehension in a case-marking language and to test the possible effect of information structure on this process.

Word order and case marking in Czech

Czech is a highly inflected Western Slavic language. Nouns are inflected for seven cases in singular and plural, verbs are inflected for person, number, tense, mood, and in the

past tense for gender as well. Morphemes marking different combinations of categories are often homophonous, e. g. the ending -a can mark the nominative singular in one class of feminine nouns, and the accusative singular in a different class of masculine nouns. The target structure in the present study were simple transitive sentences such as:

(1)   Pes honí kočku / Psa honí kočka.

dog$_{nom}$ chase $_{3sg\ pres}$ cat$_{acc}$ / dog$_{acc}$ chase $_{3sg.\ pres}$ cat$_{nom}$

The dog is chasing the cat./The cat is chasing the dog.

In these two sentences, the order of nouns is inverted but the event described is the same. The first of the two sentences has the canonical subject-verb-object (SVO) word order, which is the least marked word order in Czech. The second sentence with OVS (object-verb-subject) word order is also possible under certain pragmatic conditions. In OVS sentences, word order and case marking are in conflict with regard to sentence interpretation, but adults interpret the sentences according to the case forms, i. e. with the nominative noun as the subject, and the accusative noun as the object. As long as the case forms are unambiguous, such sentences are unambiguous as wholes. However, research from languages with similar word-order flexibility shows that comprehenders face processing difficulties when confronted with such noncanonical OVS sentences (e. g. Kaiser & Trueswell, 2004).

Transitive sentence comprehension in children

Early research in language acquisition suggested that children may initially rely on word order only when interpreting transitive sentences, and ignore other aspects of sentence structure (Slobin, 1973). Further studies showed that this is not generally the case across languages and that the relative importance of word order and other grammatical devices in acquisition depends on the properties of the language. Slobin and Bever (1982) examined the comprehension of transitive sentences in toddlers acquiring four different languages. Of these languages, English and Italian mark agents and patients using word order, but Croatian and

Turkish use case marking as well. Slobin and Bever found that English-and Italian-speaking children can interpret transitive sentences with above-chance accuracy at about 34 months. The development appeared slower in Croatian children, who performed above chance approximately at 42 months in SVO sentences, and at about 50 months in OVS sentences. In contrast, Turkish children showed good performance at the earliest age of about 26 months in both SVO and OVS sentences. Slobin and Bever (1982) related the differences in performance to the different status of word order and morphological case marking in each language. Importantly, their study showed that children start acquiring the specific means of their own language before their third birthday.

Further research on English-learning children showed some understanding of transitive sentences as early as 17 months of age (Hirsh-Pasek & Golinkoff, 1996). The data from case-marking languages with flexible word order usually show later mastery, especially in sentences with noncanonical word order (Kim, O'Grady, Deen, 2014; MacWhinney, Pleh, & Bates, 1985; Slobin & Bever, 1982; Sokolov, 1988), but Weist (1983) found comprehension of OVS structures in Polish children as young as 2;6, even though with some difficulties. Recently, Dittmar, Abbot-Smith, Lieven, and Tomasello (2008) found that children acquiring German comprehend sentences with OVS word order only at 7 years of age, while unambiguous sentences with SVO word order were comprehended at about 3 years (cf. also Lindner, 2003; Schaner-Wolles, 1989, for similar findings). There is thus considerable variation in the ages when children can interpret transitive sentences. In languages that use both case marking and word order, children typically make use of word order earlier than case marking, and have problems interpreting sentences with noncanonical word order.

The developmental advantage for the SVO word order might suggest after all that children initially ignore case marking and follow only the word-order cues. However, if this were the case, they should systematically misinterpret sentences with noncanonical OVS

word orders, interpreting them as SVO, inversely to their actual meaning. No current findings suggest such systematic misinterpretation, not even in the earliest stages (Dittmar et al., 2008; MacWhinney et al., 1985; Slobin & Bever, 1982; Sokolov, 1988; Weist, 1983). Children either show no comprehension of transitive sentences at all, or they show above-chance performance on SVO but not OVS sentences. Such a pattern cannot result from relying exclusively on word order. Children who comprehend SVO and not OVS sentences must recognize the OVS structure as distinct from SVO.

Research on early transitive sentences contributes to the discussion between two major theoretical approaches to language acquisition. While the constructivist approach maintains that children acquire the rules for agent and patient marking by a slow and piecemeal process (Tomasello, 1992, 2000), the early structure theories assume that children are ready to acquire abstract rules early, even though their productions may be limited during the earliest stages of sentence production (Fisher, 2002). According to the constructivist approach, children who are beginning to comprehend transitive sentences are likely to base their knowledge on limited-scope patterns that are specific for individual words or narrow groups of words. The constructivist approach predicts that the acquisition of rules and regularities is a protracted process. Especially the acquisition of noncanonical sentences, in which different cues are in conflict, should occur rather late (Dittmar, et al., 2008). On the other hand, the early structure approach is consistent with early and rapid acquisition of various cues and their integration in noncanonical sentences. The present study is likely to provide data that will support one of these approaches.

Lexical specificity

A number of studies of early sentence comprehension used novel verbs to exclude the effects of lexically specific knowledge. According to some proposals (e. g. Tomasello, 1992), young children do not know abstract rules of sentence structure, such as agent-verb-patient or

SVO, and their early linguistic knowledge is represented in verb-specific patterns. In this view, children know that for the verb *kick*, the kicking agent is expressed pre-verbally, and the patient of the kicking action post-verbally. For other verbs, children create similar item-specific patterns, and only later arrive at the generalization that agents or subjects are always expressed pre-verbally. To see whether children have some general knowledge about sentence structure, it is necessary to test comprehension with novel verbs for which children have no lexically-specific knowledge. Any systematic interpretation of these verbs must be due to general linguistic knowledge. However, the use of novel verbs is unnecessary when comprehension is tested in sentences with the same verb in different word orders.

The idea of verb-specific representation of early transitive sentences has been applied mainly to English, which marks the agent or patient status by word order only. It is thus conceivable that different verbs might dictate different argument structures, e. g. a structure with a postverbal subject (cf. Akhtar, 1999; Chang, Kobayashi, Amano, 2009). The argument structure of verbs may differ in terms of the number and semantic role of arguments, so children may construe the order of arguments as one of many variable parameters of argument structure. But in case-marking languages, the agent-patient distinction is marked on nouns, not verbs. If the grammatical knowledge were lexically specific, the verb would have to specify the form of the noun or noun phrase that should serve as the agent or the patient for this verb. This might be possible in a language with a completely regular system of case marking. For instance, if a language marked all nouns with two endings, say -a and -u, a verb could specify that the form marked with -a will be its agent and the form with -u the patient. However, very few languages have such a regular system. More often, the same markers serve multiple functions: the German article die is ambiguous between nominative and accusative, for example, and the ending -a can mark nominative in some Czech nouns and accusative in others. If children's verbs coded the noun form that should serve as their agent, this knowledge would have to be encoded specifically for individual combinations of verbs

and nouns. Such 'doubly item-specific' representation would be specific not only to the verbs but also to nouns, in that every noun-verb combination would be represented separately, or maybe every combination of a verb and a narrow group of formally similar nouns. Although this is, in principle, in line with the constructivist views of language, it would not explain that early constructions are quite ready to accept various nouns as its arguments (Tomasello, Akhtar, Dodson, & Rekau, 1997; Tomasello & Olguin, 1993).

Because Czech is a case marking language with flexible word order, lexically specific knowledge of individual verbs is not sufficient for reliable comprehension of case forms. It is thus unnecessary to use novel verbs, as long as the same verb is tested in sentences with varying word orders, as was the case in the present study.

The role of information structure

Besides marking the agent and patient roles in sentences, word order in many languages signals the distribution of new versus given information, i. e. the information structure (Firbas, 1992; Lambrecht, 1994). Typically, adults tend to express the known referents, topics, in the beginning of sentences, while the new information, sentence focus, is expressed after the topic. In English, this aspect may contribute to the selection of active or passive voice. In languages that use case marking and have more flexible word order, the information structure functions of word order are very salient (e. g. Firbas, 1992; Lambrecht, 1994; Sgall, Hajičová, & Panevová, 1986).

Given the role of word order in expressing information structure, it is possible that information structure plays a role in the development of sentence comprehension, especially comprehension of word order. Comprehension of sentences with noncanonical word order may be significantly affected if these are presented without the appropriate context. Also, children might initially use information structure as a guide for sentence interpretation, especially when other sources of information fail or appear unreliable. Existing research

shows that children have some knowledge of information structure at an early age, but relatively few studies addressed its role in comprehension, with mixed findings. Avrutin and Brun (2001) showed that Russian 2-year-olds preferred to express specific (i. e. known subjects and objects) in preverbal position, and non-specific ones post-verbally. De Cat (2009) demonstrated that French children as young as 2;6 use various devices to mark sentential topic, including left dislocation, which manipulates the word order. These studies indicate that even young children have a preference for expressing the given, known, or specific elements in sentence-initial positions (see also Gruber, 1967; Shaffer, 2000; Vernice & Guasti, 2014, among others). However, some other evidence suggests that the youngest children tend to express new, rather than given information in sentence-initial position (Leonard & Schwatz, 1977; Menyuk, 1969). Narasimhan and Dimroth (2008; also Dimroth & Narasimhan, 2012) found that children switch from new-old to old-new preference between the ages of 5 and 9. However, Dimroth and Narasimhan elicited coordinated noun phrases, not full sentences, which might be one reason for the atypical ordering preferences. Still other sources found no effects of givenness on children's use of word order (MacWhinney & Bates, 1978; Weist, Witkowska-Stadnik, 1986). Additional evidence indicating that children are sensitive to the context is the choice of referential expressions. Children tend to use full nouns more often if these did not appear in the preceding discourse (Campbell, Brooks, & Tomasello, 2000; Matthews, Lieven, Theakston, & Tomasello, 2006; Serratrice, 2008). Overall, it appears that children are sensitive to information structure, but that they do not always use it in the same way as adults do, sometimes ignoring it or using it in the opposite way.

The studies of information structure effects on comprehension are less prevalent, but they generally confirm that context affects how children interpret SVO and OVS sentences. Otsu (1994) used the act-out task to show that Japanese children around the age of 4 have better comprehension of noncanonical OSV sentences when the object is the known entity in

the context. Kim, O'Grady, and Cho (1995) replicated this finding with Korean children as young as 2. These studies explicitly compared comprehension of sentences with and without context, providing strong evidence that the given-new status of referents affects children's comprehension. Weist (1983) examined Polish 2 and 3-year-olds and found some effects of context in the interpretation of SVO and OVS sentences, with OVS and new-given word orders showing an increased number of errors. At the same time, new-given word order did not create problems in interpreting sentences in the absence of inflectional information, based on word order only.

The present study

The present experiment was designed to examine the role of word order and case marking in early comprehension, with two main issues of interest. One was the early interpretation of noncanonical word orders, and generally the interaction between case marking and word order in early comprehension. The second major topic was the possible effects of information structure on children's early comprehension.

With respect to word order and case marking, the main goal was to test whether children show any sensitivity to case marking in their early comprehension and whether they have problems with sentences in which word order and case marking are in conflict, i. e. the OVS sentences. Children in the majority of languages studied so far show such a pattern, but there are differences as to the age at which OVS word orders are comprehended (cf. Slobin & Bever, 1982; Weist, 1983). The hypothesis for the present study thus was that Czech children will show a similar pattern, i. e. more difficulties with OVS sentences. If this is the case and children show above chance performance in SVO sentences, but chance performance with OVS sentences, it would suggest that they are sensitive to both word order and case marking but that they cannot deal with situations where the two are in conflict. Alternatively, children could comprehend both SVO and OVS sentences from the earliest age, which would suggest

that both word order and case marking are mastered very early. The third possibility is that children completely ignore case marking. In this case, the young children should show above chance performance in SVO sentences and below chance performance in OVS sentences.

The second major goal is to test whether early comprehension of transitive sentences is affected by the given vs. new status of the nouns, i. e. whether young children's comprehension is sensitive to the relationship between information structure and word order. The existing literature provides mixed findings.

In summary, the present experiment extends the studies by Slobin and Bever (1982) and Weist (1983), who examined languages related to Czech, and those by Otsu (1994), and Kim et al. (1995). Compared to these studies, it used a larger sample, presented the target sentences from recordings, and applied more formal testing of whether children performed above chance. A novel aspect of the study is the inclusion of lexical skills as an independent measure of language development levels. Instead of relying on comparing groups of children of different ages, the study used the vocabulary scores to provide a continuous measure of linguistic development level.

Method

Participants

A total of 107 children from preschools in Prague were examined. Parents of the children were contacted by preschool teachers and after signing the informed consent form, the experiment was presented to the children in their preschool. Children's age ranged from 2;9 to 4;7, M = 3;8 (5.4). Children were enrolled in standard preschools, were native speakers of Czech, not bilingual, and did not suffer from gross neurological or developmental disorders.

Materials and procedure

Comprehension experiment Children were presented with 12 pairs of pictures presented on a laptop computer screen, side by side, plus 2 training pairs before the experiment. Each picture pair showed the same two participants engaging in the same action but in the opposite roles, e. g. a rabbit chasing an owl and an owl chasing a rabbit (see Fig. 1). Children were told that a dwarf living in the computer would tell them which picture to point to. While the pictures were shown, a pre-recorded sentence describing one of them was presented, and children were asked to point to the corresponding picture. Before presenting the pictures, the examiner introduced each trial by a short passage that mentioned one of the participants three times, e. g. *The pictures you will see now both have a rabbit. The rabbit is white and likes to run around with others. I wonder if you can find where the rabbit is, and where it is drawn the way the dwarf will tell you.* This manipulated the information structure, introducing one of the participants as the 'old', given information. An item could present the given noun in the initial (given-first) or final position (given-last).

Figure 1

The design of the study was a 2 × 2 factorial experiment with word order (SVO vs. OVS) and information structure (given-first vs. given-last) as independent variables. Since there were 12 items in total divided equally in the four combinations of conditions, there were 3 items in each combination (SVO given-first, SVO given-last, OVS given-first, OVS given-last). There were four versions of the protocol counterbalanced for word order, information structure, and the placement of the target picture. Sample protocol is reprinted in the appendix.

Lexical test Receptive vocabulary was assessed using a picture comprehension task. Because no standardized task is available for Czech children in the age of interest, an experimental task was used with format similar to the PPVT (Dunn & Dunn, 2007). The task

consisted of 30 trials, with a discontinuation rule after five incorrect responses. Based on previous experience with the items, the task was expected to differentiate well between children in the given ages. Although it couldn't provide comparisons with the population, the task provided relative comparison of children according to their vocabulary skills.

Analysis

The key analyses in this study used binomial mixed models with the logit link, and investigated the effects of experimental conditions and lexical scores on the likelihood of adult-like responses. Binomial mixed models are similar to logistic regression in that they examine the effects of a set of continuous or categorical fixed predictors on a binary variable. In addition, they estimate random effects that are due to repeated measures from persons or items. The models used in this study were fit using the lme4 library for R (Bates, Maechler, & Bolker, 2011).

Results

The mean performance in the whole sample is summarized in Table 1, along with the descriptive data on children's performance across conditions. To illustrate the developmental changes, the table also reports performance in the less and more advanced group of children after the sample was split at the median value of vocabulary scores, i. e. 19. The first step in the analysis was regressing the number of correct choices in the experiment on age and lexical score. Both predictors had a significant effect (age: β =0.25, p =0.005, lexicon: β =0.51, p< 0.001), and together accounted for 41.1 % of variance. However, age only explained 4.1 % of unique variance, while the lexical test explained 18.7 %, which shows that the lexical test was related to grammatical comprehension to a much larger extent than age. For this reason, lexical score was used in the subsequent analyses instead of age as the main indicator of language development.

Table 1

The subsequent analysis used a binomial mixed model with the response in an individual trial as the dependent variable. The fixed-effect categorical predictors were the experimental conditions, i. e. the sentence type (SVO vs. OVS), and the the placement of the given noun (initial or final). The analysis also included lexical score as a continuous fixed effect predictor, and all possible interactions of the three predictors. Orthogonal contrast coding was used on all variables to ensure correct statistical tests for interactions. The random component of the models included crossed intercept effects for persons and trials.

The analysis revealed significant main effects of word order and lexical score, a significant two-way interaction between subject position and lexical score, and a marginally significant interaction between the given noun position and lexical score (see Table 2). The main effect for word order indicates that children at the centering age (44 months) and with the median lexical scores (19 points) performed significantly worse in the object-first than in subject-first sentences. The interactions are best illustrated in Figure 2. The significant interaction between the lexical score and the subject position means that the difference between the acceptability of SVO and OVS sentences increases in lexically more advanced children. The marginally significant interaction between the lexicon and the given noun position reflects the fact that less advanced children have a tendency to respond more accurately in the given-last condition, but this tendency disappears with increasing vocabulary.

Table 2

Figure 2

The findings confirm the expectation that SVO sentences are comprehended more easily than OVS sentences, at least at the centering age of 3;8 years. It may be surprising to note the interaction between lexical score and subject position. If the advantage of SVO over OVS sentences increases with age, it would suggest that the ability to interpret OVS sentences remains more and more behind the ability to interpret canonical sentences. However, at least adults comprehend OVS sentences quite reliably (cf. e. g. Lukavský & Smolík, 2009), so the comprehension of OVS sentences must improve to approach the level of SVO sentences at some point in development. However, the present study observed children who were just beginning to comprehend transitive sentences, and the diverging pattern is due to the different initial rate of development for SVO and OVS sentences. If sentences with OVS word order are more difficult to interpret, it is not surprising that children's performance with them does not grow as fast as in the case of SVO sentences.

The developmental tendencies revealed by the overall model and graphs in Fig. 2 are suggestive, but it is useful to test the relationship between children's performance in different conditions in separate models for children with different levels of lexical development. For this purpose, two separate models were fit for children below or at the median value of 19 (N=50), and above this value (N=57). For each group, the initial model included word order as the only predictor. Additional models were fit with the given noun position as an additional predictor, as well as with the interaction of the subject and given noun position. Likelihood ratio tests revealed no significant improvement of fit after adding these predictors (cf. Table 3). For this reason, the results are reported for models with subject position as the only predictor. The models used treatment contrasts with the baseline value for subject position set to the subject-final condition. This way, the intercept in the models tested whether the performance in OVS sentences exceeded the chance level. The effect for subject position tested whether SVO sentences were comprehended better than OVS ones. The estimated odds ratios (OR) for the intercept show the chance of observing the correct

response in the baseline category. The odds ratio for subject position shows the change in the chance of correct response in SVO compared to OSV sentences.

Table 3

The results for the lexically weaker group (mean age 3;6) showed no significant intercept (OR =1.16, z =1.23, p =0.22), but a significant effect of subject position (OR =1.46, z =2.41, p =0.02). Children in the weaker group were thus at chance in OVS sentences, but their performance was significantly better in the SVO condition. The chance of correct response increased by 46 % in the SVO compared to OVS condition. In the lexically more advanced group (mean age 3;10), the intercept was statistically significant (OR =3.67, z =4.86, p< 0.001), as was the effect of word order (OR =2.71, z =4.30, p< 0.001). Children thus show above-chance performance in the OVS sentences, but comprehension of SVO sentences is even better. This corresponds to the scores reported in Table 1.

Discussion and conclusions

The two main goals of the present study were to examine the role of case marking and word order in early sentence comprehension in Czech children, and to test the potential effects of information structure. With respect to the first question, the findings confirmed that Czech children comprehend SVO sentences, in which case marking and word order indicate the same interpretation, earlier than OVS sentences. However, the delay is not large, the age difference between groups of children who could and could not comprehend OVS sentences was just 4 months. As for the second question, the study revealed only a marginally significant effect of context in interaction with the language development level. Because this effect was due to the non-adultlike performance in the least advanced children, it provides no evidence of children's sensitivity to information structure.

The results contribute to the discussion about the early comprehension in languages with flexible word order. Like in most studies, OVS sentences were more difficult to interpret for young children, but there are some interesting differences. Weist (1983) found that Polish children comprehended both SVO and OVS sentences at 2;6, if case and agreement cues were available. Even though OVS sentences resulted in more errors, Polish children before the age of 3 appeared to comprehend them, which contrasts with the present results in a closely related language. One reason for this may be that sentences in the Polish study contained agreement information in addition to case marking, and thus there were redundant cues available (cf. Weist, Pawlak, & Hoffman, 2009, for the importance of agreement in early Polish). Also, the mode of presentation might play a role. In the study by Weist, and in many other studies that showed early comprehension of OVS sentences (Kim et al., 1995; Otsu, 1994; Slobin & Bever, 1984), children heard the stimulus sentences from the examiner. In the current study, stimulus sentences were recorded in order to control the intonation. This made the task somewhat less natural, and possibly more difficult for children. On the other hand, children in the current task performed better in OVS sentences than comparable German-learning children in a number of studies (Dittmar et al., 2008; Lindner, 2003; Schaner-Wolles, 1989), comprehending OVS sentences well before the age of 5. The group of lexically advanced children in the study, which performed clearly above chance in OVS sentences, had a mean age below 4. Overall, the results are in line with previous findings from other Slavic languages (Slobin & Bever, 1982; Weist, 1983), but the present experiment examined a substantially larger sample and employed explicit testing of the effects against chance.

The findings show that children can interpret noncanonical sentences on the basis of case markers at four years of age or earlier. The presentation of individual verbs with different word orders was counterbalanced, which means that most four-year-olds can interpret the SVO and OVS sentences with the same verb. This excludes the possibility that

early comprehension is based on verb-specific word order templates (Tomasello, 1992). Importantly, the results show that even those children who cannot yet interpret OVS sentences do not rely exclusively on word order. Children who performed at chance with OVS sentences must have some sensitivity to case marking, otherwise they should follow the word order and interpret OVS systematically incorrectly. The chance performance suggests that the youngest children know that case marking is relevant for sentence interpretation, but do not know how to use it.

With regard to the theoretical approaches to early language representation, the findings are consistent with the view that children form abstract representations of linguistic categories early on and use them from the earliest stages of transitive sentence comprehension (cf. Fisher, 2002). This view is strengthened by the relatively short delay between the onset of comprehension of SVO and OVS sentences, which appears to be in months rather than years. This strongly suggests that children are ready to map case forms to the event categories of agents and patients early in their development, suggesting that these categories are not abstracted from a large set of learned constructions.

The current findings on Czech, along with other findings from case-marked languages (e. g. Slobin, Bever, 1982; Weist, 1988) are in a striking contrast with the data from research on German (e. g. Dittmar et al., 2008). The comprehension of noncanonical OVS sentences in German occurs substantially later than in Czech and other case marking languages, such as other Slavic languages or Turkish. The difference was noted already by Slobin (Slobin, 1982; Slobin, Bever, 1982), who suggested a number of information-processing explanations. One is the difference in the locality of case marking. German case is marked primarily by articles, i. e. free morphemes placed in the beginning of the noun phrase. In contrast, Turkish or Slavic languages use bound morphemes on nouns. The local, bound morphemes appear to be processed more efficiently. Also, German case marking of nominative and accusative is not very distinctive; only masculine nouns are marked

differently in these two cases, but not feminine, neuter, or plural nouns. Such a system must be difficult to acquire for children and it is thus not surprising that children need to rely on word order until school age. Similar consideration may account for differences between Slavic languages and Turkish (Slobin & Bever, 1984); the highly regular Turkish system of case marking is acquired by children earlier than the complex, syncretic and often ambiguous system in Slavic languages. Overall, the differences between Czech, Polish, or Croatian on one hand, and German on the other, suggest that the relative timing of children's comprehension of SVO and OVS sentences depends on the properties of the inflectional system in a given language. This means that children's acquisition of case marking depends on the input, but it shows that late emergence of OVS comprehension in German should not be interpreted as a general difficulty with noncanonical word orders.

The second major result of the present study is that givenness did not affect children's comprehension of transitive sentences. This is in line with some results reported for Polish (Weist, Witkowska-Stadnik, 1986), but it contrasts with some other findings on children's comprehension (Kim et al. 1995; Otsu, 1994). The available research on word order and information structure in child productions found that children are sensitive to context and often observe the adult-like given-new ordering (Avrutin & Brun, 2001; De Cat, 2009), but at the same time, a number of findings found preference for non-adultlike, new-given ordering (e. g. Dimrot & Narasimhan, 2012; Leonard & Schwarz (1977); Narasimhan & Dimroth, 2008), or no clear relation between word order and information structure (MacWhinney & Bates, 1978; Weist, Witkowska-Stadnik, 1986). The present study found no clear effect of information structure on word order. While this must be interpreted with caution, as any null finding, it suggests that Czech children do not use information structure as a major cue for interpreting transitive sentences.

One question is whether the kind of context manipulation used here would work in adults. However, the present task was aimed at children, and adults are not an appropriate

control group. Because of the prominent role of case markers in Czech, adults should case to interpret the target sentences. Reliance on case markers is a basic and undisputed property of Czech (and Slavic languages in general), so there is not much empirical research to support this. Some evidence may be found in the data reported by Lukavský and Smolík (2010), who presented SVO and OVS sentences to Czech children and adults in the preferential looking paradigm and observed their gaze behavior. The initial noun was unambiguously marked for case in half of the sentences, and the other half contained unambiguous case marking on the final noun. In the absence of unambiguous case information, adults followed the subject-initial strategy, but they were quick to shift their gaze towards the target pictures once they heard unambiguous case information, whether this was on the initial, or on the final noun. This shows that Czech adults respond to case marking very fast, and they consider inflection as the critical information.

It is possible that the method used here underestimates children's sensitivity to information structure. Perhaps different manipulations of the context could elicit information structure effects in comprehension even for children in the age range observed here. On the other hand, the main point in the present study was to test whether information structure may affect how children use case marking and word order in transitive sentence interpretation. Examining the effect of givenness to is the natural starting point here. It is possible that children are sensitive to information structure, but it is safe to conclude that information structure is not a major cue used in early stages of transitive sentence interpretation: at a time when children can reliably interpret at least the SVO sentences, they show no adult-like sensitivity to the relation between word order and givenness. Along with Weist (1983), as well as Weist and Witkowska-Stadnik (1986), who studied a closely related language, the present study indicates that the role of information structure in early Czech is limited. At the same time, it is known that children are sensitive to the linguistic and extralinguistic context (e. g. Campbell et al., 2000; De Cat, 2009; Matthews et al., 2006; Otsu, 1994; Serratrice,

2008). The lack of effects here thus does not mean that children ignore givenness, but that its effects do not override the effects of case marking.

In summary, the present findings provide support for the view that the acquisition of transitive sentences and their interpretation is a stepwise process in which the canonical structures take precedence, in line with Dittmar, et al. (2008). On the other hand, the noncanonical structures are understood well before the age of five, and children appear to be well prepared to acquire the mapping between case forms and event roles. The results also suggest that children must have some abstract representation of word order when they start comprehending transitive sentences. Otherwise, they should not show the early differences in comprehending SVO and OVS sentences. Information structure, on the other hand, does not appear to play a major role in early children's comprehension, even though the information structure plays an important role in Czech word order (Sgall et al., 1986).

Appendix: a sample protocol

The table contains the list of stimuli and conditions in one of the four protocol versions. The remaining versions were created by changing the case of the initial and final noun (to generate the opposite word order) or by changing the given word (to change given-first items to given-last and vice versa).

Given word	Sentence	Word order	Given noun placement
opice	Opice schovává slona. (The monkey is hiding the elephant.)	SVO	first
kráva	Krávu utírá kůň. (The horse is drying the cow.)	OVS	first
koza	Žirafa stříhá kozu. (The giraffe is cutting the goat's hair.)	SVO	last
kluk	Holku hladí kluk. (The boy is patting the girl.)	OVS	last
lev	Hada žere lev. (The lion is eating the snake.)	OVS	last
medvěd	Medvěd kouše tygra. (The bear is biting the tiger.)	SVO	first
sova	Králík chytá sovu. (The bunny is catching the owl.)	SVO	last
dědeček	Dědečka češe babička. (The grandma is brushing the grandad's hair.)	OVS	first
zaba	Žába houpe kotě. (The frog is swinging the kitten.)	SVO	first
stene	Zajíce krmí štěně. (The puppy is feeding the hare.)	OVS	last
kocka	Kočku přikrývá myš. (The mouse is covering the cat.)	OVS	first
kure	Pejsek honí kuře. (The dog is chasing the chick.)	SVO	last

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Table 1

Mean correct responses in the experiment and in the lexical test in the whole sample and in the low-and high-vocabulary subgroups.

	Whole sample	Low lexicon group	High lexicon group
Lexical score	17.75 (5.81)	13.72 (5.00)	22.34 (1.98)
Total of correct responses in experiment	8.13 (2.39)	6.84 (1.89)	9.6 (2.03)
Correct responses per condition:			
SVO given-first	2.20 (0.81)	1.84 (0.74)	2.54 (0.73)
SVO given-last	2.32 (0.77)	1.93 (0.81)	2.66 (0.52)
OVS given-first	1.93 (0.91)	1.55 (0.89)	2.18 (0.78)
OVS given-last	1.95 (0.82)	1.65 (0.76)	2.24 (0.78)

Table 2

Parameter estimates and p-values for the overall model.

	Log-odds	(SE)	p
Intercept	0.92	(0.13)	<0.001
Subject position	0.31	(0.07)	<0.001
Given noun position	-0.08	(0.07)	0.22
Lexicon	20.58	(3.08)	<0.001
Subj. x given posit.	-0.02	(0.07)	0.71
Subj. pos. x lexicon	6.13	(2.39)	0.01
Given pos. x lexicon	4.51	(2.38)	0.06
Three-way interaction	-3.62	(2.38)	0.13

Table 3

Model comparison for analyses in different subgroups, including the subgroup description. For each model, the deviance (−2loglikelihood) and the Bayesian information criterion values are shown, along with the likelihood ratio comparisons with X^2-tests.

	Low lexicon	High lexicon
N	57	50
Mean age	3;6	3;10
Model	Deviance	Deviance
A. Sentence type only	902.2	543.8
B. Sentence type + given noun placement	901.2	543.3
Comparison A-B	$\chi^2(1)=1, p=0.42$	$\chi^2(1)=0.5, p=0.5$
C. Sentence type, given noun placement, interaction	901.2	542.8
Comparison A-C	$\chi^2(1)=1, p=0.60$	$\chi^2(1)=1, p=0.61$

Figure Captions

Figure 1. Sample picture pair.

Figure 2. The scatterplots show the relation between the number of correct responses and the lexical score. The left panel shows the relation separately for sentences with different word orders, the right panel for sentences with different position of the given noun. The lines are nonparametrically smoothed values for each lexical score level.