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German-speaking children’s productivity with syntactic constructions and case morphology: Local cues act locally

Angelika Wittek, Max-Planck-Institute for Evolutionary Anthropology
Michael Tomasello, Max-Planck-Institute for Evolutionary Anthropology

ABSTRACT
It has been proposed that children acquiring case-marking languages might be quicker to acquire certain constructions than children acquiring word order languages, because the cues involved in grammatical morphology are more ‘local’, whereas word order is an inherently distributed cue (Slobin, 1982). In the current studies using nonce nouns and verbs, we establish that German-speaking children are not productive with passive and active transitive sentence-level constructions at an earlier age than English-speaking children; the majority of children learning both languages are not productive until after their third birthdays. In contrast, in the second and third studies reported here, the majority of German-speaking children were productive with nominative and accusative case marking inside NPs before their third birthdays – and these are of course the very same case markers centrally involved in passive and active transitive constructions. We conclude from these results that, whereas for some functions mastering local cues is all that is required, and this is fairly simple, in other cases, such as the case marking involved in sentence-level syntactic constructions, the mastery of local cues is only one part of the process of forming complex analogical relationships among utterances.

KEYWORDS
Case marking; grammar; language acquisition; learning; syntax
A central issue in the study of child language acquisition is productivity. Children learn to use particular linguistic items and phrases in the way that others use them, but they also go beyond this to use them in creative – and yet still conventional – ways. This creativity or productivity is based on children’s ability to discern patterns in the acts of linguistic communication they experience around them, and thereby to construct the abstract linguistic categories and constructions that underlie mature language use (Tomasello, 2003).

In the case of sentence-level syntactic constructions involving agents and patients (e.g., transitives, intransitives, passives), at least five different lines of observational and experimental evidence suggest that English-speaking children construct their linguistic abstractions more slowly, and in a more piecemeal manner, than was previously believed. First, distributional analyses of English-speaking children’s spontaneous speech demonstrate that they use each of their early constructions with only a very restricted set of verbs and other predicates; that is, their early constructions are ‘lexically specific frames’, ‘verb islands’ or ‘limited scope formulae’ (Bowerman, 1976; Braine, 1976; Lieven, Pine & Baldwin, 1997; Tomasello, 1992). Second, when children are taught a novel verb in one syntactic construction and then encouraged, through various forms of discourse, to use it in another syntactic construction, they are loath to do so until fairly late in development – mostly after 3 years of age – suggesting again the lexical specificity of these constructions (Brooks & Tomasello, 1999; Tomasello & Brooks, 1998). Third, when children are asked to ‘Show me: The dog is meeking the cat’ (and they already know the action associated with meeking), they are random in choosing the appropriate agent and patient until after 3 years of age, and other forms of comprehension tests reveal similar limitations (Akhtar & Tomasello, 1997). Fourth, when children are taught a novel verb in a non-canonical word order (SOV: ‘The dog the cat is pilking’), and then given the opportunity to use that verb themselves, they use it in the unusual way they have heard it used, until after 3 years of age, at which point they begin correcting it to canonical SVO form – again suggesting that the abstractness of their SVO transitive construction emerges only gradually (Abbot-Smith, Lieven & Tomasello, 2001; Akhtar, 1999). Fifth, if 3-year-old children are primed with instances of a syntactic construction in a picture-naming game, when it is their turn to name a picture they are not influenced by the prime if there is not substantial lexical overlap between the prime and the utterance they want to produce; in other words, there is no structural priming until after 4 years of age (Savage, Lieven, Theakston & Tomasello, 2003).

Virtually all these studies focusing on the productivity of children’s early syntactic constructions have been conducted with English-speaking children (for a review, see Tomasello, 2000). But each language has its own peculiarities, and so it is possible that these findings are restricted to languages such as English which rely heavily on word order for marking basic agent-patient relations. Indeed, on the basis of his review of the existing evidence, Slobin (1982) concluded that children learning languages that mark agent-patient relations with case markers, such as Turkish, comprehend agent-patient syntax earlier than children learning word order languages such as English. The basic idea is that a case marker on a noun is easier to learn and use as an indicator of agent-patient relations than is word order ‘because it applies to a particular noun and can be interpreted without taking the entire sentence into account’ (p. 163); that is, it is
a 'local cue'. It is also worth noting that word order has no phonological content per se, and so it may be a somewhat ephemeral cue for young children, whereas morphological markers give them some concrete phonology on which to base a meaningful syntactic distinction.

The problem is that all the evidence Slobin reviews comes from studies of children's skills with known words (spontaneous production and comprehension experiments with known words), and none of it involves novel word studies, priming techniques or other methods aimed specifically at determining productivity (i.e., the abstractness and generality of the underlying linguistic representations). Indeed, there are very few studies in any language other than English that use novel verbs or other words to investigate the abstractness of children's understanding of agent-patient relations. One exception is Berman (1993), who presented young Hebrew-speaking children with novel verbs in unaccusative intransitive utterances (of the form 'The ball dacks') and then tried in various ways to elicit from them a transitive utterance with that same verb (of the form 'John dacks the ball'). Because Hebrew requires children both to modify the verb (add a causative marker) and to rearrange the order of elements, children below about 4 years of age mostly did not succeed in this task. In the most straightforward use of the term, however, Hebrew does not use local cues to mark agent-patient relations. The fact is that there are basically no experimental studies using novel verbs that focus on case-marking per se, that is, in languages which use local cues to mark agent-patient relations.

The current study was designed to investigate the degree to which children learning a case-marking language are productive in marking agent-patient relations, that is, the degree to which they display competence with nonce words in the syntactic marking of agent-patient relations. The focus was on German, which is a case-marking language, but with the novelty that case relations are encoded in particular forms of the determiners (and adjectives) which are used along with nouns (only in some instances on the nouns themselves). The cue is thus more local than that of word order languages such as English since the marking is inside the NP (but perhaps not as local as that of the classic kinds of case-marking languages such as Turkish and Russian in which the marking is directly on the noun). For instance, the two sentences below indicate situations in which (1) The elephant kisses the dog, and (2) The dog kisses the elephant.

1. Der Elefant küsst den Hund.
2. Der Hund küsst den Elefant.

The situation is complicated by the fact that the determiners are portmanteau, and so carry information about gender and number as well as case, and by the fact that some case forms are used in multiple functions (e.g., in the above examples, der, masculine nominative, can also be used in other contexts as a feminine dative determiner). Word order in German is relatively variable, and it is quite common in some situations to hear utterances of the type 'Den Hund küsst der Elefant' (comparable to 'It was the dog the elephant kissed'), not to mention the fact that the most common past tense sentences and all modal sentences (with modals such as can, may, should, will, want,
etc.) are verb final (for studies of German adults’ processing of case marking, see Kempe & MacWhinney, 1998, 1999).

In their spontaneous speech, German-speaking children appear to go through four phases in their acquisition of case morphology (Clahsen, 1984; Tracy, 1984): initially they use nouns without determiners; then they use mostly nominative forms of determiners independent of context; then there seems to be a binary case system involving both nominative and accusative (accusative forms are often used also in contexts requiring the dative); and finally children begin to use dative forms as well. In a recent set of comprehension experiments with known words, children began to use case – as opposed to other potential cues such as animacy and word order – to determine agent-patient relations reliably between 3 and 4 years of age (Lindner, 2003). In these same experiments, children basically never relied heavily on word order to determine agent-patient relations.

But again these naturalistic data and experiments with known words do not provide evidence about children’s productivity with syntactic constructions and case marking. In the current studies, therefore, we taught German-speaking children novel verbs and nouns, and then attempted to elicit utterances in which children used them. In the first study, modelled on Brooks’ & Tomasello’s (1999) study of English-speaking children, we taught children approaching their third birthdays a nonce verb in either an active or passive transitive construction and then attempted to elicit that verb in the other construction. The main question here was whether children learning a case-marking language (German) would be productive with sentence-level constructions (use a novel verb in them) at an earlier age than for English-speaking children, as one test of Slobin’s local cues hypothesis. In the second and third studies we taught children novel nouns in one case-marked form (e.g., Der Doso dreht sich ‘The doso is turning’, nominative) and then tried in various ways to see if they could, in another sentence context, produce doso with a different case marker (e.g., accusative: Der Clown schiebt den Doso ‘The clown is pushing the doso’). In this case, the main question was about age. Specifically, the question was whether German-speaking children would be productive in these word-level tasks with the very same case markers (nominative, accusative) used in the test of sentence-level productivity in the first study. Comparison across the studies enabled testing of the hypothesis that children may be productive with local cues at the level of words at an earlier age than they are productive with sentence-level constructions that use these same local cues in complex configurations distributed across words.

**STUDY 1: PRODUCTIVITY WITH PASSIVE AND ACTIVE TRANSITIVE CONSTRUCTIONS**

This study was essentially a German version of Brooks’ & Tomasello’s (1999) study of English-speaking children’s productivity with the active transitive and passive constructions, with adaptations made to fit with the particularities of the German language. The hypothesis was that the German children would be productive at an earlier age than the English children since case marking is a local cue whereas word order is a more distributive cue.
Method

Participants
Twenty-four German-speaking children (mean age 34 months, range 32–37 months) participated in the study, 12 boys and 12 girls. Two additional children did not speak much and did not use verbs at all in the test phase of the experiment and so were excluded. The children were recruited and tested at several kindergartens in Leipzig, Germany. All children were tested individually in a separate room in their kindergarten. Each child was tested in two sessions (about 20–30 minutes each) within the time span of a week.

Materials and design
Two novel verbs mieken and tammen were used to describe two novel transitive actions. The apparatuses on which these actions were performed were built according to the description in Brooks & Tomasello (1999): mieken was used to refer to an agent pulling a patient (inside a clear tube attached to a string) up a ramp; tammen was used to refer to an agent (attached to a pendulum) knocking a patient. For each enactment of each of the novel actions, different pairs of agents and patients were used, each of which was a puppet or plastic toy.

Each child learned both of the novel verbs, one in the active transitive (e.g., Die Uhr hat den Ball gemiekt ‘The clock meeked the ball’), and one in the passive construction (e.g., Das Pferd wurde vom Schlüssel getammt ‘The horse got tammed by the key’). The order of the novel verbs and the assignment of verbs to constructions was counterbalanced across participants. Training and elicitation procedure was identical to that of Brooks & Tomasello (1999, Study 2), except that the models and test questions were in German and we made one small change to the discourse pattern during training (see below). There were two experimenters: E1, who was the main interactor with the child, and E2, who kept a handwritten log on which she noted down the child’s utterances. All sessions were audio- and video-recorded and the handwritten log was checked against the recordings back in the lab.

In the first session, children were taught 10 sequences of models for each verb, one in the active transitive and the other in the passive construction. Each sequence consisted of 8 utterances. Several children were piloted with the sequences of models as described in Brooks & Tomasello (1999: 31), but lost interest in the game after a short while. We therefore decided to change the procedure slightly to make it more interesting. We added toys that could not act as proper agents or patients (e.g., because they were too fat and so did not fit in the plastic container, or because they were too small and so were not able to move another character up the ramp or off the pedestal), which made for a more interesting discourse topic. That is, the aim of the games was to try out the toys and see if they could or could not perform the actions. For example, a child who heard mieken introduced in the passive construction, would hear the following sequence of models:

Der Ball wird gleich gemiekt. (E1 tries to fit ball into container)
The ball is going to get meeked.
Nein, der Ball wird nicht gemiekt. (ball is too big, E1 uses horse instead)
No, the ball is not going to get meeked.
Das Pferd wird gleich gemiekt.
The horse is going to get meeked.
Wird das Pferd gleich vom Auto gemiekt?
Is the horse going to get meeked by the car?
Nein, das Pferd wird nicht vom Auto gemiekt.
No, the horse is not going to get meeked by the car.
Das Pferd wird vom Schlüssel gemiekt.
The horse is going to get meeked by the key. (while performing the action)
Hast du gesehen, von wem das Pferd gemiekt wurde?
Did you see what got meeked by the horse?
Genau, das Pferd wurde vom Schlüssel gemiekt.
Exactly, the horse got meeked by the key.

A child who heard *mieken* introduced in the active transitive construction, would hear the following sequence of models:

Das Auto wird gleich etwas mieken.
The car is going to meek something.

Nicht das Auto wird etwas mieken, sondern …
The car is not going to meek something, but …

Der Schlüssel wird gleich etwas mieken.
The key is going to meek something.

Wird der Schlüssel gleich den Ball mieken? (E1 tries to fit ball into container)
Is the key going to meek the ball?

Nein, der Schlüssel wird das Pferd mieken. (ball is too big, E1 uses horse instead)
No, the key is going to meek the horse.

Der Schlüssel miekt das Pferd.
The key is meeking the horse.

Hast du gesehen, was der Schlüssel gemiekt hat?
Did you see what the key meeked?

Genau, der Schlüssel hat das Pferd gemiekt.
Exactly, the key meeked the horse.

As was done by Brooks & Tomasello (1999), children were encouraged to participate in discourse in several ways. First, children were requested to name the game (*Das ist Mieken. Sag mal ’Mieken’. ‘This is called meeking. Say ”meeking”’,*), or finish an utterance (*Das Pferd wird gleich vom Schlüssel … ‘The horse is by the key …’*) at regular intervals. E1 also invited children to answer neutral questions (*Was ist passiert? ‘What happened?’*). In addition, children heard ‘agent’ (e.g., *Schau was der Schlüssel macht ‘Look what the key is doing’) and ‘patient’ (*Schau, was mit dem Pferd passiert ‘Look what is happening to the horse’) comments throughout the training that matched or mismatched the perspective on the event which was established by the model sentences.
In the second session, two more sequences of models were provided for the first verb, then E1 administered the elicited production task. In this phase of the experiment, the novel action was performed three times, with unique pairs of objects. Each enactment was accompanied with three questions: (a) an agent-focused question calling for an active transitive response (Was wird der Frosch machen? 'What is the frog going to do?' or Was hat der Frosch gemacht? 'What did the frog do?'); (b) a patient-focused question calling for a passive response (Was passiert mit der Uhr? 'What happened to the clock?'; and (c) a neutral question (Was passiert da gleich? 'What is going to happen now?' or Was ist da passiert? 'What happened?'). The order of the three questions was randomized so that each ordering occurred about an equal number of times. So, in all, children were given three opportunities to answer each question type, for a total of 9 questions (3 calling for active, 3 calling for passive, and 3 neutral).

This entire procedure was then repeated for the second verb. For both verbs, each multword response during the elicited production task was categorized as passive (full and truncated passives not differentiated) or active transitive.

Results

The frequencies with which children produced different kinds of utterances during the elicited production period are depicted in Fig. 1. Because overall frequencies were fairly low, these figures represent children’s responses to all three types of elicitation questions (9 questions in all) for each type of verb (actively trained and passively trained). Because only three children provided more than one response to a given question, such extra responses were not included (unlike in Brooks & Tomasello, 1999). Overall, children produced, on average, a little over one productive active transitive utterance per child (i.e., for the passively trained verb) and about one-third of one productive passive utterance per child (i.e., for the actively trained verb). There were thus productive responses to about 15% of the elicitation questions overall. Children produced about double that number of non-productive utterances, i.e., active utterances in response to active models and passive utterances in response to passive models (but with new NPs).

The data from Fig. 1 were subjected to a 2 (model type: active, passive) × (response type: active, passive) ANOVA. There were no main effects, but there was a significant interaction, $F(1,17) = 8.15, p < 0.01$. The interaction was such that in response to the active models children produced more active than passive utterances ($p < 0.02$, Fischer LSD), whereas in response to the passive models they produced equal numbers of active and passive utterances. Almost all of children’s passive utterances came in response to neutral and patient focused questions (almost 90%), whereas almost all of children’s active utterances came in response to neutral and agent focused questions (almost 90%). Children were marginally more productive with the active transitive than with the passive construction ($p < 0.10$, Fischer LSD).

The German children in the current study talked much less than did the American children in the study of Brooks & Tomasello (1999), by several orders of magnitude. But virtually all this extra talk by the American children was non-productive utterances, that is,
active utterances in response to active models and passive utterances in response to passive models. Thus, the American children also averaged less than one productive utterance per child for each verb (about 0.8 utterance each). The most natural comparison, then, is simply to compare the proportion of children in each of the studies who were productive with at least one active and/or passive utterance. Figure 2 presents these comparisons.

**Figure 1**  Average number of passive and active transitive utterances as a function of model type in Study 1

**Figure 2**  Percentage of children producing at least one productive passive or active transitive utterance in German (Study 1) and in English (Brooks & Tomasello, 1999); children in both studies were about 2.9
proportions. It can be seen that an almost identical proportion of German-speaking and English-speaking children were productive with the active transitive construction (about one-third), whereas a higher proportion of the English-speaking children were productive with the passive construction (40% to 17%). Chi-square analyses, using frequencies of children, revealed that neither of these differences was statistically reliable (although the difference for passives approached significance, $\chi^2 = 3.00, N = 44, p < 0.10$). This supports the general proposal that approximately equal numbers English-speaking and German-speaking children are productive with these two basic syntactic constructions: between about 20% and 40% of all these nearly-3-year-old children in all cases.

Discussion

A significant minority of German-speaking children nearing their third birthdays have begun to create abstract and verb general syntactic constructions. In the current study just under one-fifth of children at this stage produced one or more instances of a passive construction with a verb they had never before heard in that construction; just over one-third of the children were productive with the active transitive construction. This finding for the passive accords well with a case study of a German-speaking child (Abbot-Smith & Behrens, forthcoming). They found that this child became productive – as assessed by three criteria of productivity for use with naturalistic data – with both the werden passive (as used in the current study) and the sein passive during the period from 2.5 to 3 years of age.

When these figures were compared with those of Brooks’ & Tomasello’s (1999) similar study of English-speaking children, the overall level of productivity was found to be quite similar, with similar proportions of children being productive with active transitives and with slightly more American children being productive with passives. More generally, when these results are compared with the meta-analysis reported by Tomasello (2000), which concerned almost exclusively English-speaking children’s use of the active transitive, the German children fall right in the middle for children of this age.

German-speaking children’s level of productivity with the active transitive and passive constructions thus seems to be similar to that of children speaking English (and perhaps other word order languages). And so in terms of whole sentence-level constructions, case marking – at least of the German kind – does not seem to significantly facilitate children’s creation of sentence-level abstractions. In this meaning of ‘local cues’, they do not seem to make a huge difference as compared with more distributed cues such as English-style word order. Nevertheless, it may still be true that case markers provide easily processable local cues at the level of the words/phrases they are attached to, and that children speaking case-marking languages might be productive with the case markers themselves – as morphological markers at the level of the word/phrase – relatively early in development. If this were true, it would suggest that German 3-year-olds’ difficulties in creating sentence-level abstract constructions does not derive from their inability to identify the case of individual noun phrases, but rather from the same source as for English-speaking children, namely, the difficulty of establishing analogies across complex relational predications such as whole sentences. It may be that to construct categories across simpler non-relational linguistic
items, such as NPs, is simpler. Studies 2 and 3 were designed to investigate this possibility.

STUDY 2: NOMINATIVE AND ACCUSATIVE CASE MARKING

This study investigated German-speaking children's productivity with nominative and accusative case markers. That is, we taught children a novel noun in conjunction with a definite determiner in one of these cases, and then attempted to elicit that noun in conjunction with a definite determiner in the other case. Because the children in this study only needed to process individual words/phrases (i.e., NPs), the hypothesis was that they would be productive at an earlier age than children in the first study who had to create analogies across utterances using particular configurations of nominative and accusative case marking.

Method

Participants

Forty-eight children (24 girls and 24 boys) participated in this experiment, divided into two age groups: 24 2.5-year-olds (9 girls and 15 boys, mean age 2;7, range 2;5–2;9) and 24 3-year-olds (15 girls and 9 boys, mean age 3;1, range 2;10–3;3). The children were thus slightly younger and slightly older than those of the first study – about 3 months in either direction. The children were recruited and tested at several kindergartens in Leipzig, Germany. Twenty-three additional children were excluded from the analysis because they either failed to complete the study (11 children) or they completed the study but did not use determiners with either familiar nouns or the novel nouns (4 children), did not use the novel nouns (5 children), were bilingual (1 child), or an experimenter error occurred (2 children).

Materials and design

Four novel masculine nouns (Doso, Pebo, Divu, Tomu) were used to label four novel objects (two objects and two puppet characters). All nouns were bi-syllabic; two nouns ended in -ö and the other two in -u, because these are atypical vowel endings for German masculine nouns. Atypical endings were chosen because the nouns should not sound like nouns children might already know (in this case children might 'mistake' the novel noun plus determiner combinations for forms they already know). Each child learned each of the four nouns: two of the nouns were introduced with accusative case marking (accusative models), and the other two with nominative case marking (nominative models).

Children were tested on their ability to produce the type of case marking they had not heard. Thus, when presented with accusative models, they were tested on their ability to produce nominative marking. The accusative models for one of the nouns contained transitive verbs as case assigners (schieben ‘push’ and ziehen ‘pull’, e.g., Der Clown schiebt den Pebo ‘The clown is pushing the pebo’, henceforth ‘Nominative target (verb) condition’), and for the other noun directional prepositions (auf ‘onto’ and
vor ‘in front of’, e.g., Der Clown hüpf auf den Pebo ‘The clown is jumping onto the pebo’, henceforth ‘Nominative target (preposition) condition’ as case assigners. For both nouns, children were tested on their ability to produce nominative case marking in a presentational construction (Hier ist der Pebo ‘Here is the pebo’). Similarly, when presented with nominative models, children were tested on their ability to produce accusative case marking. The nominative models for both nouns included presentational constructions (e.g., Hier ist der Doso ‘Here is the doso’) and constructions using the intransitive, reflexive verb sich drehen ‘to turn’ (e.g., Der Diwu dreht sich ‘The diwu is turning’). Children were tested on their ability to produce accusative marking with two types of case assigners: for one noun with the transitive verb schieben ‘push’ (e.g., Der Clown schiebt den Doso ‘The clown is pushing the doso’, henceforth ‘Accusative target (verb) condition’), and for the other with the directional preposition auf ‘onto’ (Der Clown hüpf auf den Diwu ‘The clown is jumping onto the diwu’; henceforth ‘Accusative target (preposition) condition’). The verbs and prepositions used in these elicitations are typically part of the vocabulary of young German-speaking children (Augst 1984; Grimm 1975).

The four conditions were counterbalanced for order across participants. For each participant, the four novel objects were randomly assigned to the four conditions. Table 1 describes the training conditions and the targets of elicitation.

Procedure

Children were seen individually in a separate room in their kindergarten. Sessions took about 15 minutes for each child, including a warm-up session with talk employing familiar feminine or neuter (not masculine) nouns with their determiners. The sessions were audio- and video-taped and a live handwritten log was kept of the children’s utterances. One female experimenter was the main interactant with the child, and another one recorded the sessions and kept track of the number of models given, noted down all utterances in which children used the novel nouns, asked the test questions (see below) and also occasionally provided linguistic models. Back in the lab, the recordings were used to check (and, if necessary, correct) the codings that had been done on-site.

Each of the novel nouns was first introduced in a presentational construction with the indefinite determiner (e.g., Das ist ein Doso ‘This is a doso’). Then the child was presented with about 16 models for each novel noun. To familiarize children with the novel noun forms, they were asked to repeat each novel noun-determiner combination about four times during these models, either by itself (E asked: Kannst du das sagen: Der Doso? ‘Can you say that: the doso’), or as part of a model (Kannst du das sagen: Der Doso dreht sich? ‘Can you say that: the doso is turning?’).

Children were tested in the following way. First, the experimenter referred to a relevant event by using a whole sentence containing a familiar noun phrase in the place where the novel noun would need to go later (children who seemed to need it were given two of these). Crucially, the determiner for the critical noun never contained the target case marking, that is, the noun was a familiar feminine or neuter, never a masculine, noun. Then E performed the same action on a different object (again, the noun being feminine or neuter) and prompted the child to describe the event (Und jetzt? ‘And now?’). If the child did not answer, E started the sentence, but
never went further than uttering the case assigner (verb or preposition), thus allowing the child to fill in at least the noun phrase. For the actual test, E then continued in the same way with one of the novel objects (e.g., she made the clown push the doso, prompted the child to describe this event, and then began the sentence herself if the child did not answer immediately). Finally, after the test children experienced the same procedure with a familiar masculine noun, to see if they could provide the appropriate case inflection with nouns that they had heard before in this case.

An utterance was coded as productive if it contained a full noun phrase including the novel noun and an appropriately inflected determiner (e.g., in one of the accusative target conditions, *den Doso* 'the doso'). In the accusative target conditions, cliticized determiners such as ‘*n Doso* were also counted.

### Results

Since our main interest was to assess productivity with nominative and accusative case marking, the main analysis collapsed over type of case assigner. Table 2 presents the
Table 2  Mean number of productive answers (and standard deviations), as a function of condition and age group (out of 2) in Study 2

<table>
<thead>
<tr>
<th>Age group (years)</th>
<th>Condition</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Nominative target</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.5</td>
<td>0.83 (0.76)</td>
<td>1.21 (0.66)</td>
<td></td>
</tr>
<tr>
<td>3.0</td>
<td>0.92 (0.88)</td>
<td>1.25 (0.75)</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>0.88 (0.82)</td>
<td>1.23 (0.70)</td>
<td></td>
</tr>
</tbody>
</table>

Table 3  Number of children productive with case marking, as a function of condition and age group (out of 2) in Study 2

<table>
<thead>
<tr>
<th>Age group (years)</th>
<th>Condition</th>
<th></th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Nominative target</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Verb model</td>
<td>10</td>
<td>16 (3)</td>
<td>13 (3)</td>
</tr>
<tr>
<td>Preposition model</td>
<td>10</td>
<td>16 (1)</td>
<td>14 (4)</td>
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<tr>
<td>Verb case assigner</td>
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<tr>
<td>Prep. case assigner</td>
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</table>

Note. N = 24 in each cell; the number of utterances in which the definite determiner was cliticized are given in brackets.

mean number of productive answers for nominative and accusative case marking. A 2 (case marking: nominative, accusative) × (age: 2.5-, 3.0-year-olds) ANOVA on the mean number of productive uses of case revealed a significant effect for case ($F(1,46) = 5.23, p = 0.027$), such that children were more productive with the accusative than with the nominative. There was no difference between the different ages, and no interaction between case and age.

In terms of individual children, from 8 to 16 children out of 24 were productive in the various conditions, again with no large age differences (see Table 3). For purposes of comparison with Study 1, which was focused on sentence-level constructions, the conditions with a verb case assigner are most appropriate. In this case, 42% of the 2.5-year-olds (10) were productive with the nominative and 67% (16) with the accusative; 58% of the 3-year-olds (14) were productive with the nominative and 67% (16) with the accusative. Because the age of children in Study 1 fell in the middle of the age range in this study, if we sum across the two ages, the overall figures are 50% of the
children (24) were productive with the nominative and 67% with the accusative (32). This is as compared with under one-third of children in the first study who were productive with one or another type of sentence-level construction. Type of case assigner (verb vs. preposition) had no significant effects on the number of productive children (all four Cochran’s Qs non-significant).

In the final test question with a familiar masculine noun, 35 out of the 48 children produced a nominative inflection at least once (19 2.5-year-olds and 16 3-year-olds), and 43 children produced an accusative inflection at least once (20 2.5-year-olds and 23 3-year-olds). This demonstrates that when children knew the appropriate forms ahead of time they could produce them in this task.

Discussion

Half of the 2.5- to 3-year-old children in this study used the nominative form of the German definite determiner productively with a novel noun to mark its syntactic role (case). Two-thirds of the children used the accusative determiner productively, leading to significantly better performance than with the nominative. There were no large age differences in the productive use of either determiner, nor was there any significant difference in performance as a function of the syntactic contexts used for introducing the forms (case assigners).

The finding that children were better with the accusative than with the nominative is surprising in the light of the fact that in their spontaneous speech young German-speaking children use nominative determiners earlier and more frequently than others (Clahsen, 1984; Mills, 1985). It is possible that this reflects the real state of affairs in the world. It might be, for example, that the ambiguity of the masculine nominative definite determiner with the feminine dative definite determiner causes children problems (the masculine accusative definite determiner is ambiguous only with plural forms). The use of clitics for accusative definite determiners might also make them easier. But it is also possible that the difference derives from certain specifics of the experimental procedure. Thus, the sentence frame used to elicit the nominative form at test was a presentational construction (Hier ist … ‘Here is …’), which is more often used with an indefinite determiner (‘Here is a …’), and indeed a number of the children used indefinite determiners at test in the nominative target conditions but not in the accusative target conditions.

In any case, the main finding is that German-speaking children from 2.5 to 3 years of age are overall quite productive with nominative and accusative case marking: half and two-thirds of the children, respectively. Only about one-third and one-fifth of children were productive with active transitive and passive constructions in Study 1, even though they use exactly these two case forms. This would suggest that being productive with all the local cues of case marking involved in a particular construction is not sufficient by itself to lead automatically to productivity with that construction as a whole. This proposal will be discussed further in the general discussion section.

The nominative and accusative forms of the definite determiner are both relatively frequent in the language that German-speaking children hear. An interesting further question, therefore, is how these compare with a less frequent form of the definite determiner, namely, the dative. This form is used for indirect objects in sentence-level
constructions such as the ditransitive (X-nom gives Y-dative the Z-acc), and it is also
used to mark the object of some prepositions. In their spontaneous speech, children
use the nominative and accusative earlier than the dative (Clahsen 1984; Mills 1985;
Tracy 1984). An interesting question, therefore, is whether children would also have
more difficulties with the less frequent dative form in our nonce noun paradigm.
Testing the dative in comparison with the nominative would also enable investigation
of the possibility that children can ‘get to’ the nominative definite determiner more
easily from the dative than from the accusative as in Study 2.

STUDY 3: NOMINATIVE AND DATIVE

In a third study we assessed children’s productivity with the dative and, as a
comparison, again with the nominative (providing a partial replication of Study 2). We
used the same methods and procedures as in Study 2, except for the stimulus
materials. As in Study 2, two types of case assigners (verb and preposition) were used
in the linguistic models and target constructions. Again, the main question was the
age at which children would be productive with these two case markers.

Method

Participants
Forty-eight children (32 girls and 16 boys) participated in this experiment, divided into
two age groups: 24 2.5-year-olds (19 girls and 5 boys, mean age 2;7, range 2;4–2;8)
and 24 3-year-olds (13 girls and 11 boys, mean age 3;0, range 2;10–3;2). The children
were recruited and tested in the same basic way as in Study 2. Thirty-one additional
children were excluded because they either failed to complete the study (17), or they
did not use determiners with either familiar nouns or the novel nouns (5), did not use
the novel nouns (7), or were subject to experimenter error (2).

Materials and design
The same four novel noun forms (Doso, Pebo, Diwu, Tomu) as for Study 2 were used
for Study 3. Unlike Study 2, in Study 3 the novel objects were all animate puppet
characters. The same design and procedure was used as for Study 2, except that Study
3 tested children’s productivity with the dative instead of the accusative. All accusative
case assigners were therefore replaced by dative case assigners. Table 4 gives an
overview of the types of linguistic models and test sentences.

Procedure
The procedure was the same as for Study 2, except that in the introductory sentences
the critical nouns were always feminine and not neuter because the dative of the
neuter is homonymous with the dative of the masculine. The locative prepositions
used were auf ‘on’ and vor ‘in front of’; they are part of German children’s early
vocabulary (Grimm, 1975). Verbs assigning the dative are not so common in young
children’s speech, but based on a search of two longitudinal databases the most
frequent such verbs were *geben* 'give' and *zeigen* 'show', and so these were the verbs used as case assigners for the dative in Study 3.

In terms of scoring responses, the dative presented special problems, mainly because dative and accusative inflections are acoustically not easily discriminable, and also children sometimes overgeneralize the accusative to dative contexts. Compounding the problem, in the dialects spoken in the Leipzig area even adult speakers sometimes use accusative inflections in supposedly dative contexts (Baumgärtner, 1959). This tendency was confirmed by an informal survey conducted with 5 adult dialect speakers from the Leipzig area. When asked to complete sentences containing the case assigners that had been used in Study 3 (*auf* 'on' + dative, and *geben* 'give'), they almost exclusively used the determiners as clitics, the majority of which were indiscriminable forms, that is, it was not possible to determine whether dative or accusative inflections had been used. So, if children hear accusative (or some indiscriminable form) in contexts requiring the dative, it should not surprise us when they do the same in their spontaneous speech. We therefore scored children's

Table 4  Models and targets in the four experimental conditions of Study 3

<table>
<thead>
<tr>
<th>Condition</th>
<th>Models</th>
<th>Targets</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominative target (verb)</td>
<td>a. <em>Der Clown zeigt es dem X.</em>  'The clown is showing it to the X.'</td>
<td><em>Hier ist der X.</em>  'Here is the X.'</td>
</tr>
<tr>
<td></td>
<td>b. <em>Der Clown gibt es dem X.</em>  'The clown is giving it to the X.'</td>
<td></td>
</tr>
<tr>
<td>Nominative target (preposition)</td>
<td>a. <em>Der Clown sitzt auf dem X.</em>  'The clown is sitting on the X.'</td>
<td><em>Hier ist der X.</em>  'Here is the X.'</td>
</tr>
<tr>
<td></td>
<td>b. <em>Der Clown sitzt vor dem X.</em>  'The clown is sitting in front of the X.'</td>
<td></td>
</tr>
<tr>
<td>Dative target (verb)</td>
<td>a. <em>Hier ist der X.</em>  'Here is the X.'</td>
<td><em>Der Clown gibt es dem X.</em>  'The clown is giving it to the X.'</td>
</tr>
<tr>
<td></td>
<td>b. <em>Der X dreht sich.</em>  'The X is turning.'</td>
<td></td>
</tr>
<tr>
<td>Dative target (preposition)</td>
<td>a. <em>Hier ist der X.</em>  'Here is the X.'</td>
<td><em>Der Clown sitzt auf dem X.</em>  'The clown is sitting on the X.'</td>
</tr>
<tr>
<td></td>
<td>b. <em>Der X dreht sich.</em>  'The X is turning.'</td>
<td></td>
</tr>
</tbody>
</table>

Note. The neuter pronoun *es* 'it', which was always used together with the ditransitive verbs *geben* 'give' and *zeigen* 'show', was used to refer to the transferred object (e.g., *das neuter Flugzeug* 'the airplane', *das neuter Auto* 'the car'). See Drenhaus (2000) for evidence that children are familiar with the order: pronoun as direct object followed by full noun phrase as indirect object.
Results

Since our main interest was again to assess productivity with case marking, the main analysis collapsed over type of case assigner. Table 5 presents the mean number of productive answers for nominative and dative case marking – conservative scoring. A 2 (case marking: nominative, dative) × (age: 2.5-, 3.0-year-olds) ANOVA on the mean number of productive uses of case revealed a significant effect for case ($F(1,46) = 23.05, p < 0.001$), such that children were more productive with the nominative than with the dative case. There was also a difference due to age ($F(1,46) = 6.66, p < 0.05$), but no interaction between age and case.2

In terms of individual children, again using the conservative scoring for the dative, from 2 to 19 children out of 24 were productive in the various conditions (see Table 6). For purposes of comparison with Study 1, which was focused on sentence-level constructions, the conditions with a verb case assigner are most appropriate. In this case, 42% of the 2.5-year-olds (10) were productive with the nominative but only 8% (2) with the dative; 67% of the 3-year-olds (16) were productive with the nominative but only 33% (8) with the dative. If we sum across the two ages, the overall figures are 54% of the children were productive with the nominative and only 21% with the dative. Type of case assigner (verb vs. preposition) had no significant effects on the number of productive children (all four Cochran's Qs non-significant). Using the more lenient scoring criteria for datives (in parentheses in Table 6), 29% of the 2.5-year-old children (7) and 63% of the 3-year-old children (15) were productive with the dative – a significant effect of age ($p < 0.05$, Cochran's Q).

In the final test question with a familiar masculine noun, 42 out of the 48 children produced a nominative inflection at least once (18 2.5-year-olds and 24 3-year-olds),

Table 5  Mean number of productive answers (and standard deviations), as a function of condition and age group (out of 2) in Study 3

<table>
<thead>
<tr>
<th>Age group (years)</th>
<th>Condition</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Nominative target</td>
<td>Accusative target</td>
</tr>
<tr>
<td>2.5</td>
<td>1.00 (0.93)</td>
<td>0.38 (0.80)</td>
</tr>
<tr>
<td>3.0</td>
<td>1.46 (0.72)</td>
<td>0.75 (0.76)</td>
</tr>
<tr>
<td>Total</td>
<td>1.23 (0.86)</td>
<td>0.56 (0.81)</td>
</tr>
</tbody>
</table>

Note. The mean number of productive answers in the Dative target condition using the conservative scoring criterion; analysis using the more generous scoring criterion is given in Note 2.
and 42 children produced a dative inflection, lenient criterion, at least once (19 2.5-year-olds and 23 3-year-olds). This demonstrates that when children knew the appropriate forms ahead of time they could produce them in this task.

**Discussion**

With regard to the nominative definite determiner, the results of this study replicate those of Study 2 for the younger children; about half of the 2.5-year-olds were productive. However, the 3-year-olds were much more productive with the nominative in this third study. Because the eliciting conditions at test were identical in the two studies, the explanation for this difference must lie in the exposure conditions. Specifically, 3-year-old children find it easier to ‘get to’ the nominative from the dative than from the accusative. One possible reason for this is that in everyday speech the prepositions vor and auf are used most commonly with the dative (as in Study 3) not with the accusative (as in Study 2); children may thus have been more sure of themselves in identifying the case and gender of the determiner in the exposure conditions of the third study. Related to this, if children in Study 2 were not sure if Doso was singular or plural, they could not identify the gender of this novel word (since the masculine accusative is ambiguous with some plural forms, which are the same in all genders); this was not an issue with the datives in the exposure conditions of Study 3.

With regard to the dative, strictly accurate productive use was significantly worse than with the nominative. This is not surprising since children hear and use it less often (Clahsen, 1984; Mills, 1985). Another issue is that the masculine dative is also the neuter dative (dem), which means that we may be overestimating children’s productivity with this marker. But of course all of this is complicated by the fact that in the local dialect of the children we were studying, it turned out that accusative and dative forms are often conflated, and so it is very difficult to be sure in the case of the dative exactly what children do and do not know.

---

**Table 6** Number of children productive with case marking, as a function of condition and age group (out of 2) in Study 3

<table>
<thead>
<tr>
<th>Age group (years)</th>
<th>Condition</th>
<th>Nominative target</th>
<th>Dative target</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Verb model</td>
<td>Preposition model</td>
<td>Verb case assigner</td>
</tr>
<tr>
<td>2.5</td>
<td>10</td>
<td>14</td>
<td>2 (7)</td>
</tr>
<tr>
<td>3.0</td>
<td>16</td>
<td>19</td>
<td>8 (15)</td>
</tr>
</tbody>
</table>

Note. N = 24 in each cell. The number productive children if a lenient scoring criterion is used in the Dative target conditions are given in brackets.
Our main conclusions from this study are therefore: (1) children showed a bit more productive control over the nominative definite determiner than they evidenced in Study 2, seemingly finding it easier to get to the nominative from the dative than from the accusative; and (2) children showed less productive control over the dative definite determiner, although a number of ambiguities in the language (especially the local dialect) make this very difficult to assess precisely.

GENERAL DISCUSSION

As they approach their third birthdays, many German-speaking children are in the process of becoming productive with sentence-level syntactic constructions. In the current study, over one-third of the children in this age range were productive with the active transitive construction, in the sense that they could use a verb heard only in a passive utterance to create novel active transitive utterances. About one-fifth of the children in this age range were productive with the passive construction, in the sense that they could use a verb heard only in an active transitive utterance to produce novel passive utterances. German-speaking children’s level of productivity with the active transitive construction is thus very similar to that of English-speaking children with ‘the same’ construction, and their level of productivity with the passive is also the same, or perhaps a bit lower (see Brooks & Tomasello, 1999; Tomasello, 2000). It is therefore not the case that children learning case marking languages – at least not of the German variety with the case marking on determiners – are at a significant advantage in creating sentence-level abstract constructions. Although of course each language has its own peculiarities, generally supportive data for this proposal come from nonce verb studies of Hebrew (Berman, 1993) and Russian (Dodson & Tomasello, 1998).

It is not clear, however, that Slobin’s local cues hypothesis should be expected to apply to whole sentence-level constructions as linguistic Gestalts. Indeed, in the second and third studies reported here, German-speaking children were very productive with case marking at the level of individual nouns and noun phrases. Although they struggled to some degree with the dative, that is understandable as this case morpheme is not so frequent in children’s experience and is easily confusable with other case markers. On the other hand, across the two studies more than half the 2.5- to 3-year-old children were productive with the nominative case marker in the sense that they used the masculine nominative determiner with a novel noun they had only heard used with a determiner in some other case. An even higher percentage of children, about two-thirds, were productive in this same sense with the accusative marker. And so something in the neighborhood of double the number of children were productive with nominative and accusative case markers as with active transitive and passive sentence-level constructions, the relational structure of which is indicated mainly by these very same case markers.

That this finding is not a fluke is indicated by somewhat similar findings of Wittek & Tomasello (2002) for a very different set of grammatical structures. In that study, young German-speaking children were extremely good at supplying the past participle productively for novel verbs (about two-thirds of the children at 2.5 and 3.5 years). But using the German present perfect tense in a sentence requires children to choose one
of two appropriate auxiliaries (based mainly on verb semantics) in combination with this past participle and to place both of these in their appropriate sentential positions (second position and sentence final position, respectively). In this case, only between one-quarter and one-half of the children could form the full present perfect tense using a novel verb in a sentence. Wittek and Tomasello (2001) argue that this kind of distributed (discontinuous) construction creates various kinds of processing difficulties which may overshadow the relative simplicity of each of the local cues involved.

One could thus argue something very similar with respect to the current studies, namely, that although the nominative and accusative case markers are each relatively easy for German-speaking children to learn – because they are relatively frequent and consistent local cues (as compared with the dative, for example) – sentence-level constructions that make use of these markers in some particular way (e.g., active transitive and passive constructions on the level of the sentence) are complex linguistic symbols with their own properties and must be learned in their own right (Goldberg, 1995). This does not mean that knowing the case markings involved does not help the learner. It might very well be that a German-speaking child who had productive control over the nominative and accusative case markers would construct abstract passive and active transitive sentence-level constructions more quickly than a child who did not; control of case marking may indeed be part of the ‘constructional conspiracy’ involved in creating abstract syntactic constructions of this kind (Abbot-Smith & Behrens, forthcoming). The main point is that knowing the pieces is not by itself sufficient to know the whole. We would thus propose a modification to Slobin’s local cues hypothesis to the effect that the local cues help locally – with issues of cue validity and reliability playing a crucial role (Bates & MacWhinney, 1989) – and that in some cases such as plural and past tense marking in English that is all. But sentence-level syntactic constructions that rely on a unique configuration of local cues still require additional acquisitional work.

As a related point, it should perhaps be noted that in English, which has no case markers for lexical nouns, it is still the case that children learn frequent and consistent nominal and verbal morphology, such as the plural -s and present progressive -ing, quite early relative to their mastery of abstract sentence-level constructions (Akhtar & Tomasello, 1997). And so perhaps an important part of the picture, in addition to the notion of distributed constructions, concerns the abstraction processes involved. The point is simply that it is one thing to categorize a set of simple linguistic items, each with a single coherent function (with the category being based on some commonality of function), but it is quite another to categorize a set of multi-morpheme utterances each with its own internal relational complexity (such as different instantiations of the passive construction). Basically, categorization in this more complex case is better thought of as analogy (Tomasello, 2003), and it is more complex than categorization of single items for many obvious reasons, as evidenced by the fact that young children are much more skilful at categorizing items than at making analogies across complex relational structures (Gentner & Markman, 1997). The current findings thus provide important facts about some factors that contribute to the relative ease and difficulty that children experience in creating linguistic abstractions of different kinds.

The literature contains some data on the spontaneous speech of children learning a wide variety of languages (Slobin, 1985, 1992, 1997), and also a fair number of
experimental studies of children learning quite a wide variety of languages, mainly in terms of their comprehension of known words and constructions (e.g., see reviews in Bates & MacWhinney, 1989; Slobin, 1982). But there are very few studies of languages other than English specifically directed at the issue of productivity – the abstractness of children’s linguistic constructions at different ages – which require special methodologies such as nonce words and structural priming. The current study represents an attempt to learn more about how children make their linguistic abstractions in languages other than English, and the very general proposal is that to do this we need to distinguish between local cues that act locally and those that contribute to a larger constructional whole in a more distributed fashion.

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NOTES

1. The data were from the Kerstin-corpus (Miller, 1976) and the Leo-corpus of the Max-Planck-Institute for Evolutionary Anthropology in Leipzig, Germany.
2. A second analysis using the more generous scoring criteria found no effect for case, but an effect of age ($F(1,46) = 5.24, p = 0.027$), such that older children were better than younger children.

REFERENCES


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