

Impact of Context and Type of Referring Expression on Sentence Comprehension in German-Speaking Children

Antje Sauer mann and Barbara Höhle

1. Introduction

1.1. Comprehension of non-canonical sentences

Previous research in language acquisition demonstrated that children even up to school age have problems understanding sentences in non-canonical word orders when thematic roles cannot be assigned on the basis of semantic information such as animacy or plausibility (e.g., Dittmar, Abbot-Smith, Lieven, & Tomasello, 2008; Grünloh Lieven, & Tomasello, 2011). For instance, when German-speaking preschoolers were asked to match a sentence in the OVS word order (1b) wherein thematic roles were assigned on the basis of case marking morphology at the first and second NP, they often chose the picture showing the reversed thematic role assignment (corresponding to an SVO sentence like 1a) or chose at random (e.g., Mills, 1977; Schipke, 2012).

- 1) a) **Der Tiger** kitzelt den Hund. (SVO)
The.nom tiger tickles the.acc dog.
b) **Den Tiger** kitzelt der Hund. (OVS)
The.acc tiger tickles the.nom dog.

However, corpus data from spontaneous speech revealed that German-speaking children produce OVS sentences already at an age of 2;6-3 (e.g., Fleischhauer, 2009; Poeppel & Wexler, 1993; see also Sauer mann, 2015 for object initial ditransitive sentences). This discrepancy between the corpus data and the comprehension studies is unexpected because it is usually assumed that children need to understand the construction to be able to produce them.

Crucially, the experimental settings employed in previous comprehension studies differed from the setting typically found in spontaneous speech. In particular, the test sentences in comprehension studies were usually presented without an appropriate context and used sentences wherein the subject and the object were realized as lexical NPs. Yet in spontaneous speech, OVS sentences typically occur in a context that makes them felicitous and often at least one referent, usually the subject, is realized as a (personal) pronoun (cf., Dittmar et al., 2008; Fleischhauer, 2009).

Both factors, i.e., the missing of an appropriate context and the occurrence of a lexical NP as an unusual type of referring expression, may be related to the processing and comprehension difficulties of OVS sentences in children as well as the online processing difficulties in adults (e.g., Hemforth, 1993; Schipke, 2012; Weskott, 2003). In particular, it has been argued that non-canonical sentences, e.g., OVS sentences, may be difficult to process because (i) the OVS word order is less frequent than the

* Antje Sauer mann, Centre for General Linguistics (ZAS), Berlin, antje.sauer mann@googlemail.com. Barbara Höhle, University of Potsdam, hoehle@uni-potsdam.de. We thank Constanze Otto, Anna Richter, Maike Riegel for assistance in collecting the data, Tom Fritzsche for technical support, and Frauke Berger and Maja Stegenwallner-Schütz for helpful comments. This research was funded by the German Science Foundation (DFG) within the Collaborative Research Center “Information structure” – SFB 632, Project C3 “L1-acquisition of linguistic means to mark information structure: Prosodic, syntactic and lexical aspects”.

SVO word order (cf., Dittmar et al., 2008; MacDonald, Pearlmutter, & Seidenberg, 1994), (ii) because the OVS word order is not felicitous in an all-new context (cf., Crain & Steedman, 1985, Crain & Thornton, 1998), or (iii) because the OVS word order violates grammatical locality constraints, i.e., it leads to intervention effects when the object crosses the subject during the derivation (cf., Friedmann, Belletti & Rizzi, 2009).

1.2. Impact of information structure on sentence comprehension

Previous research has demonstrated that presenting non-canonical sentences in an appropriate context or providing prosodic cues can reduce processing difficulties in German-speaking adults (e.g., Bornkessel, Schleswesky, & Friederici, 2003; Burmester, Spalek, & Wartenburger, 2014; Weber, Grice, & Crocker, 2006). With respect to OVS sentences, Burmester and colleagues demonstrated that processing difficulties at the sentence-initial object in OVS sentences were reduced when the sentences were presented following a question that defines the object as the topic of the OVS sentences (e.g., *Was ist mit dem Tiger?* ‘What is about the tiger?’). Weber and colleagues (2006) showed that a contrastive accent on the object can reduce the SVO preference for temporarily ambiguous sentences.

Research in child language also showed that thematic role assignment in non-canonical sentences may be influenced by contrastive prosody and a preceding context (Grünloh, Lieven & Tomasello, 2011). Grünloh and colleagues employed a pointing task wherein German speaking 5-year-olds were asked to point to one of two movies that matched a target sentence, with one movie showing the action with correct thematic role assignment and the other movie depicting the action with reversed thematic roles. When case marking indicated the OVS word order (cf. 2c), children pointed to the correct film around 67% of the time when the object of the OVS sentence was contrastively focused but performed at 50% chance level when a flat prosody was used. A supportive context, illustrated in (2), further increased sentence comprehension in both cases when OVS sentences were presented with contrastive (75% correct) and flat prosody (60%).

Notably, the context in (2) defines the subject of the target OVS sentence (2c) as the agent and discourse topic, in particular in the SVO sentence in (2a). Thus, not only the topic and agent status of the subject but also the continuation of the agent and topic status across the discourse may contribute to the pattern of results.

- 2) a) Puppel 1: Der Löwe VERB den Frosch.
 The.nom lion VERB the.acc frog.
 b) Puppel 2: Nicht den Frosch VERB der Löwe, sondern
 Not the.acc. frog VERB the.nom lion, but
 c) den Hund VERB der Löwe.
 the.acc dog VERB the.nom lion.

Yet, contrastive focus prosody clearly improved sentence comprehension and it has been argued that focus may ease sentence comprehension because focus-initial structures are more likely to occur with OVS sentences than with SVO sentences (cf., Grünloh et al., 2011, Weber et al., 2006).

While focus seems to ease sentence comprehension it is less clear whether a context that imposes a topic-first order on the OVS sentence may also ease sentence comprehension in children. Crucially, the topic-first order is felicitous for both the SVO and OVS word order in German. Thus, the topic-first order per se may not be seen as a frequency-based cue to the OVS word order, rather it has been suggested that this order eases discourse processing, i.e., the access and integration of the initial object into the preceding discourse (Burmester et al., 2014; Schumacher & Hung, 2012).

Experiment 1 investigated whether the topic-first context eases OVS sentence comprehension in German-speaking children and thus may contribute to the current debate on the extent to which children are sensitive to the impact of discourse context on sentence comprehension (Crain & Thornton, 1998; Tomson & Poulson, 2015; Trueswell, Sekerina, Hill, & Logrip, 1999).

1.3. Impact of pronouns on sentence comprehension

Research on the impact of the type of referring expression on sentence comprehension mainly investigated relative clauses. Children usually have problems comprehending object relative clauses wherein the relative pronoun is the object of the relative clause (3b) while they have less problems understanding subject relative clauses wherein the relative pronoun is the subject (3a) (Brandt, Kidd, Lieven, & Tomasello, 2009; Friedmann et al., 2009). Similarly, even adults experience processing difficulties when reading object relative clauses (3b) in comparison to subject relative clauses (3a) (e.g., Warren & Gibson, 2002).

- 3) a) Show me the tiger that tickles the pig. (subject relative clause)
 b) Show me the tiger that the pig tickles. (object relative clause)
 c) Show me the tiger that it tickles. (object relative clause)

However, when the subject of the relative clause is realized as a personal pronoun rather than as a lexical NP (3c) comprehension accuracy in children is increased (e.g., Brandt et al., 2009; Friedmann et al., 2009) and online processing difficulties in adults are reduced (Warren & Gibson, 2002). The reduction of the comprehension and processing difficulties has been explained in terms of the syntactic structure, i.e., intervention effects or memory factors, and in terms of discourse and frequency-based factors.

With respect to syntactic structure, it has been argued that sentences like (3b) lead to intervention effects because locality constraints ban the movement of the object across the subject when both arguments (the subject and the object) share similar features. Intervention effects are reduced when the subject and object are dissimilar, e.g., when the subject is a pronoun (e.g., Friedmann et al., 2009).

Processing accounts link the difficulties in object relative clauses to memory (and discourse) factors, i.e., processing difficulties arise because the subject and object need to be accessed at the verb where thematic roles are assigned. Subject pronouns reduce the processing difficulties because differences in the type of referring expression between the subject and object reduce interference effects (Gordon, Hendrick, & Johnson, 2001) or because pronouns require less processing resources because they are already given in the discourse (Warren & Gibson, 2002).

Frequency or usage-based accounts relate processing difficulties to the lower frequency of object relative clauses. Pronominal subjects reduce processing and comprehension difficulties because the pronoun may be seen as a frequency-based cue to the subject or agent status (Brandt et al., 2008), although the link between pronouns and subject status may be modulated by information structure, i.e., topic status (Kaan, 2001).

Similar to object relative clauses, OVS sentences may also be analysed as a filler-gap dependency so that pronouns may also ease the processing of OVS sentences in terms of reduced memory load or reduction of intervention effects. In addition, either the subject or the object of OVS sentences may be realized as a pronoun so that transitive sentences may provide insight into whether the impact of pronouns on sentence comprehension is influenced by their grammatical role.

1.4. Goal of the present study

We investigated whether OVS sentence comprehension is improved when the sentences are presented in a topic-first context in comparison to a neutral context (Experiment 1) and when the topic is realized as personal pronoun rather than as lexical NP (Experiment 2). Experiment 1 will indicate whether the advantages in discourse processing linked to the topic-first context also facilitates sentence comprehension in children. Experiment 2 will indicate whether personal pronouns ease processing not only in relative clauses but also in other non-canonical sentences, and if so, whether the effect is influenced by the grammatical role of the pronoun. Both results will contribute to the current discussion on the factors influencing the comprehension of non-canonical sentences in children (Grünloh et al., 2011; Boeg Thomsen & Poulsen, 2015).

2. Experiment 1

2.1. Design and materials

A sentence-movie verification task was used to assess the comprehension of SVO and OVS sentences in a “neutral” and “topic” context. The experiment used a 2 x 2 repeated measures design with Word Order and Context as independent variables and comprehension accuracy as dependent variable (see Table 1).

Table 1: Experimental conditions in Experiment 1 (disambiguating case marking in bold)

Context	Word Order	
	SVO	OVS
<i>Look what is happening here. (neutral)</i>	Ich wette, der Tiger kitzelt gleich das Schwein. I bet, the.nom tiger will tickle the pig.	Ich wette, den Tiger kitzelt gleich das Schwein. I bet, the.acc tiger the pig will tickle.
<i>Now you hear a story about the tiger. (topic)</i>	Ich wette, der Tiger kitzelt gleich das Schwein. I bet, the.nom tiger will tickle the pig.	Ich wette, den Tiger kitzelt gleich das Schwein. I bet, the.acc tiger the pig will tickle.

The SVO and OVS sentences were introduced by a lead-in (*ich wette*, ‘I bet’). Word Order of the target sentence was modified by case marking on the first NP. Nominative case marking at the determiner of the first NP (*der*) indicated that the first NP was the subject (SVO word order) whereas accusative case (*den*) indicated that it was the object (OVS word order). Morphological case marking on the second noun phrase was ambiguous.

Context was modified by a context sentence that was presented before the target sentence. The context sentence defined either the referent of the first NP as the topic of the target sentence (*Nun kommt eine Geschichte über den Tiger*. ‘Now, you hear/see a story about the tiger.’, topic context) or did not mention any of the animals and defined a “neutral” context (*Schau mal was hier passiert*. ‘Look what happens here.’, neutral context).

The SVO and OVS sentences were produced using the hat pattern intonation (e.g., Féry, 1993), with a rising accent (L*+H) on the first NP and a falling accent (H*+L) on the second NP. This pattern is compatible with the topic-comment structure (e.g., Féry, 1993, Steube, 2001) and compatible with both word orders. The lead-in (*ich wette*, ‘I bet’) and the sentences in the SVO or OVS word order were separated by an intonation phrase boundary.

24 experimental items were created. Each item was used to create the four conditions illustrated in Table 1. The target sentences described an action involving two out of 48 animals. Animal labels of masculine grammatical gender were combined with animal labels of neuter or feminine gender. Masculine animal labels always occurred in the first position of the sentence and allowed the identification of the grammatical roles via morphological case marking. Feminine or neuter labels occurred in the last position of the sentence and were ambiguous with respect to morphological case marking. The actions described by the test sentences were either “tickling” or “chasing” with “dangerous” animals (e.g., tiger, wolf) being usually involved in tickling actions.

2.2. Participants

Forty-five 4-year-olds (mean age: 4;7), forty-four 5-year-olds (mean age: 5;7) and twenty-six 7-year-olds (mean age 7;6) were tested. All children were monolingual German speakers and none of the children had indications of delay or impairment in language development. In addition, twenty-eight adult native speakers of German, students from the University of Potsdam, participated as a control group.

2.3. Procedure

Participants watched movies together with a cartoon character who would predict what the two animals shown in each scene would do. Each prediction was formulated in terms of the test sentences (Table 1) and was followed by a movie showing either the correct action (e.g., the tiger tickles the pig) or the reversed action (e.g., the pig tickles the tiger). Half of the trials in each word order and context showed the correct action and the other half the incorrect (reversed) action. The children were asked to say whether the animals were doing what the cartoon character had predicted (yes/no answer).

Participants were shown 24 experimental items. Each participant saw each item (animal pair) only in one of the four conditions and (overall) an equal number of items in each condition. The experimental items were arranged in 4 blocks and separated by a filler movie. Yet, participants could take breaks within the blocks because the experimenter started each trial after a response to the yes-no question had been given.

2.4. Results and discussion

The accuracy results indicated that children could be split up into three response groups: yes-bias children, SVO-bias children and non-biased children. Binomial tests on the responses testing against chance (chance level set at 50%) were used to define the groups. Yes-biased children were determined by their answers for SVO and OVS-trials. They gave - overall - 18 or more yes-answers ($\geq 18/24$), i.e., their number of yes-answers was above chance level regardless of whether the movie showed the correct action or not. SVO-bias children were determined on the basis of the accuracy of their answers to OVS-trials. They answered the SVO trials correctly, i.e., they said “no” when the movie showed the incorrect action and “yes” when the movie showed the correct action. However, they answered only two or less of the OVS trials correctly ($\leq 2/12$), i.e., they apparently treated OVS sentences like SVO sentences. All other children were assigned to the “non-biased” group, except for one 4-year-old showed a OVS-bias (25% of SVO sentences correct). This child was excluded from further analyses.

Table 2 presents the percentage of children in each response group separately for each age group. The yes-bias and SVO-bias were more common in the younger age groups. In the following, we only consider the data of the non-biased children.

Table 2: Response groups (children)

Age group	Yes-bias	SVO-bias	Non-biased
4-year-olds (N = 44)	48% (21)	25% (11)	27% (12)
5-year-olds (N = 44)	32% (14)	23% (10)	45% (20)
7-year-olds (N = 26)	8% (2)	23% (6)	69% (18)

Logistic linear mixed effects models (LME, Baayen, 2008; Jaeger, 2008) were used to conduct inferential statistical analyses in the R environment. Separate linear mixed models were calculated for children and adults to estimate the fixed effects of Word Order (SVO, OVS), Context (neutral vs. topic) and their interaction on the comprehension accuracy. The variables Participant and Item were treated as random factors. The contrast coding of the fixed effects resembled those of traditional ANOVA analyses.

Model fitting was performed in a step-wise fashion, starting with the most complex model that included the full factorial set of random effects (random slope-adjustment for all fixed effects and their interactions for both random and Items). During model fitting, the complex models were trimmed down in a step-wise fashion using log-likelihood tests for model comparisons (e.g., Baayen, 2008). Slope-adjustments were kept in the models if the models fitted the data better than the less complex models.

Figure 1 illustrates the mean accuracy for SVO and OVS sentences (left panel vs. right panel) in each context (neutral context: light grey bars, topic context: dark bars) for each age group (4-year-olds, 5-year-olds, 7-year-olds, adults). As can be seen in the Figure, adults (last two bars in each panel) performed at ceiling on both sentences regardless of the context condition. Logistic LME models revealed no effects of Context or Word Order on response accuracy.

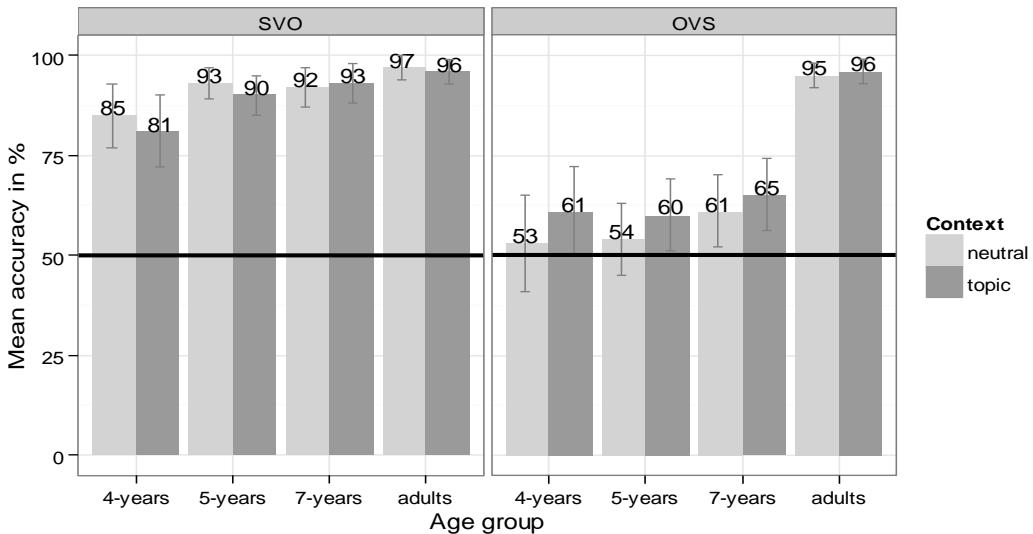


Figure 1: Mean accuracy (with 95%-CI) for SVO and OVS sentences (left vs. right panel) in the neutral and topic context (light vs. dark bars) in children and adults (Experiment 1)

The models for the child data revealed a significant main effect of Word order in all age groups (4-year-olds: $b = -1.32$, $SE = 0.28$, $z = -4.699^{***}$; 5-year-olds: $b = -2.52$, $SE = 0.47$, $z = -5.326^{***}$ (slope-adjustment for participants); 7-year-olds: $b = -2.00$, $SE = 0.30$, $z = -6.757^{***}$), resulting from higher accuracy scores for SVO than OVS sentences. The effects of Context and the interaction of Context and Word order were not significant.

Additional logistic LME models tested the comprehension accuracy for OVS sentences in each context against 50% chance level. The models showed that 7-year-olds understood OVS sentences above chance level in the topic context ($b = 0.71$, $SE = 0.29$, $z = 2.487$, $p < .05$) and marginally above chance level in the neutral context ($b = 0.53$, $SE = 0.28$, $z = 1.865$, $p = .062$) whereas 4- and 5-year-olds understood OVS sentences at chance level (all $t < 1.8$, $p > .08$) in both context conditions.

Experiment 1 replicates previous findings that German-speaking pre-schoolers have problems understanding OVS sentences in a neutral context and that even 7-year-olds do not understand OVS sentences at ceiling. Crucially, the experiment could not demonstrate that the topic-first context influences comprehension accuracy in children or adults.

3. Experiment 2

3.1. Design and materials

Experiment 2 also used a 2x2 repeated-measures design with Word Order and Context as dependent variables (see Table 2). The same set of transitive sentences was used as in Experiment 1, yet the topic of the sentences was realized as a personal pronoun (*er* 'he' in topic-first context, *es/sie* 'it/she' in the topic-last context). The SVO and OVS sentences were preceded by a context sentence that defined the first NP (topic-first context) or the second NP (topic-last context) as the topic of the target sentence. The modification of the Context allows assessing the impact of the link between pronouns, topic status and the grammatical role, i.e., by comparing OVS sentences in which the pronominal topic is object (topic-first context) with OVS sentences in which it is the subject (topic-last context). Moreover, a neutral context could not be used in this design because the third person pronouns are not felicitous in an all-new context.

Table 3: Experimental conditions in Experiment 2 (disambiguating case marking in bold)

Context	Word Order	
	SVO	OVS
<i>Now you hear a story about the tiger. (topic-first)</i>	Ich wette, er kitzelt gleich das Schwein. I bet, he (tiger) will tickle the pig.	Ich wette, ihn kitzelt gleich das Schwein. I bet, him (tiger), the pig will tickle.
<i>Now you hear a story about the pig. (topic-last)</i>	Ich wette, der Tiger kitzelt es gleich. I bet, the.nom tiger will tickle it (pig).	Ich wette, den Tiger kitzelt es gleich. I bet, the.acc tiger, it (pig) will tickle.

SVO and OVS sentences following the topic-first context were produced in a hat pattern prosody: the rising accent (L*+H) was placed on the verb of the lead-in (*wette* ‘bet’) and the falling accent on the second NP (H*+L). For sentences following the topic-last context, the hat pattern could not be used. Thus, they were produced with a rising accent (L+H*) on the verb of the lead-in (*wette* ‘bet’) and a contrastive H* accent on the first NP. The second NP, the pronoun, was deaccented.

3.2. Participants

Twenty-eight 4-year-olds (mean age: 4;6), twenty-five 5-year-olds (mean age: 5;5) and 24 adult native speakers of German, students from the University of Potsdam were tested. All children were monolingual German speakers and none of the children had indications of delay or impairment in language development.

3.3. Procedure

The procedure was the same as in Experiment 1.

3.4. Results and Discussion

As it was the case in Experiment 1, children were assigned to one of the three response groups on the basis of their responses. Two 4-year-olds were assigned to the yes-bias group, two further to the SVO-bias group and the remaining twenty-four to the non-biased group. All 5-year-olds were assigned to the non-biased group.

As in Experiment 1, logistic LME models were calculated to estimate the fixed effects of Word Order (SVO vs. OVS) and Context (topic-first vs. topic-last) on comprehension accuracy. Participants and Items were included as random effects. Contrast coding resembled those of traditional ANOVA analyses.

Figure 2 illustrates the mean accuracy of SVO and OVS sentences (left panel vs. right panel) in each context (topic-first context: light grey bars, topic-last context: dark bars) for each age group (4-year-olds, 5-year-olds, adults). As can be seen in Figure 2, adults (last two bars in both panel) performed at ceiling on both sentence types regardless of the context condition. Logistic LME models revealed no effects of Context or Word Order.

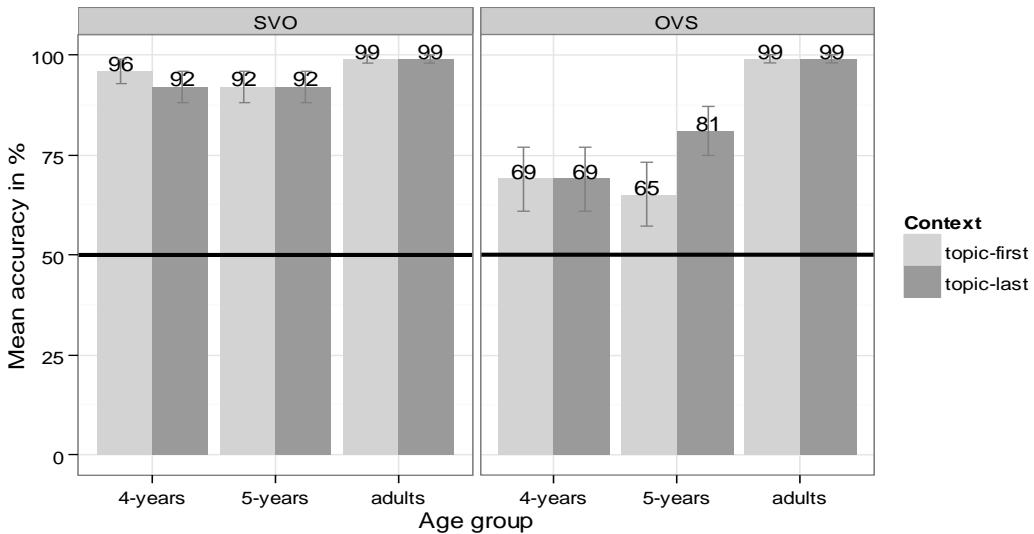


Figure 2: Mean accuracy (with 95%-CI) for SVO and OVS sentences (left vs. right panel) in the topic-first and topic-last context (light vs. dark bars) in children and adults (Experiment 2)

The statistical models for the 4-year-olds revealed a main effect of Word Order resulting from higher response accuracy for SVO than OVS sentences ($b = -2.09$, $SE = 0.36$, $z = -5.794^{***}$, slope-adjustment for participants), but no further effects. The models for the 5-year-olds also revealed a main effect of Word Order resulting from higher accuracy for SVO than OVS sentences ($b = -1.65$, $SE = 0.60$, $z = -2.773^{**}$, slope adjustment for participants), but also a marginal interaction between Word Order and Context ($b = -0.90$, $SE = 0.47$, $z = -1.941$, $p = .0522$). As can be seen in Figure 2, the effect of Word Order seemed to be stronger in the topic-first context than in the topic-last context.

Logistic LME models were calculated to test the comprehension accuracy for OVS sentences in both contexts against 50%-chance level. These tests showed that the comprehension accuracy for OVS sentences was above chance level in both contexts in the 4-year-olds (topic-first: $b = 0.92$, $SE = 0.24$, $z = 3.819$, $p < .001$; topic-last: $b = 0.92$, $SE = 0.24$, $z = 3.819$, $p < .001$) and 5-year-olds (topic-first: $b = 0.92$, $SE = 0.36$, $z = 2.546$, $p < .05$; topic-last: $b = 1.99$, $SE = 0.39$, $z = 5.164$, $p < .001$).

In comparison to the results of Experiment 1, the results revealed that the use of pronouns eased sentence comprehension in 4-year-olds and 5-year-olds. A direct comparison between the experiments confirmed that response accuracy on OVS sentences was higher in Experiment 2 than Experiment 1 (4-year-olds: $b = 0.59$, $SE = 0.31$, $z = 1.908$, $p = .05645$; 5-year-olds: $b = 0.91$, $SE = 0.41$, $z = 2.196$, $p < .05$). Notably, in the 5-year-olds, the effect was triggered by the high performance in the topic-last context.

While the direct comparison between the experiments shows only a weak effect, it is important to note that in Experiment 1, 4-year-olds and 5-year-olds performed at chance level on OVS sentence in the neutral and topic context, and children in Experiment 1 were more likely to show an SVO-bias.

5-year-olds show higher comprehension accuracy for OVS sentences in the topic-last context than the topic-first context, whereas 4-year-olds showed no differences between both contexts. This pattern is also reflected by the individual performance for OVS sentences in both contexts.

Table 4 shows the percentage (and number) of children in each age group who responded correctly to OVS sentences in each context above 50% chance level (at least 5 out of 6 OVS sentences correct), at chance level (2-4 sentences correct) and below chance level (less than 1 sentence correct). Note that (individual) children were not necessarily above chance level in both contexts. Around half of the 4-year-olds responded correctly to understood OVS sentences in each context whereas the others performed at chance level or below chance level.

The majority of the 5-year-olds (72%) responded correctly above chance-level to OVS sentences in the topic-last context whereas only half of the 5-year-olds performed above chance level on OVS

sentences in the topic-first context. Notably, seven 5-year-olds performed below chance level in this context, i.e., they apparently showed an SVO-bias; yet this was only the case for one 4-year-old. Six of the seven 5-year-olds performed above chance level on OVS sentences in the topic-last context, indicating that they could comprehend OVS sentences in general. Yet, given that the object is the topic in OVS sentences in the topic-first context it might be that these children were influenced by the “violation” of the link between personal pronouns and subject status.

Table 4: Percentage (with absolute number) of children who understood OVS sentences above 50% chance level, at chance level or below chance level, separated by Age Group and Context

	Above chance	At chance	Below chance
4-year-olds (N = 24)			
Topic-first	54% (13)	46% (11)	0
Topic-last	50% (12)	33% (8)	12% (4)
5-year-olds (N = 25)			
Topic-first	52% (13)	20% (5)	28% (7)
Topic-last	72% (18)	24% (6)	4% (1)

4. Conclusion

The results of Experiment 1 showed that the topic-first context did not influence comprehension accuracy of OVS sentences in comparison to the neutral context. Experiment 2 showed that realizing the topic as personal pronouns improved sentence comprehension in 4-year-olds and 5-year-olds, regardless of whether the personal pronoun was the subject or the object of the sentence. Yet, 5-year-olds performed better in the topic-last than topic-first context, whereas 4-year-olds showed no differences.

Experiment 2 clearly demonstrates that realizing the topic as a personal pronoun improves the comprehension of OVS sentences. Crucially, the sentence comprehension was also improved when the topic was the object of the sentence. This suggests that the link between personal pronouns and the subject status cannot solely ease OVS sentence comprehension; although it may explain the results of the 5-year-olds (see below).

Personal pronouns may ease comprehension because they reduce interference effects (Friedmann et al., 2009) or because they reduce memory costs related to the similarity-based interference (Gordon et al., 2001) or discourse integration (Warren & Gordon, 2002). However, Experiment 1 could not demonstrate that the topic and givenness status of the initial object eased sentence comprehension. This is unexpected if the givenness status per se explains how pronouns ease sentence comprehension (cf. Warren & Gibson, 2002; see also Burmester et al., 2014). It might be that children have problems linking lexical NPs with givenness and the preceding discourse because in child language and child-directed speech lexical NPs usually refer to new referents and pronouns to given and topical referents (e.g., Fleischhauer, 2009; Sauermaun, 2015; Wittek & Tomasello, 2005; see also Hendriks, Koster, & Hoeks, 2014).

Experiment 2 also showed that 5-year-olds performed better in the topic-last than topic-first context and in this condition better than the 4-year-olds. In the topic-last context children may either use the contrastive information as a cue to thematic roles assignment or use the link between personal pronouns and subject status. Grünloh and colleagues (2011) showed that contrastive information eases OVS sentence comprehension in 5-year-olds even when both arguments are realized as lexical NP. It is an open issue whether 4-year-olds may also rely on this information. Snedeker and Yuan (2008) showed that English-speaking 4-to-6-year-olds were able to use prosodic information for sentence disambiguation so that German-speaking 4-year-olds may also be sensitive to prosodic information during sentence comprehension.

Alternatively, it is possible that 5-year-olds may be more sensitive to the link between personal pronouns and the subject status than 4-year-olds. This might be supported by the comprehension

problems of the seven 5-year-olds who had problems understanding OVS sentences in the topic-first context. That is, at least these seven children may be influenced by the link between personal pronouns and subject status not only in the topic-first context wherein the pronominal objects may cause problems but also in the topic-last context wherein the personal pronoun is the subject and thus may facilitate OVS sentence comprehension. In addition, this hypothesis would also fit to current work by Bittner and Kuehnast (2011) who argued that German-speaking 3-year-olds use demonstrative pronouns as default pronouns for reference whereas 5-year-olds are more likely to consider the discourse-properties of demonstrative pronouns and personal pronouns. In this case, the link between personal pronouns and subject status may be influenced by information structure and discourse factors like topicality (cf., Kaan, 2001).

The results of Experiment 1 did not show that the topic context influenced sentence comprehension. This differs from the results of the adults (e.g., Burmester et al., 2014) but does not necessarily indicate that children - per se - are not sensitive to the impact of context on sentence comprehension. As suggested above, it might be that children may need a more direct link to the preceding discourse and/or have problems linking lexical NPs to the topic or givenness status. This may indicate that pre-schoolers already have some discourse knowledge (given – pronoun, new – lexical NP) although it is less clear to what extent they already have more elaborate discourse skills involving topic continuity and topic shift (cf., Boeg Thomsen & Poulsen, 2015; Hendriks et al., 2014; Karmiloff-Smith, 1981; vs. Megherbi & Ehrlich, 2009; Song & Fisher, 2005).

Notably, the topic context in Experiment 1 may induce a repeated name penalty that usually occurs when aboutness topics are realized as lexical NP rather than as pronoun (e.g., Almor, 1999; Gordon, Grosz, & Gilliom, 1993). Experiment 1 could not identify any comprehension difficulties in comparison to the neutral context, especially in the 7-year-olds who – as a group - understood OVS sentences most of the time in the topic and the neutral context, even though they did not perform at ceiling in either context. Yet, previous research by Megherbi & Ehrlich (2009) showed that French-speaking 7-year-olds are sensitive to the repeated name penalty. Further studies may reveal whether children, in particular 5-year-olds and 7-year-olds who may have more developed discourse skills, may experience the repeated name penalty during online processing.

Our results also contribute to the previous research on the impact of contextual information during sentence comprehension. On the one hand, Grünloh et al. (2011) and Boeg Thomsen and Poulsen (2015) showed rather strong effects on sentence comprehension when the context also provides cues to thematic role assignment. On the other hand, research that merely modified information structure factors, e.g. by providing a context that imposes the given-before-new order on a sentence (Gourley & Catlin, 1978) revealed weaker effects on sentence comprehension, at least in children. The fact that the information structure orderings like topic-first and given-before-new are compatible with both the SVO and OVS word order and thus do not provide an “additional” cue to thematic role assignment may be a reason for the differences between the studies.

To summarize, Experiment 1 could not demonstrate that the topic-first context itself influences sentence comprehension in German-speaking 4- to 7-year-olds. Experiment 2 demonstrated that realizing the topic as personal pronoun eased OVS sentences comprehension regardless of the grammatical role of the pronoun. This suggests the impact of the pronouns on sentence comprehension may be related to the syntactic structure, i.e., they reduce intervention effects or memory costs. Crucially, the 5-year-olds suggest that frequency-based factors, e.g., the link between pronouns and subject status, may also influence OVS sentence comprehension and that this link may be influenced by the acquisition of information structure and discourse skills.

References

- Almor, Amit (1999). Noun-phrase anaphora and focus: The informational load hypothesis. *Psychological Review*, 106 (4), 748–765.
- Baayen, R. Harald (2008). *Analysing linguistic data*. Cambridge: Cambridge University Press.
- Bittner, Dagmar, & Kuehnast, Milena (2011). Comprehension of intersentential pronouns in child German and child Bulgarian. *First Language*, 32 (1-2), 176–204.

- Boeg Thomsen, Ditte, & Poulsen, Mads (2015). Cue conflicts in context: interplay between morphosyntax and discourse context in Danish preschooler's semantic role assignment. *Journal of Child Language*, available on CJO2015. doi:10.1017/S0305000914000786.
- Bornkessel, Ina, Schlesewsky, Matthias, & Friederici, Angela D. (2003). Contextual information modulates initial processes of syntactic integration: The role of inter- versus intrasentential predictions. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 29(5), 871–882.
- Brandt, Silke, Kidd, Evan, Lieven, Elena, & Tomasello, Michael (2009). The discourse bases of relativization: An investigation of young German and English-speaking children's comprehension of relative clauses. *Cognitive Linguistics*, 20 (3), 539–570.
- Burmester, Juliane, Spalek, Katharina, & Wartenburger, Isabell (2014). Context updating during sentence comprehension: The effect of aboutness topic. *Brain and Language*, 137, 62–76.
- Crain, Stephen, & Steedman, Mark (1985). On not being led up the garden path: the use of context by the psychological syntax processor. In David R. Dowty, Lauri Karttunen, & Arnold M. Zwicky (Eds.), *Natural language parsing: Psychological, computational and theoretical perspectives* (pp. 320–358). Cambridge: Cambridge University Press.
- Crain, Stephen, & Thornton, Rosalind (1998). *Investigations in universal grammar: A guide to experiments on the acquisition of syntax and semantics*. Cambridge, MA: MIT Press.
- Dittmar, Miriam, Abbot-Smith, Kirsten, Lieven, Elena, & Tomasello, Michael (2008). German children's comprehension of word order and case marking in causative sentences. *Child Development*, 79 (4), 1152–1167.
- Féry, Caroline (1993). *German intonation pattern*. Tübingen: Niemeyer.
- Fleischhauer, Elisabeth (2009). *Word order variation in German child language: A single case corpus analysis* (Unpublished master's thesis). University of Potsdam.
- Friedmann, Nama, Belletti, Adriana, & Rizzi, Luigi (2009). Relativized relatives: Types of intervention in the acquisition of A-bar dependencies. *Lingua*, 119, 67–88.
- Gordon, Peter C., Grosz, Barbara J., & Gilliom, Laura A. (1993). Pronouns, names, and the centering of attention in discourse. *Cognitive Science*, 17, 311–347.
- Gordon, Peter C., Hendrick, Randall, & Johnson, Marcus (2001). Memory interference during language processing. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 27 (6), 1411–1423.
- Gourley, Judith W., & Catlin, Jack (1978). Children's comprehension of grammatical structures in context. *Journal of Psycholinguistic Research*, 7 (6), 419–434.
- Grünloh, Thomas, Lieven, Elena, & Tomasello, Michael (2011). German children use prosody to identify participant roles in transitive sentences. *Cognitive Linguistics*, 22 (2), 393–419.
- Hemforth, Barbara (1993). *Kognitives Parsing: Repräsentation und Verarbeitung sprachlichen Wissens*. Sankt Augustin: Infix.
- Hendriks, Petra, Koster, Charlotte, & Hoeks, John C. J. (2014). Referential choice across the lifespan: why children and elderly adults produce ambiguous pronouns. *Language, Cognition and Neuroscience*, 29 (4), 391–407.
- Jaeger, Florian T. (2008). Categorical data analysis: Away from ANOVAs (transformation or not) and towards logit mixed models. *Journal of Memory and Language*, 59 (4), 434–446.
- Kaan, Edith (2001). Effects of NP type on the resolution of word-order ambiguities. *Journal of Psycholinguistic Research*, 30, 529–547.
- Karmiloff-Smith, Annette (1981). The grammatical marking of thematic structure in the development of language production. In W. Deutsch (Ed.), *The child's construction of language* (pp. 121–147). London: Academic Press.
- MacDonald, Maryellen C., Pearlmutter, Neal J., & Seidenberg, Mark S. (1994). Lexical nature of syntactic ambiguity resolution. *Psychological Review*, 101 (4), 676–703.
- Megherbi, Hakima, & Ehrlich, Marie-France (2009). The on-line interpretation of pronouns and repeated names in seven-year-old children. *Current psychology letters*, 25(2).
- Mills, Anne E. (1977). *First and second language acquisition in German - A parallel study*. Ludwigsburg: R.O.U. Strauch.
- Poeppl, David, & Wexler, Ken (1993). The full competence hypothesis. *Language*, 69(1), 1–33.
- Saueremann, Antje (2015). Impact of the type of referring expression on the acquisition of word order variation. (Unpublished doctoral dissertation). University of Potsdam.
- Schipke, Christine S. (2012). *Processing mechanisms of argument structure and case-marking in child development: Neural correlates and behavioral evidence* (Unpublished doctoral dissertation). University of Potsdam.
- Schumacher, Petra B., & Hung, Yu-Chen (2012). Positional influences on information packaging: Insights from topological fields in German. *Journal of Memory and Language*, 67, 295–310.
- Snedeker, Jesse, & Yuan, Sylvia (2008). Effects of prosodic and lexical constraints on parsing in young children (and adults). *Journal of Memory and Language*, 58, 574–608.
- Song, Hyon-joo, & Fischer, Cynthia (2005). Who is “she”? discourse prominence influences preschoolers' comprehension of pronouns. *Journal of Memory and Language*, 52, 29–57.

- Steube, Anita (2001). Grammatik und Pragmatik von Hutkonturen. *Linguistische Berichte*, 77, 1–29.
- Trueswell, John C., Sekerina, Irina, Hill, Nicole, & Logrip, Marian L. (1999). The kindergarten-path effect: studying on-line sentence processing in young children. *Cognition*, 73, 89–134.
- Warren, Tessa, & Gibson, Edward (2002). The influence of referential processing on sentence complexity. *Cognition*, 85, 79–112.
- Weber, Andrea, Grice, Marine, & Crocker, Matthew W. (2006). The role of prosody in the interpretation of structural ambiguities: A study of anticipatory eye movements. *Cognition*, 99, B63-B72.
- Weskott, Thomas (2003). *Information structure as a processing guide. The left periphery of German verb-second sentences and its interpretation in context* (Unpublished doctoral dissertation). University of Leipzig.
- Wittek, Angela, & Tomasello, Michael (2005). Young children's sensitivity to listener knowledge and perceptual context in choosing referring expressions. *Applied Psycholinguistics*, 26, 541–558.

Proceedings of the 6th Conference on Generative Approaches to Language Acquisition North America (GALANA 2015)

edited by Laurel Perkins, Rachel Dudley,
Juliana Gerard, and Kasia Hitczenko

Cascadilla Proceedings Project Somerville, MA 2016

Copyright information

Proceedings of the 6th Conference on Generative Approaches
to Language Acquisition North America (GALANA 2015)
© 2016 Cascadilla Proceedings Project, Somerville, MA. All rights reserved

ISBN 978-1-57473-468-3 library binding

A copyright notice for each paper is located at the bottom of the first page of the paper.
Reprints for course packs can be authorized by Cascadilla Proceedings Project.

Ordering information

Orders for the library binding edition are handled by Cascadilla Press.
To place an order, go to www.lingref.com or contact:

Cascadilla Press, P.O. Box 440355, Somerville, MA 02144, USA
phone: 1-617-776-2370, fax: 1-617-776-2271, sales@cascadilla.com

Web access and citation information

This entire proceedings can also be viewed on the web at www.lingref.com. Each paper has a unique document # which can be added to citations to facilitate access. The document # should not replace the full citation.

This paper can be cited as:

Sauermann, Antje and Barbara Höhle. 2016. Impact of Context and Type of Referring Expression on Sentence Comprehension in German-Speaking Children. In *Proceedings of the 6th Conference on Generative Approaches to Language Acquisition North America (GALANA 2015)*, ed. Laurel Perkins et al., 90-101. Somerville, MA: Cascadilla Proceedings Project. www.lingref.com, document #3209.