Pragmatic children

How German children interpret sentences with and without the focus particle *only**

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Our study investigated the abilities of 6-year-old German-speaking children to interpret sentences with and without the focus particle *nur* (only). We report two experiments: In Experiment 1 the study by Paterson et al. (2003) on English was replicated in German. We found that German-speaking children do not interpret *only*-sentences target-like. This supports Paterson et al. that children ignore information that is not verbally given. The second experiment investigated children's pragmatic ability to judge underinformative sentences. The results indicate that children take into account information that is showed on a picture, but not verbally introduced. We argue that children's performance in Experiment 1 is not caused by an insufficient pragmatic knowledge but rather to its methodological set up.

1. Introduction

Previous comprehension studies reported that up to school age children interpret sentences containing the focus particle *only* not in an adult-like fashion (for English: Crain, Ni & Conway 1994; Philip & Lynch 2000; Gualmini, Maciukaite & Crain 2003; Paterson, Liversedge, Rowland & Filik 2003; for Dutch: Bergsma 2002;

* Portions of this study were presented at the 30th Child Language Seminar (CLS) 2007 at the University of Reading (Müller et al. 2007a) and at the 32nd Boston University Conference on Language Development (BUCLD) 2007 (Müller et al. 2007b).

This study was supported by the German Research Foundation (DFG) as part of the SFB 632 "Information structure: the linguistic means for structuring utterances, sentences and texts" with a grant to Barbara Höhle and Jürgen Weissenborn. We are grateful to Angela Grimm for discussions of the topic. The paper also benefited from the comments of the anonymous reviewers. Thanks to Paul Abbott for lending his native eye to the English. Special thanks go to Dr. Kevin Paterson for providing the materials for the current studies.

Szendrői 2004; for Portuguese: Costa & Szendrői 2006). Crain et al. (1994) and Gualmini et al. (2003) argued that children prefer a default interpretation because they misconstrue the scope domain of the focus particle. In contrast, Paterson et al. (2003) propose that children fail to process the intended set of alternatives because this information is not verbally introduced in the actual discourse. Consequently, according to Paterson et al. children assign the same meaning to sentences with and without *only*.

In the present study we investigated how 6-year-old German-speaking children interpret sentences with *nur* (only). As to date there is no study on how German children interpret focus particle sentences with *nur*, we replicated the study by Paterson et al. (2003), which was carried out in English. The results we found are in line with Paterson et al.'s assumption that children do not consistently instantiate the set of alternatives in their actual discourse model, as required upon encountering a focus particle in a sentence. In the second experiment we investigated how children interpret sentences without a focus particle like *nur*. Our results show that in fact children are able to take into account information that is visually present in the context, even though it is not verbally introduced in the discourse. Hence, it seems that the children's difficulties in Experiment 1 and in the Paterson et al. study are not caused by difficulties to take into account information that is not verbally given but important for the sentences meaning. Rather we suggest that the observed performance is due to an infelicitous use of the focus particle in the experimental task. We assume that children solved the task by creating a discourse model which is adequate with respect to the given test situation, i.e. the discourse model accepts an interpretation of the sentence without taking into account the meaning and the function of the focus particle.

This paper is organized as follows: Focus particles are described in more detail in Section 2. Previous acquisition studies on the comprehension of focus particles are reported in Section 3. The study by Paterson et al. (2003) is presented in more detail, since our Experiment 1 is a close replication of that study. In Section 4 of the paper we present our experiments. We conclude with a discussion of our results in the light of recent research on focus particles.

2. Focus particles and children's acquisition task

According to Rooth (1992), focus particles are a special set of quantifying expressions that behave like semantic operators. They take scope over the part of a sentence they c-command in the parse tree (Jacobs 1983; König 1991). Within their scope domain focus particles take a specific constituent as their argument. This constituent is called *related constituent* (rc) (Reis & Rosengren 1997; Dimroth

2004). Typically, the related constituent corresponds to the focus of the sentence and is prosodically highlighted by a pitch accent (Altmann 1976; Jacobs 1983; König 1991; Dimroth & Klein 1996).[1]

In order to interpret a sentence with a focus particle the child has to master a demanding task which requires syntactic, semantic as well pragmatic knowledge about the felicitous use focus particles. Consider examples (1) and (2) with the focus particle *nur*:[2]

(1) A: Mögen Popeye und Olivia Spinat?
'Do Popeye and Oliva like spinach?'
B: Nein. Nur [POPEYE]rc mag Spinat.
'No. Only [POPEYE]rc likes spinach'

(2) A: Mag Popeye Spinat und Möhren?
'Does Popeye like spinach and carrots?'
B: Nein. Popeye mag nur [SPINAT]rc.
'No. Popeye only likes [SPINACH]rc.'

As shown in (1) and (2) focus particles can occur in different sentence positions. In (1) the focus particle *nur* occurs in utterance initial position. The following subject-NP *Popeye* is the related constituent and thus the focus of the sentences. In contrast, in (2) *nur* appears in postverbal position. In this case the Objekt-NP *spinach* is the related constituent of the focus particle. As both examples show, in German typically the focus particle precedes its related constituent. Additionally, the focus particle typically occurs adjacent to its related constituent. In general, in German focus particles are syntactically more restricted than in English (König 1991). The restriction for the position of the focus particle and its related constituent is part of the general constraint, called *Maximale Fokusnähe* (Jacobs 1983). This constraint requires that a focus particle selects the next constituent as its related constituent. Therefore, example (3a) in German is marked, whereas the English equivalent (3b) is felicitous.

1. Pitch accent is marked by capital letters.

2. Note that there are other meaning variants of nur (e.g. Altmann 1976; Lerner & Zimmermann 1981). For instance, the particle nur can also be used as a modal particle, e.g. Kommen sie nur herein ('Just come in please') and as particle with a scalar reading, e.g. Ich bin nur ein Lehrer ('I am just a teacher'). Hence, the child has to learn to distinguish between the use of nur as a focus particle and as a modal particle, respectively. In the present paper we focus on children's interpretation of the focus particle nur.

(3) a. ? Popeye hat nur Olivia [BLUmen]rc geschenkt.
Popeye sent only Olivia flowers.
'Popeye sent Olivia only flowers.'
b. Popeye only sent Olivia some [FLOWers] rc.

Furthermore, the previous examples (1) to (3) show that by selecting a related constituent the focus particle *nur* affects the meaning of the carrier sentence. The underlying structure of sentence (1) is *Popeye likes spinach*. The proposition of that sentence is [LIKE(Popeye, Spinach). This proposition is the presupposition of the *only*-sentence (1). In other words, *Only Popeye likes spinach* presupposes that 'Popeye likes spinach' is true. *Nur* belongs to the group of restrictive focus particles, i.e. *nur* establishes an exclusive contrast between its related constituent and a so-called set of alternatives that is typically verbally introduced in the actual discourse The entities of that set signal that there are referents which represent alternatives to the focused element (cf., Rooth 1992). The set of alternatives is required for the sentence interpretation because only by taking into account this set the hearer is able to interpret the focus particle sentence. In example (1) the use of *nur* signals that in the given discourse 'Popeye' is the only person who likes spinach. In the given discourse the second individual 'Olivia' represents the set of alternatives for which the property of the related constituent is understood as being false. The reading of example (2) in the present discourse is that wrt both types of food in question Popeye likes only spinach. Hence, the set of alternatives consists of the NP 'carrots'.

As shown in the examples above a felicitous use of a focus particle requires that the set of alternatives is present in the actual discourse. Typically, the set of alternatives is either verbally introduced during the preceding conversation or is already part of the common background knowledge of speaker and hearer (cf. Jackendoff 1972). In order to interpret a focus particle sentence the child has to be able to identify the set of alternatives in the discourse. As she has to take into account this information for the sentence interpretation she has to integrate this information into the actual discourse model, which provides the basis for the sentence interpretation. Thus, the identification of the set of alternatives is required for a correct interpretation of a focus particle sentence. This suggests that the preceding verbal discourse, providing the set of alternatives, play an important role in focus particle comprehension.

In sum, to interpret sentences with a focus particle the child has to master the following tasks: She has to identify the sentence position of the focus particle in the sentence and the related constituent. Then, she must evaluate the set of alternatives from the preceding verbal discourse and must integrate this information into her current discourse model. Furthermore, the child has to establish a contrast between the focus particle and the set of alternatives and to take into account this contrast when interpreting the sentence.

3. Previous studies on children's comprehension of sentences with only

Several acquisition studies have investigated how children acquire focus particles. Although an early and target-like production of focus particles has been documented (Penner, Tracy & Weissenborn 2000; Nederstigt 2003; Hulk 2003; Höhle, Berger, Müller, Schmitz & Weissenborn 2009), several comprehension studies have reported a non adult-like interpretation of focus particle sentences up to school age.[3]

The study by Crain, Ni & Conway (1994) was one of the first to investigate children's ability to interpret sentences with the focus particle *only*. Using a sentence-picture-matching task, Crain et al. found that 3- to 6-year-old English-speaking children interpreted sentences with the focus particle in pre-subject position (4a) as having the meaning of sentences with the focus particle in preverbal position (4b).

(4) a. Only the cat is holding a flag.
b. The cat is only holding a flag.

In this study participants were presented with a picture depicting a cat holding a flag, a duck holding a flag and a balloon, and a frog holding a balloon. Crain et al. reported that the majority of the children judged the sentence (4a) as a true description of the picture, thus assigning the meaning of (4b) to the sentence. To account for that error pattern, they suggested that children had difficulty correctly restricting the scope of the focus particle *only*. As a consequence, children selected as a default the direct object as the related constituent, regardless of the surface position of *only*. A study by Philip & Lynch (2000) seems to support these findings. They found that 3- to 5-year-old English-speaking children accepted the sentence *Only the dog is holding a starfish* as a true description of a picture showing a dog and a cat both holding a starfish, corresponding to the interpretation of *only* in pre-object position.

A further study was conducted by Gualmini, Maciukaite & Crain (2003), which also seems to support the account of Crain et al. (1994). In line with Crain et al.'s results Gualmini et al. reported a default interpretation of sentences with *only*. Within a truh-value-judgement task 4- to 5-year-old English-speaking children were asked to judge sentences like (5a) and (5b).

(5) a. The farmer only sold a [BANANA]rc to Snow White.
b. The farmer only sold a banana to [SNOW WHITE] rc.

3. In the following we concentrate on studies which tested unambiguous sentences with *only*. For research which investigated children's comprehension of ambiguous sentences with *only* see Crain et al. (1994) and Paterson, Liversedge, White, Filik & Jaz (2006).

In contrast to Crain et al. (1994) the focus particle sentence was preceded by a short story narrated by the experimenter. After the story the experimenter prompted a puppet with *What happened in the story?* The child's task was then to judge whether the puppet's answer was felicitous given the story. The results showed that children interpreted sentences like (5a), in which the direct object was prosodically highlighted, as having the meaning of (5b), i.e. children identified the indirect object instead of the direct object as the related constituent. Gualmini et al. concluded that children are insensitive to prosodic information as a reliable cue for interpreting sentences containing *only*. Instead, children resort to a default interpretation by assigning *only* to the indirect object. These findings were replicated using the same experimental design by Szendrői (2004) for Dutch and Costa & Szendrői (2006) for European Portuguese. Hence, it seems that children are not able to use prosodic information to unambiguously identify the related constituent of a focus particle.[4]

Paterson et al. (2003) pointed to another possible cause of the problems that children can have when interpreting sentences with *only*. They suggested that due to an insufficient representation of the set of alternatives children neglect the meaning of the focus particle and thus interpret sentences with focus particles in the same way as sentences without focus particles. To test this hypothesis Paterson et al. presented children with sets of six pictures and corresponding test sentences. Each picture set comprised six drawings (see Figure 1). The corresponding set of test sentences represented three different experimental conditions (see Example 6 a–c).

(6) a. *The fireman is holding a hose.* Sentence without only:
b. *Only the fireman is holding a hose.* Sentence with pre-subject *only*:
c. *The fireman is only holding a hose* Sentence with pre-verbal *only*:

Using a picture-selection task, the experimenter presented the whole picture set to the participant and read one of the test sentences (6a) to (6c) aloud. The participant was asked to point to all pictures that matched the given sentence. Paterson et al. grouped the different response patterns into three main categories, reflecting the correct interpretation for each of the three experimental conditions. For

4. Findings by Höhle et al. (2009) cast doubt on the assumption that children generally ignore prosodic information when identifying the related constituent of a focus particle. In an eye-tracking study with three- and four-year-olds, they tested sentences like (ia) and (ib) with the focus particle *auch* (also) and found that children reacted differently to the two accent patterns.

(i) a. Toby hat AUCH eine Puppe. 'Toby possesses ALSO a doll.' (like e.g. Anna)
b. Toby hat auch eine PUPPE. 'Toby possesses also a DOLL.' (in addition to e.g. a ball)

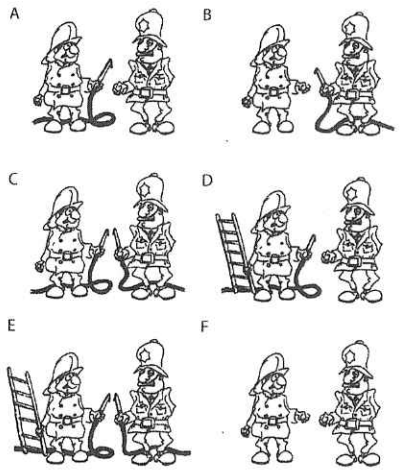

Figure 1. Picture set used by Paterson et al. (2003:272)

the condition without-*only* (6a), pictures A, C, D, and E constitute the correct response, because in all four pictures the proposition of the test sentence, in this case HOLD(fireman, hose) was fulfilled. For the test sentence with pre-subject *only* (6b) pictures A and D should be chosen because in both pictures the fireman is performing the described action and nobody else is. When presented with pre-verbal *only* (6c) the participants should point to pictures A and C because in both pictures the fireman is holding a hose and there is nothing else that he is holding. Paterson et al. hypothesized that if children do not process the information triggered by the focus particle, they should exhibit the same response pattern for sentences with and without *only*. However, if children misconstrue the scope of *only* as predicted by Crain et al. (1994), then children should point to pictures A and C for both conditions (6b) and (6c).

Paterson et al. tested 6- to 7-year-old, 8- to 10-year-old and 11- to 12-year-old English-speaking children as well as a control group of adults. All participants showed a better performance for sentences without *only* than with *only*. The group of adults gave more correct responses than the other age groups on all types of test sentences. For further analyses Paterson et al. concentrated on the group of 6-year-olds. When presented with test sentences without *only* these children pointed to the expected response pattern (pictures A, C, D, E) in 84% of all cases. For pre-subject *only* sentences Paterson et al. found 26% correct responses (pictures A, D) and for pre-verbal *only* sentences 34% correct responses (pictures A, C). A more detailed

analysis of the unexpected responses in these two *only*-conditions revealed that a relatively high proportion of children's responses (45% in the pre-subject *only* condition; 49% in the pre-verbal *only* condition) could be ascribed to ignoring the focus particle when interpreting the sentence. In these cases children selected the pictures A, C, D, E. Only a minority of responses was compatible with Crain et al.'s assumption of problems with scope restrictions (16% in the pre-subject-only condition).

These findings were taken by Paterson et al.'s to support their account, i.e. that children tend to ignore the information given by the focus particle when interpreting an *only*-sentence. More precisely, children are not able to consistently instantiate the set of alternatives in the actual discourse model when this is only triggered by the presence of the focus particle in the sentence. Paterson et al. argued that this inability is caused by the still insufficiently developed pragmatic knowledge of the children.

In summary, previous research on the comprehension of sentences containing the focus particle *only* indicates that children up to age 6 do not interpret these sentences in adult-like fashion. Gualmini et al. (2003) argued that children are not able to use prosodic focus information to identify the related constituent of *only*. Crain et al. (1994) claimed that children misconstrue the scope of the focus particle. Both accounts suppose a default interpretation for associating *only* with the last constituent in the sentence. However, Paterson et al. (2003) argued that previous studies on *only* did not clearly show that children's difficulties are due to problems with the identification of the correctly related constituent of *only*. Instead, they suggested that children fail to instantiate the set of alternatives in the actual discourse model and thus tend to interpret the focus particle sentences as sentences without *a* focus particle.

One way to obtain further evidence that may be helpful in deciding between these different accounts is a crosslinguistic comparison. If children up to a specific age show problems in integrating the set of alternatives into their sentence interpretation then across languages no variation in the interpreting sentences with focus particles is expected. Thus, if Paterson et al.'s account is correct, we should obtain the same results for German-speaking children. On the other hand, if children have problems with the identification of the scope of the particles then differences across languages related to structural variation between the languages should occur. In German there are stronger positional restrictions for the focus particle *only* as compared to English. *Only* typically precedes its related constituent directly which might help the child to identify the related constituent of the particle. Therefore we replicated the Paterson et al. (2003) study with German learners.

4. The study

4.1 Experiment 1

Experiment 1 replicated the Paterson et al. (2003) study in German. As Paterson et al. focused on the results of the 6-year old English-speaking children, we tested German-speaking children of the same age.

4.1.1 *Participants*

Thirty 6-year-old German-speaking children (15 girls and 15 boys) participated in this experiment (mean age 6;8 years; range 6;1 – 7;2 years). The children were recruited from several schools in Potsdam, Brandenburg. All children are growing up in monolingual German-speaking homes. In addition, 30 adults were tested as a control group.

4.1.2 *Materials and procedure*

We used the original test pictures from Paterson et al. (2003) as visual stimuli and translated their sentence material into German. In some cases adequate translation required the use of a verb with a separable particle. These items were excluded. Nine out of the twelve original test sets were then included in the replication (see Appendix A). Each of the nine test sentence types was used in the three experimental conditions: in a sentence without *nur* (7a), in a sentence with *nur* in pre-subject position (7b) and in a sentence with *nur* in pre-object position (7c).

(7) a. Der Feuerwehrmann hält einen Schlauch. Without *nur*
'The fireman is holding a hose.'

b. Nur der Feuerwehrmann hält einen Schlauch. Pre-subject *nur*
'Only the fireman is holding a hose.'

c. Der Feuerwehrmann hält nur einen Schlauch. Pre-object *nur*
'The fireman is holding only a hose.'

As shown in the examples the German sentences in *pre-object* condition (7c) differ systematically from the English sentences as the focus particle in German always directly precedes its related constituent (cf., 6c). The sentence material was divided into three lists such that each list contained nine sentences, three of each condition. None of the test sentence types appeared more than once in a list. Each participant was only tested with one list, thus no participant was presented more than once with each test sentence type and the corresponding picture set. The participants were randomly assigned to one of the three test lists. The test sentences were orally presented to the participants. The experimenter read aloud the test sentences in which the focussed constituent of the sentences was prosodically highlighted.

In the case of the test sentences without *nur* the experimenter presented the sentence with normal intonation, i.e. with an accent on the final object-NP.

The children were tested after school in their day care center. The child and the experimenter sat in a separate room from the other children in the dare care center. At the beginning the experimenter presented the first picture set to the child and asked to name the persons depicted at the pictures. After that the experimenter presented the test sentence and asked the child to point to the pictures which match the test sentence. When the child finished the experimenter showed the next picture set and the experimental procedure was repeated. An experimental session lasted for about ten to 15 minutes. The participants of the adult control group were also tested individually.

4.1.3 *Results*

As in Paterson et al. (2003) the responses of each participant were assigned to one of the four following categories: *no scope*, *subject scope*, *object scope*, and *other*. If the participant pointed to the pictures A, C, D, E, this response was coded as *no scope* because this response was the expected pattern for sentences without the focus particle. If only the pictures A and D were selected, this response counted as *subject scope*. Selections of only the pictures A and C were assigned to the category *object scope*. The remaining responses were coded as *other*.

As Table 1 illustrates adults gave the expected responses in the majority of the cases in all three conditions. In contrast, children's major response type corresponded to the *no scope* interpretation.[5] A 2 (age group) × 3 (sentence condition) ANOVA based on the number of correct responses revealed a main effect for the factor age group ($F(1,58) = 311,128$; $p < .001$). Furthermore, there was a main effect for the factor sentence condition ($F(1,58) = 89,963$; $p < .001$) and also an interaction between both factors ($F(1,58) = 65,629$; $p < .001$). Separate one-way ANOVAs for both age groups revealed an effect for the factor sentence condition for the children ($F(1,29) = 133,218$; $p < .001$) but not for the adults ($F(1,29) = 1,482$; $p = .236$) A paired t-test showed that children made significantly more errors with sentences with pre-subject *nur* and pre-object *nur*, respectively, than with sentences without *nur* ($t_{(29)} = 13,646$; $p < .001$; $t(29) = 12,892$; $p < .001$). There was no significant difference between the performance for sentences with *nur* in pre-subject position and in pre-object position ($t_{(29)} = ,405$; $p = .689$). A comparison of children's and

5. 13 of the 30 children always selected pictures A, C, D, and E when interpreting sentences with *nur* in either condition. Only one child gave the expected responses in all three conditions, with the exception of one sentence in the pre-object *nur* condition. The remaining children showed various responses for the *nur*-sentences.

Table 1. Children's and adults' responses for the sentences with *nur* in pre-subject and pre-object position and without *nur*. (Grey coloured fields indicate the expected/ correct response.)

sentence		no scope (pointing A, C, D, E)	subject scope (pointing A & D)	object scope (pointing A & C)	other
Without *nur*	children	94%	0%	1%	5%
	adults	100%	0%	0%	0%
pre-subject	children	70%	13%	6%	11%
nur	adults	2%	96%	0%	2%
pre-object	children	71%	5%	13%	11%
nur	adults	1%	1%	98%	0%

adults performance revealed that adults gave significantly more expected responses in the pre-subject and pre-object condition than children (unpaired t-test: $t(58) = 12{,}618$; $p<.001$; ($t(58) = 14{,}523$; $p = .001$). For sentences without *nur* no significant difference was found ($t(58) = 1{,}248$; $p = .217$).

In a further analysis we compared the frequency of responses in which children unambiguously ignored the set of alternatives (*no scope errors*) and in which they unambiguously misconstrue the scope of *nur* (*scope analysis errors*). A paired t-test revealed that children produced significantly more *no scope errors* than *scope analysis errors* ($t(29) = 7{,}753$; $p<.001$).

In summary, both groups of participants interpreted the test sentences without the focus particle *nur* as expected. However, unlike the adults the children frequently judged the pictures A, C, D, E as a felicitous depiction for *nur*-sentences which was actually the expected response for sentences without *nur*.

4.1.4 *Discussion*

Our first experiment replicated the findings of Paterson et al. (2003). Whereas adults selected the expected pictures in all three sentence conditions. 6-year-old children most frequently selected the picture set that corresponds to the reading of the sentence without a focus particle, and they did so even when presented with sentences including the focus particle. In summary, our German data are compatible with the account by Paterson et al.

As mentioned above, Paterson et al. assume that children have difficulties instantiating information in their current discourse model that is not verbally introduced. Therefore, the set of alternatives which is implicated by the focused constituent, i.e. the related constituent, but not verbally given is ignored in children's interpretation. According to Paterson et al. this non adult-like performance is rooted in the children's insufficient pragmatic knowledge.

Apart from Paterson et al.'s account, two alternative accounts could explain children's performance as well: First, assume that children in general exhibit difficulties instantiating information that is not verbally introduced in the discourse, regardless of whether they interpret a sentence with or without a focus particle. Then it would follow that preschool children also fail to compute the pragmatic contribution of *nur* to the sentence interpretation. Second, wrt children's acquisition task (Section 2) the interpretation of a focus particle sentence requires the existence of a set of alternatives. Either the set of alternatives is presented in the preceding verbal discourse or it is already part of the common background knowledge of speaker and hearer. That means, that the ability to identify the set of alternatives in a visual presented picture belongs not to the abilities which are required for the mastery of focus particle sentences. Therefore, it is possible that children calculate focus particles only if the set of alternatives is explicitly introduced in the preceding discourse. In that case, children interpret focus particle sentences adult-like when the set of alternatives is explicitly mentioned in the discourse, but not in the absence of such a context as in the Paterson et al. study.

The first account will be investigated in Experiment 2, discussed in the following, for the second account (cf. Müller, in prep.).

4.2 Experiment 2

To test whether children in general have difficulties in instantiating information that is not verbally introduced in their discourse model we chose sentences without focus particles as test material for Experiment 2. These were taken from Experiment 1. We presented a subset of the pictures from Experiment 1 that varied with respect to their informational complexity. Furthermore the pictures represent more information than is mentioned in the sentence. The sentences are underinformative with respect to the information contained in the pictures shown. The children's task was to evaluate whether a sentence matched a picture. If children are not sensitive to the degree of informativeness of a given sentence in relation to a given picture, i.e. they are insensitive to information that has not been explicitly mentioned, we expect no differences in the children's judgements for the different pictures. In contrast, sensitivity to informativeness should result in the following response pattern: The higher the informational complexity of the picture the lower should be the acceptance rate.

As test materials we used the picture types A, C, D, E (see Fig. 2) and the test sentences without *nur* from Experiment 1. Although all these pictures are a logically true description of the test sentences without the focus particle, they differ with respect to the amount of additional information depicted. For example, in Figure 2 all four pictures depict a fireman holding a hose. However, all pictures

contain additional information, which is not mentioned in the test sentence: A policeman (all pictures), a hose held by the policeman (pictures C and E) and a ladder held by the fireman (picture E). This difference we refer to as (visual) informational complexity. On this complexity scale, Picture A is informationally the least complex picture and picture E is the most complex one, with pictures C and D being in between. With respect to the maxim of quantity (Grice 1975) the sentence *The fireman is holding a hose* is most informative wrt picture A, and least informative wrt picture E. Besides the mentioned event, Picture E displays another character (the policeman) who performs the same action as the fireman. Moreover, in picture E the fireman performs a second activity, i.e. holding a ladder. Thus, there are at least three pieces of information depicted in picture E that are not verbally expressed in the test sentence. Therefore, with respect to the maxim of quantity the sentence *The fireman is holding a hose* is underinformative with respect to picture E. In picture A, the police man is also present, but no other activities are portrayed. As a result, the degree of underinformativeness of the sentence is dependent on the complexity of the picture. If underinformativeness effects children's judgements along a scale of visual informational complexity, we would expect the highest acceptance rate for picture A and the lowest acceptance rate for picture E.

4.2.1 *Participants*

Thirty-two 6-year-old German-speaking children (16 girls and 16 boys) participated in our second experiment (mean age 6;9 years; range 6;6 – 7;0 years). As in our first experiment all children are growing up in monolingual German families and were recruited from several schools in Potsdam. In addition, 30 adults were tested as a control group.

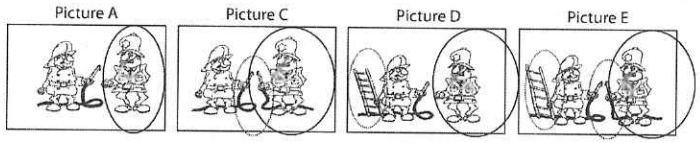

Figure 2. Example of test pictures in Experiment 2

4.2.2 *Material and procedure*

A felicity judgement task was developed. In this task children were asked to judge whether a given sentence matches a given picture, which was presented simultaneously. The picture types A, C, D, E (see Figure 2) and the sentences without *nur* from the stimulus sets used in Experiment 1 (8) served as material for this experiment

(cf. Appendix for a complete list of the test items). To balance the sentence-picture pairs with respect to the four picture types we added three test sentences and the corresponding four picture types. In all, we used twelve test sentences and 48 test pictures (twelve for each picture type).

(8) Der Feuerwehrmann hält einen Schlauch.
'The fireman is holding a hose.'

Four item lists were created. Each list consisted of twelve test sentences and twelve test pictures that were distributed across the four different lists so that no participant had to judge one sentence with two picture types of the same set. List 1 contained picture type A of the fireman example, list 2 contained picture type C, list 3 included picture type D and list 4 included picture type E. In addition, four supplementary control picture-sentence pairs were added to each list in which a sentence's proposition was not depicted on the picture. For example, for the sentence *The woman is walking a chicken* the picture showed a women walking a dog and a cat and a man who is walking by himself. These items provided clear cases of a mismatch between picture and sentence and thus should evoke no-responses. All in all each list consisted in 16 sentences and 16 test pictures.

Children were tested after school in their day care center. After introducing a puppet the experimenter showed the first picture to the child and read the test sentence aloud. Afterwards the puppet asked the child whether the sentence matched the picture or not. After the child answered the question the experimenter presented the next picture and the experimental procedure was repeated. At the beginning of the experiment two practice items were presented: Once prompting a yes-response and the other a no-response. This way, children should become aware that a no-response could be a correct response. The whole test session lasted for about ten to 15 minutes and was audio-taped. The adults of the control group were also tested individually.

4.2.3 *Results*

Table 2 presents the percentages of sentences that were accepted (yes-responses) as felicitous matches to the picture types A, C, D, and E.

The number of yes-responses in both children and adults decreases from the least informative picture type A to the most informative picture type E. A 2 (age group) × 4 (picture type) ANOVA revealed a significant main effect for the factor age group ($F(1,62) = 9{,}630$; $p < .001$) and a significant main effect for the factor picture type ($F(1,62) = 6{,}072$; $p < .05$) but no interaction between the two factors $F(1,62) = .564$; $p = .455$). A paired t-test revealed that children accepted picture type A significantly more often than picture type C ($t(31) = 3{,}371$; $p < .01$), picture type D ($t(31) = 3{,}127$; $p < .05$), and picture type E

Table 2. Percentages of yes-responses for children and adults

	Picture type A	Picture type C	Picture type D	Picture type E
Children	88%	76%	65%	58%
Adults	100%	93%	81%	79%

($t(31) = 4{,}244$; $p < .001$). There were also significantly more yes-responses for the picture type C than for type E ($t(31) = 2{,}672$; $p < .05$). No difference was found between picture types C–D ($t(31) = 1{,}259$; $p = .218$) and D–E ($t(31) = 1{,}677$; $p = .104$). For the group of adults the paired- t-test revealed a significant difference between picture types A–D ($t(31) = 2{,}982$; $p < .05$) and A–E ($t(31) = 3{,}374$; $p < .05$) but not between picture types A–C ($t(31) = 1{,}923$; $p = .064$). Furthermore the t-test showed a significant difference between picture types C–D ($t(31) = 2{,}868$; $p < .05$) and picture types C–E ($t(31) = 3{,}371$; $p < .05$). No difference was found between picture types D–E ($t(31) = 1{,}249$; $p = .221$).

In summary, both groups rated the picture types A, C, D, and E differently according to their assumed complexity of additional information, and children rejected all picture types much more often than adults.

4.2.4 *Discussion*

The results of our second experiment suggest that children as well as adults are affected by the informational complexity of a picture when they have to decide whether a sentence matches a picture. The sentence-picture pairs were judged better matches when the degree of underinformativeness of the sentence wrt the picture is small. Overall the amount of no-responses given by children is higher than by adults. This suggests that children might be even more affected by the degree of underinformativeness of the sentence than adults. Obviously children expect that sentences are maximally informative about the depicted events. For the same assumption see also Paterson et al. (2006).

Most importantly, these results clearly indicate that 6-year-old children do not generally ignore information that is only visually present. Our results indicate that this kind of information is relevant in children's evaluation of how well a sentence describes a given situation. Thus, they seem to adhere to the maxim of quantity (Grice 1975). In other words, children's judgment of a sentence-picture match is not purely based on the match between the sentence's proposition and the picture, because in this case all four types of pictures would have been judged alike. The fact that children's reaction to the pictures was significantly different suggests that they are sensitive to the (pragmatically flavoured) felicity of a sentence wrt a picture. This finding casts doubt on the assumption that children's responses to sentences with focus particles found in Experiment 1 resulted from

children's ignorance of information that is not explicitly mentioned. We will come back to this in the general discussion.

Interestingly, the rejection pattern of children and adults were not the same. For adults, the four picture types were split in two groups: picture types A and C as one group, and picture types D and E as the second group. Type A/C was accepted significantly more often than type D/E. In contrast, the children showed a more gradual response pattern. A closer examination of the adult responses shows that they pattern according to the presence or absence of a second object attributed to the subject mentioned in the sentence (the fireman in our example). Presence or absence of an object attributed to the second protagonist, in contrast, does not seem to influence the acceptance. This suggests that the concept of underinformativeness is different for children and adults. For children every person or object present in a picture but not mentioned in the verbal discourse increases the underinformativeness of the sentence in that case. For adults underinformativeness seems to relate only to the subject of the sentence. Further evidence for this difference is the fact that children rejected picture type A, which only shows an additional protagonist, as not matching the sentence in 12% of the cases, while all adults accepted that picture. The behavior of the adults might be explained within Rooth's (1992) account of Alternative Semantics. A central claim of this proposal is that focus in general indicates the presence of alternatives that are relevant for the interpretation of a linguistic expression. The sentences presented in this experiment were prosodically unmarked, i.e. the nuclear stress was on the utterance's final element, the object of the sentence (cf., Cinque 1993). This prosodic marking supports a reading of the sentence in which the object is the focused constituent of the sentence that may turn the hearer's attention to the set of alternatives that consisted of the second object held by the protagonist (the ladder in our example). This assumption could be tested by changing the focus of the sentences to the subject, for instance by prosodic highlighting. If our hypothesis is correct we would expect a change in the adults' response pattern but not in the children's.

5. General discussion

The aim of the present study was to determine how German-speaking children interpret sentences with and without the focus particle *nur*. The first experiment replicated the findings of Paterson et al. (2003) for German-speaking children. Children seem to assign the same reading to sentences with and without the focus particle *nur*. The error pattern observed did not provide any evidence that misconstrued scope restrictions are the basis for children's difficulties in the interpretation of sentences with the focus particle *nur*. In contrast, the similarity

of the response patterns for sentences with and without *nur* is compatible with the Paterson et al.'s assumption that children do not implement the set of alternatives in their actual discourse model when interpreting sentences with *nur* in isolation.

Experiment 2 tested whether children are unable to integrate information into the discourse model that is not explicitly given in the verbal context and has to be inferred from the visual context. The results of this experiment indicate that children do not ignore information provided only visually. In addition, we found that visual information influenced children's decision about how well a sentence matched a given picture. In sum, the results of the second experiment suggest that children's failure to integrate the information signalled by the focus particle into their current discourse model as shown in our first experiment is not due to a general problem in implementing information that is not verbally introduced in the discourse.

The comparison of children's responses in the two experiments suggests that children responded differently when asked to judge the felicity of the sentence without *nur* given the four picture types. Whereas in Experiment 1 these four pictures were judged to match the sentences without *nur* in almost all of the cases, there were much fewer match responses for the same pictures and the same sentences in Experiment 2 (see Table 3).

We suggest that this discrepancy is rooted in the differences in the procedures that were used in the two experiments. In Experiment 1 we used a picture-selection

Table 3. Comparison of the match responses for pictures A, C, D, and E in Experiment 1 and 2

		Picture			
		A	C	D	E
Sentences without *nur*	Experiment 1	99%	98%	97%	98%
	Experiment 2	88%	76%	65%	58%

task: The child saw six pictures at once and was asked to "point to the pictures that matched the sentence". Hence, the formulation of the task or more precisely the use of plural noun 'pictures' may have signalled to the child that she could or had to point to more than one picture in order to solve the task correctly. In contrast, in Experiment 2 we used a felicity judgement task: The child saw only one picture and was asked to judge whether the given sentence matched the picture or not.

A central question of our study is why children seem to ignore the meaning of *nur* when interpreting sentences with this focus particle. In the following, based on the results for Experiment 2, we propose an alternative account to Paterson et al. (2003) that relates children's performance in our first experiment (as well as in the

Paterson et al. study) to methodological aspects of that study. The task in Experiment 1 called on the participants to draw pragmatic inferences. Importantly, the *nur*-sentences were not embedded in a verbal context motivating the use of the focus particle. Instead, the information licensing the use of the focus particle in the test sentence was contained in the visual stimulus. Thus, children had to infer the set of alternatives from the picture. The focus particle in the sentences may not have served as a cue for the children to search for a set of alternatives within this test situation, as was obviously the case for the adults. The test situation, i.e. the presentation of the *nur*-sentence together with a set of six pictures, obviously did not suffice to make the children understand why the focus particle is used. Consequently, the children were not able to establish the discourse model, which was intended by the experimental set up, solely on the basis of the visual information. Based on this assumption, we are led to conclude that the investigation into children's ability to interpret sentences with a focus particle was confounded by the requirement to (re)construct an appropriate discourse model.

Our assumption is in line with the discussion on the probable impact of the requirements of a given task on children's performance when interpreting scalar terms (cf., Noveck & Sperber 2004). In this field the discussion concentrates on the extent to which experimental settings provide an adequate verbal context for use of a scalar term in a given utterance (cf., Noveck & Sperber 2004; Papafragou & Musolino 2003). Papafragou & Musolino (2003) and Papafragou & Tantalou (2004) compared children's comprehension of scalar implicatures when the sentences were presented with and without an appropriate verbal context. They found that 5-year-old children performed better when the scalar term was embedded and motivated by a verbal context.

In the case of focus particles, a felicitous use moreover depends on the specific kind of verbal context. Gualmini et al. (2003), for example, embedded the focus particle test sentences in a short story, which was read aloud and acted out by the experimenter in front of the child. As mentioned before, children showed difficulties when interpreting sentences like (9a) where the related constituent of *only* is the direct object. In the Gualmini et al. study the question *What happend in the story?* directly preceded the *only*-sentence. However, Papafragou & Tantalou (2004) pointed out that this type of question is too general for licensing the use of quantifying expressions. Likewise, we suggest that this question does not licence a felicitous use of a focus particle in a sentence like (9a). The question *What happened in the story?* is felicitous if the questioner has no specific knowledge about the story. The answer to this question is characterized by wide focus with elements on the right periphery carrying the nuclear stress (Cinque, 1993). Thus, (9a) with an accented direct object does not provide an adequate answer to the question.

(9) What happened?

a. ? The farmer only sold a [BANANA]$_{rc}$ to Snow White.
b. The farmer only sold a banana to [SNOW WHITE]$_{rc}$.[6]

From this point of view children's tendency to interpret sentence (10a) as having the meaning of sentence (10b) as found by Gualmini et al. (2003) might be due to the fact that the children were aware of this mismatch between the question and the prosodic pattern of the test sentence.

To conclude, our study aimed at a better understanding of how children interpret sentences with (and without) focus particles. In Experiment 1 we replicated the study by Paterson et al. (2003) and found that the German-speaking children behaved like their English-speaking peers. The 6-year-olds did not seem to integrate the set of alternatives into their current discourse model when the set of alternatives was not introduced in the verbal context. As the same design yielded the same pattern of results, crosslinguistic differences between English and German in the syntactic restrictions for focus particles did not seem to play a role in interpreting the focus particle sentences. Therefore, we predict that instantiating a set of alternatives based upon accommodating implicit information to be a challenge at age 6 across languages.

Second, our findings in Experiment 2 suggest that children's inability to integrate this information in the discourse model in Experiment 1 is not caused by the fact that this information was not verbally introduced in the discourse. Children did not ignore the information visually present in the pictures, without being mentioned in the verbal discourse. Hence, we claim that children's difficulties observed in Experiment 1 may be caused by an insufficient activation of the set of alternatives on the child's part. Possibly children's performance would increase if the focus particle sentences is embedded in a verbal context, which introduce the set of alternatives and thus established it in the discourse. This is tested in ongoing work (Müller, in prep.).

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6. Note that sentence (9c) seems to be out too as a felicitous answer because of the contrastive stress on the indirect object.

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Appendix A

(Nur) das Mädchen streichelt (nur) ein Pferd.
'(Only) the girl is (only) stroking a horse.'
(Nur) der Mann trägt (nur) eine Tasche.
'(Only) the man is (only) carrying a briefcase.'
(Nur) der Junge angelt (nur) einen Fisch.
'(Only) the boy is (only) caught a fish.'
(Nur) der Hund jagt (nur) eine Katze.
'(Only) the dog is (only) chasing a cat.'
(Nur) der Postbote bringt (nur) einen Brief.
'(Only) the postman is (only) delivering a letter.'
(Nur) die Frau schiebt (nur) einen Kinderwagen.
'(Only) the woman is (only) pushing a pram.'
(Nur) der Junge hält (nur) einen Drachen.
'(Only) the boy is (only) holding a kite.'
(Nur) der Junge spielt (nur) mit einem Ball.
'(Only) the boy is (only) playing with a ball.'
(Nur) der Feuerwehrmann hält (nur) einen Schlauch.
'(Only) the fireman is (only) holding a hose.'

Appendix B

Test sentences

Das Mädchen streichelt ein Pferd.
'The girl is stroking a horse.'
Der Mann trägt eine Tasche.
'The man is carrying abriefcase.'
Der Junge angelt einen Fisch.

'The boy is caught a fish.'
Der Hund jagt eine Katze.
'The dog is chasing the cat.'
Der Postbote bringt einen Brief.
'The postman is delivering a letter.'
Die Frau schiebt einen Kinderwagen.
'The woman is pushing a pram.'
Der Junge hält einen Drachen.
'The boy is holding a kite.'
Der Junge spielt mit einem Ball.
'The boy is playing with a ball.'
Der Feuerwehrmann hält einen Schlauch.
'The fireman is holding a hose.'
Der Junge hält einen Hammer.
'The boy is holding a hammer.'
Der Mann trägt einen Korb.
'The man is carrying a basket.'
Die Krankenschwester trägt einen Eimer.
'The nurse is carrying a bucket.'

Control sentences

Der Weihnachtsmann bringt einen Roller.
'Santa Claus is bringing a scooter.'
Die Katze spielt mit einer Puppe.
'The cat is playing with a doll.'
Der Polizist stoppt einen Fahrradfahrer.
'The policeman is stopping a car.'
Die Frau spaziert mit einem Huhn.
'The woman is walking with a chicken.'