

Journal of Child Language

<http://journals.cambridge.org/JCL>

Additional services for *Journal of Child Language*:

Email alerts: [Click here](#)

Subscriptions: [Click here](#)

Commercial reprints: [Click here](#)

Terms of use : [Click here](#)



German children's productivity with tense morphology: the *Perfekt* (present perfect)

ANGELIKA WITTEK and MICHAEL TOMASELLO

Journal of Child Language / Volume 29 / Issue 03 / August 2002, pp 567 - 589

DOI: 10.1017/S0305000902005147, Published online: 22 July 2002

Link to this article: http://journals.cambridge.org/abstract_S0305000902005147

How to cite this article:

ANGELIKA WITTEK and MICHAEL TOMASELLO (2002). German children's productivity with tense morphology: the *Perfekt* (present perfect). Journal of Child Language, 29, pp 567-589 doi:10.1017/S0305000902005147

Request Permissions : [Click here](#)

German children's productivity with tense morphology: the *Perfekt* (present perfect)*

ANGELIKA WITTEK AND MICHAEL TOMASELLO

Max-Planck-Institute for Evolutionary Anthropology, Leipzig

(Received 19 May 2000. Revised 24 June 2001)

ABSTRACT

Two nonce-word studies examined German-speaking children's productivity with the *Perfekt* (present perfect) from 2;6 to 3;6. The German *Perfekt* consists of the past participle of the main verb and an inflected form of an auxiliary (either *haben* 'have' or *sein* 'be'). In Study 1, nonce verbs were either introduced in the infinitival form, and children (seventy-two children, aged 2;6 to 3;6) were tested on their ability to produce the *Perfekt*, or introduced in the *Perfekt*, and children were tested on their ability to produce the infinitive. In Study 2 twenty-four children aged 3;6 were given the past participle form of nonce verbs to see if they could supply the appropriate auxiliary (based mainly on verb semantics). The results were that many children as young as 2;6 used past participles productively (more than used infinitival forms productively), but all children had much difficulty in supplying both auxiliaries appropriately. The current findings suggest that mastery of the *Perfekt* construction as a whole does not take place before the age of four and that frequency of exposure is an important factor in determining the age at which children acquire grammatical constructions.

INTRODUCTION

Tense morphemes are grammaticalized forms that express the location of an event in time (cf. Comrie, 1985). Tense morphemes locate the time of an event on the time axis in relation to some other time span (most typically the

[*] We are grateful to the Leipzig kindergarten directors, teachers, parents and the children who were willing to participate in the study. For excellent assistance with the project including serving as experimenters we would like to thank Katharina Haberl (who coordinated the research), Jana Jurkat, Angela Loose, Susanne Mauritz, Antje Paulsen, Kirsten Smith, Susanne Strassberger. Thanks to Josep Call for helping with the statistics. Thanks also to Heike Behrens, Holger Diessel, Michael Israel, Elena Lieven, Kirsten Smith, Angeliek van Hout, and two anonymous reviewers for helpful comments on earlier versions of this paper. All remaining interpretations and errors are, of course, ours. Address for correspondence: Angelika Wittek/Michael Tomasello, Max-Planck-Institute for Evolutionary Anthropology, Inselstr. 22, 04103 Leipzig, Germany. e-mail: wittek@eva.mpg.de/tomas@eva.mpg.de

time of the utterance), for example, we can talk about events before, while, or after they happen. One important question for developmental psycholinguists is when children have productive command of tense morphemes.

This study is concerned with the German *Perfekt* (present perfect), the preferred way to express past time in conversational German (e.g. *Gestern hat der Papst gelacht* 'Yesterday has the pope laughed', i.e. Yesterday, the pope laughed). The *Perfekt* is – unlike past time expressions in languages such as English – a composite form, consisting of the past participle of the main verb and an inflected form of the auxiliaries *haben* 'have' or *sein* 'be'.

The past participle is typically formed by prefixing the verb stem with *ge-*, and by adding a suffix: *-t* for 'regular' or 'weak' verbs (e.g. *lachen* 'laugh' → *gelacht* 'laughed'), and *-en* for 'irregular' or 'strong' verbs (e.g. *laufen* 'walk' → *gelaufen* 'walked', Duden, 1984). The verbs *haben* 'have' and *sein* 'be' are highly frequent auxiliaries and are both conjugated in highly irregular ways. Productivity with this construction thus requires more than one generalization.

In some theories, *-t* participle suffixation is considered to be rule-based (i.e. speakers should apply this suffix productively when encountering novel verbs), whereas strong participle forms should be stored in memory, see Clahsen (1997) for evidence in favour of this position. This issue is highly controversial, however, see Marchman (1997) and Lindner (1998) for discussion.

There is evidence that around their second birthdays German-speaking children use *Perfekt* forms in their spontaneous speech (Szagun, 1976, 1979; Behrens, 1993). Children typically start off with using the past participle only, but shortly after that they use the auxiliary, that is, they use full *Perfekt* forms. It is important to know, however, whether children who use *Perfekt* forms simply mimic the forms they hear in the input, without being aware of their internal structure, or whether they have developed some more abstract schema which they productively apply.

Thus, it has been observed (see Behrens, 1993) that some German-speaking children aged 2;0 already use the same verb roots with various types of tense marking, suggesting that these children have indeed analysed the forms into verbs and tense markers. And yet, since these are naturalistic data, it is still possible that children might only be able to produce those *Perfekt* forms that they have heard adults using, that is, that they do not have the ability to generate *Perfekt* forms productively.

One way to measure productivity is experiments with novel words (cf. Berko, 1958). In a few studies the novel verb technique has been employed to test English- and Spanish-speaking children's productivity with tense marking. Their results suggest that children in both languages become productive with past tense marking around 3;0 (see Olguin & Tomasello, 1993, and Akhtar & Tomasello, 1997, for English; and Perez-Periera, 1989,

for Spanish), with a fair amount of individual variability. Several studies have addressed German-speaking children's acquisition of verb inflections using paradigms with novel verbs (e.g. Weyerts & Clahsen, 1994), but these studies were mainly concerned with children's mastery of regular vs. irregular past participle formation, and not with the question of when children start to use tense forms productively. The youngest children in Weyerts & Clahsen's (1994) study who produced past participles productively were 3;10.

In the current study we used the novel verb technique to investigate German-speaking children's (age range 2;4–3;6) productivity with tense marking in *Perfekt* and infinitival constructions. Children were taught novel verbs as labels for novel actions. The novel verbs were either introduced only in the infinitival form (*Der Elefant kann auf der Brücke mieken!* 'The elephant can miek on the bridge'), or only with the *Perfekt* marking (*Der Clown ist auf das Kissen getammt* 'The clown has tammed onto the pillow', i.e. The clown tammed onto the pillow) and children were tested on their ability to produce the form they had not heard. We expected that children who were productive with tense marking would be able to provide the appropriate tense markers, even though they had never heard the given verb together with this marker.

The novel actions included situations with and without a natural endpoint. This is because the results of existing work on tense(-aspect) marking in child language suggest that children initially might generalize particular tense markers only to particular semantic classes of verbs. It has been observed that children initially use past time marking predominantly with verbs used to describe situations with a natural terminal point (e.g. verbs specifying state changes like *break*), and present or progressive marking with verbs specifying inherently unbounded situations (like *dance*) (cf. Antinucci & Miller, 1976, for English and Italian, Behrens, 1993, for the earliest stages in German).¹

Since in this study children did not provide auxiliaries very often, in a second study children's ability to choose the appropriate auxiliary (*haben*

[1] Bloom L., Lifter, K. & Hafitz, J. (1980) (among others) have hypothesized that the reason why children tend to use the past tense marker on verbs that refer to state changes, rather than on state or activity verbs, is that the latter do not refer to events resulting in a present state. This hypothesis is based on the observation that children prefer to talk about the here-and-now and are often unable to present events from a viewpoint other than their own (cf. Piaget, 1946). More generally, Bloom *et al.* (1980) hypothesized that when children first begin to use inflections, they will tend to use them with verbs whose inherent semantics appears most compatible with the meaning of the inflection ('Aspect-Before-Tense' Hypothesis, see also Bronckart & Sinclair, 1973, and Antinucci & Miller, 1976). However, the results of several studies suggest that tense and aspect marking emerge simultaneously (see Behrens, 1993, and references; Weist, R. M., Wysocka, H., Witkowska-Stadnik, K., Buczowska, E. & Konieczna, E., 1984, on Polish, which has both tense and aspect markers).

'have' vs. *sein* 'be') was tested. According to Shannon (1990), auxiliary selection in German can be determined on the basis of verb semantics and transitivity. The *haben*-Perfekt is used with all transitive verbs, and with intransitive verbs that denote activities performed by an agent (like *lachen* 'laugh'). The *sein*-Perfekt is used with intransitive verbs denoting a state change (often, these are verbs with separable particles, like *umfallen* 'over-fall', i.e. fall over) or a manner of motion, when used in description for a location change (like *in das Tor rollen* 'roll into the goal'). A number of verbs can be used with both auxiliaries when they are used in different contexts. For example, *Ich habe getanzt* 'I have danced', but *Ich bin durch das Zimmer getanzt* 'I have danced through the room' (Duden, 1984: 122). The semantics of the choice of auxiliaries is thus a subtle one.

STUDY 1

METHOD

Subjects

Seventy-two children (37 girls, 35 boys) participated in this experiment, divided into 3 age groups, with about an equal number of girls and boys in each age group: Twenty four children aged 2;6 (age range 2;4–2;8, mean age 2;6), 24 children aged 3 (age range 2;10–3;2, mean age 3;0), and 24 children aged 3;6 (age range 3;4–3;8, mean age 3;6).

The children were recruited and tested at several kindergartens in Leipzig, a city in the eastern part of Germany. Fifteen additional children also served as participants in the experiment, but were excluded from the analysis, because they either failed to complete the study (7 children), or they completed the study but neither responded appropriately in the warmups (see the Procedure) nor showed productivity with any of the novel verbs (8 children).

Materials and design

Four novel intransitive verbs (*tammen*, *dupen*, *baffen*, *mieken*, see Table 1 below) were used to describe four novel actions.

Two of the novel actions involved a location change of a puppet character ('endpoint conditions', 1 and 2 in Table 1). The linguistic models were construed in favour of conceptualizing these situations as having an endpoint in that they contained directional prepositional phrases (*in die Feder* 'into the spring') or their pronominal forms (*da rein* 'there into', i.e. into it) specifying the endpoint of the movement.² In the other two actions no change was involved ('no-endpoint conditions'). The linguistic models were construed

[2] In German, the endpoint of location changes is typically not specified in the verb, but in a prepositional phrase or verbal particle (see Talmy, 1985).

TABLE 1. *Novel verbs used in Study 1, and description of the novel actions*

Situation type	Models	Description
Endpoint	1 <i>X kann auf das Kissen tammen/X ist auf das Kissen getammt</i> ‘X can tam onto the pillow’/ ‘X is tammed onto the pillow’	A cardboard ramp with a pillow at its lower end. A little toy clown is placed on top of the ramp. When being pushed, the clown makes somersaults down the ramp onto the pillow.
	2 <i>X kann in die Feder dupen/X ist in die Feder geduapt</i> ‘X can dup into the spring/X is duped into the spring’	A large spring, attached to a wooden board, with a rubber band fastened inside, at its bottom. The rubberband is pulled out and a little toy animal is fastened at its end. When the rubberband is released, the animal is catapulted into the spring.
No-endpoint	3 <i>X kann an der Schnur baffen/X hat an der Schnur gebafft</i> ‘X can baff on the cord/ ‘X has baffed on the cord’	A telephone cord, fastened on top of a big pole (table leg). A toy animal is attached to cord. When the cord is swung around the pole, the animal wobbles on the cord.
	4 <i>X kann auf der Brücke mieken/X hat auf der Brücke gemiekt</i> ‘X can miek on the bridge/ ‘X has mieked on the bridge’	A wooden bridge which slopes down to the ground. A wooden animal is placed on the bridge and walks down it in a funny way.

in favour of conceptualizing these situations as having no endpoint, i.e. they contained static prepositional phrases (e.g. *auf der Brücke* ‘on the bridge’) or their pronominal forms (*da drauf* ‘there on’, i.e. on it) specifying the location where a toy character performed an action (3 and 4 in Table 1, see Randall, van Hout, Weissenborn & Baayen, in press, for using static and directional prepositional phrases to indicate this difference of situation types).

Each child learned two of the novel verbs (one in the endpoint, and one in the no-endpoint condition) introduced in the infinitival form, and the other two verbs (again, one in the endpoint, and one in the no-endpoint condition) introduced in the *Perfekt* (see the Procedure for the details).

Procedure

Children were tested individually in two 15–25-minute sessions conducted within the span of one week. Each subject was tested in the endpoint condition in one session and in the no-endpoint condition in the other. Both variables (endpoint – no-endpoint, *Perfekt* – infinitive) were counterbalanced for order across children.

The sessions were audio- and videotaped and a live hand-written log was kept of the children’s utterances and the experimenter’s number of models. Two experimenters conducted the experiment: one of them was the main interacter with the child, the other one recorded the sessions and kept the log, i.e. kept track of the number of models, non-verbally informed the experimenter on how many models remained, noted down all utterances in which children used the novel verbs and asked the test questions (see below).

Each child learned all four novel verbs: two of the verbs (one in the endpoint, and one in the no-endpoint condition) were introduced in the infinitival form, and subjects were tested for productivity with the *Perfekt* (*Perfekt* Target condition). The other two verbs (again, one in the endpoint, and one in the no-endpoint condition) were introduced in the *Perfekt*, and subjects were tested for productivity with the infinitive (Infinitive Target condition). When the novel verb was introduced in the infinitival form, the modal *kann* ‘can’ was always used together with it (as examples for the linguistic models, see 1 and 3 below). It might seem more natural to use the 3rd person singular present (e.g. *der Elefant miekt* ‘the elephant mieks’). We decided against this, however, because the phonological form of this and the participle (*gemiekt*) are very similar (especially since children often drop the initial *ge-* of the participle, see Mills, 1985), and could thus not easily be distinguished. See also Perez-Pereira (1989: 303) for advantages of presenting novel verbs in modal verb+infinitive constructions over third person singular. When the novel verb was introduced in the *Perfekt*, the novel verb itself was introduced in its past participial form, and co-occurred either with the auxiliary *sein* ‘be’ or with *haben* ‘have’ (see 2 and 4 below). In Table 1, items 1 and 2 take *sein* ‘be’, and items 3 and 4 take *haben* ‘have’, see Helbig

& Buscha (1972: 119) for how auxiliary selection is determined. Issues of auxiliary selection will be addressed in Study 2.

The assignment of tense markers to verbs was counterbalanced across subjects. To give an example, one child might have received the following assignment of tense markers to verbs:

Linguistic models

Endpoint condition

Perfekt Target condition:

- (1) Der Clown kann auf das Kissen tammen! Der kann dadrauf tammen!
 ‘The clown can onto the pillow tam! He can there-onto tam!’
 (The clown can tam onto the pillow! He can tam onto it!)

Infinitive Target condition:

- (2) Die Maus ist in die Feder gedupt! Die ist da reingedupt!
 ‘The mouse is into the spring duped! It is there into-duped!’
 (The mouse duped into the spring! It duped into it!)

No-endpoint condition

Perfekt Target condition:

- (3) Der Bär kann an der Schnur baffen! Der kann dadran baffen!
 ‘The bear can on the cord baff! He can there-on baff!’
 (The bear can baff on the cord! He can baff on it!)

Infinitive Target condition:

- (4) Der Elefant hat auf der Brücke gemiekt! Der hat dadrauf gemiekt!
 ‘The elephant has on the bridge mieked! He has there-on mieked!’
 (The elephant mieked on the bridge! He mieked on it!)

Each subject was presented with 18 models for each novel verb. This number of models has been sufficient for learning in previous studies (see e.g. Tomasello & Brooks, 1998). The models were given in doubles or triples, with the first model containing full nominal phrases and the second or third their pronominal forms (see the examples above), accompanied by enactments of the novel actions. Children were also encouraged to act out the novel actions themselves. To keep the pragmatics of the discourse natural, we included several puppet characters for each game with which the novel actions could not be performed. Typically, before acting out, the experimenter held up a puppet character in the air and proposed to check whether the puppet is able to perform the novel action (e.g. *Schauen wir mal, ob die Schildkröte das kann*. ‘Let’s see whether the turtle can do it.’). If a puppet character was not able to perform a novel action, the corresponding linguistic model contained negation (e.g. *Oh, die Schildkröte kann nicht auf das Kissen tammen!* ‘Oh, the turtle cannot tam onto the pillow!’). Since most

of the children viewed this feature of the procedure as the aim of the game, their interest in the games could be held up throughout the experiment.

To familiarize children with the novel verb forms, they were asked to repeat each verb about three times (e.g. *Kannst du das sagen: tammen/ getammt?* 'Can you say that: tam/tammed?'). Subjects were given a chance to use each of the novel verbs productively twice, after 9 and after 18 models. To encourage children to use the novel verbs with the target tense marking, i.e. productively, the experimenter who kept the log asked a question (test question, see examples 5–8), pretending she had not seen and not heard what had just happened.

For the verbs that were introduced with the infinitival marking, the test questions pulled for the *Perfekt* (*Perfekt* Target condition, see 5a and 7a), and for the verbs that were introduced with the *Perfekt*-marking, the test questions pulled for the infinitive (Infinitive Target condition, see 6a and 8a). If a child did not respond or did not use the required verb in his or her answer, one of the experimenters started the answer for the child by successively providing the subject, the auxiliary or modal, and the prepositional phrase (indicated by slashes in the examples below). The child could then fill in the rest of the sentence, i.e. at least the required form of the verb (the b versions of 5 to 8).

Test questions

Endpoint condition

Perfekt Target condition:

- (5) a Was hat der Clown gemacht?
 'What has the clown done?' (What did the clown do?)
 b Der Clown/ ist/ auf das Kissen ...
 'The clown/ is/ onto the pillow ...' target: ... *getammt*.

Infinitive Target condition:

- (6) a Was kann die Maus machen?
 'What can the mouse do?'
 b Die Maus/ kann/ in die Feder ...
 'The mouse/ can/ into the spring ...' target: ... *dupen*.

No-endpoint condition

Perfekt Target condition:

- (7) a Was hat der Bär gemacht?
 'What has the bear done?' (What did the bear do?)
 b Der Bär/ hat/ an der Schnur ...
 'The bear/ has/ on the cord ...' target: ... *gebafft*.

Infinitive Target condition:

TABLE 2. *Study 1: number of children productive with tense morphology, broken down by situation type, tense and age group*

Age group	Endpoint condition		No-endpoint condition	
	<i>Perfekt</i> target	Infinitive target	<i>Perfekt</i> target	Infinitive target
2;6 years	15	8 [8]	18	10 [7]
3;0 years	17	14 [11]	18	11 [9]
3;6 years	18	14 [12]	18	18 [15]
Total (<i>N</i> = 72)	50 (69%)	36 (50%)	54 (75%)	39 (54%)

N = 24 in each cell, the number of children productive with *Perfekt* and *Infinitive* are given in square brackets.

TABLE 3. *Study 1: mean number of productive answers broken down by condition and age group in (highest possible score is 2)*

Age group	Endpoint condition		No-endpoint condition	
	<i>Perfekt</i> target	Infinitive target	<i>Perfekt</i> target	Infinitive target
2;6 years	1.08	0.50	1.25	0.71
3;0 years	1.33	0.96	1.33	0.71
3;6 years	1.38	0.92	1.29	1.25
Total	1.26	0.79	1.29	0.89

- (8) a Was kann der Elephant machen?
 'What can the elephant do?'
 b Der Elephant/ kann/ auf der Brücke ...
 'The elephant/ can/ on the bridge ... target: ... *mieken*.

Before each session, there were two warmups with familiar verbs (e.g. *über den Zaun hüpfen* 'jump over the fence') which were similar in structure to the actual test items. A child was included in the analysis, if he or she produced a *Perfekt* and an infinitival form at least once in these warmup sessions. Second, if a child did not respond appropriately in the warmups, but showed productivity with the novel verbs nevertheless, he or she was also included in the analysis.

RESULTS

The results of Study 1 are presented in Tables 2 (number of children productive with tense morphology) and 3 (mean number of productive answers). Forms produced in the *Perfekt* Target condition lacking the *ge-* (e.g. *miekt*) were coded as productive answers, as long as the *-t* ending could be heard. This coding decision was made because it is known from existing

literature (e.g. Mills, 1985) that young children tend to omit the *ge-* prefix, and many of the children in our study who dropped the *ge-* in their answers to the questions also dropped it when they were asked to repeat *Perfekt* forms. Analogously, forms produced in the Infinitive Target condition lacking the *-en* (e.g. *miek*) were coded as productive answers, as long as subjects stripped off the *ge-* prefix and the final *-t*. Again, children's repetitions served as a control: most of the children who provided infinitives like *miek* did utter the *ge-* prefix when asked to repeat a *Perfekt* form.

Table 2 presents the number of children productive with tense morphology, broken down by situation type (endpoint and no-endpoint), tense (*Perfekt* Target and Infinitive Target) and age group. Note that even though each child was given two chances per trial to provide a productive answer, a child who gave one productive answer per trial was counted as productive. Table 2 therefore presents the number of children productive with tense morphology, with a subject being classified as productive if he or she showed productivity in at least one of the two possible cases.

To complete the picture of the overall results, Table 3 presents the mean number of productive answers, broken down by condition and age group.

Even the youngest children showed some productivity with tense marking. As can be seen from Table 2, at least one third of these children (in the Infinitive Target and endpoint condition) up to three quarters (in the *Perfekt* Target and no-endpoint condition) answered productively at least once. In the *Perfekt* Target condition, five children (2 children aged 2;6 and 3 children aged 3;6) used what appears as 'irregular' participle formation (e.g. *gemieken*), the rest used the 'regular' affixes (e.g. *gemiekt*). However, in none of the conditions and none of the age groups were more than three quarters of the children productive.

On the basis of the results as given in Table 2, a McNemar test was conducted to examine whether there was a difference in performance in the endpoint and no-endpoint conditions. The analysis revealed no significant difference either for all subjects taken together ($p = 0.118$), nor for any of the age groups (children aged 2;6: $p = 0.109$, children aged 3;0: $p = 1$, children aged 3;6: $p = 1$).

A series of McNemar tests was then applied to compare performance in the *Perfekt* Target with performance in the Infinitive Target condition. Performance in the *Perfekt* Target condition was significantly better than in the Infinitive Target condition for all subjects taken together (endpoint condition: $p = 0.007$, no-endpoint condition: $p = 0.011$). For the children aged 2;6, the difference was significant in the endpoint condition ($p = 0.016$), and marginally so in the no-endpoint condition ($p = 0.057$). For the children aged 3;0 the difference was marginally significant in the no-endpoint condition ($p = 0.065$), and not significant in the endpoint condition ($p = 0.508$). There was no significant difference for the children aged 3;6.

Further, productive answers increased with age. To compare the number of children in each age group and experimental condition who were productive with a given tense type, Chi-Square analyses were conducted. No significant differences were found in the *Perfekt* Target condition. This might be due to many of the youngest children already showing productivity with the *Perfekt* (about 2/3 of the children aged 2;6 were productive, see Table 2). But in the Infinitive Target condition there were significant differences: in the no-endpoint condition, the children aged 3;6 performed significantly better than the children aged 3;0, $\chi^2(1, N = 48) = 4.269$, $p < 0.05$, and the children aged 2;6, $\chi^2(1, N = 48) = 5.486$, $p < 0.05$. In the endpoint condition, the difference between children aged 3;0 and 2;6 was marginally significant, $\chi^2(1, N = 48) = 3.021$, $p = 0.082$. The same holds for the difference between the children aged 3;6 and 2;6.

The children who did not use tense marking productively fell into three categories. First, and most revealing for issues of productivity, some children imitated the verb forms they heard in the input (23% of the time, i.e. in 66 out of the 288 trials), suggesting that they have not analysed the novel forms into verb and tense marking. For example, as an answer to the question *Was kann der Elefant machen?* 'What can the elephant do?', children said: *gemiekt*. Second, children avoided using the novel verbs and instead used existing verbs, e.g. instead of *mieken* they used *laufen* 'walk' (11% of the time, i.e. in 31 trials). They typically used these verbs with the appropriate marking, indicating that they were able to make the right choice of tense marking, but might still lack the means to use tense marking productively. Third, children did not give an answer at all (4% of the time, i.e. in 12 cases).

Frequency of Perfekt vs. können 'can' + infinitive constructions in child directed speech

Because children performed significantly better in the *Perfekt* Target than in the Infinitive Target condition, we checked whether there is an asymmetry in the language children hear, i.e. whether caretakers use the *Perfekt* more often than *können* + infinitive constructions in their speech to children.

A search was conducted through two databases containing longitudinal recordings of spontaneous speech of children and adults: the Kerstin-corpus (Miller, 1976) and the Arno-corpus.³ In the Kerstin-corpus (which consists of 49 recordings between the ages 1;3 and 3;7) we searched through all adult utterances between the ages 2;0–2;11. In the Arno-corpus (which

[3] The data for the Kerstin-corpus were collected by Miller, the data for the Arno-corpus by the Max-Planck-institute for Evolutionary Anthropology in Leipzig, Germany. Both corpora were checked and transcribed in CHAT format at the Max-Planck-Institute for Evolutionary Anthropology, under the supervision of Heike Behrens.

consists of five one-hour recordings per week) we searched through the utterances at 2;6 only, because this corpus is so large.

The results suggest that caretakers in their speech to children indeed use *Perfekt* constructions more often than constructions with inflected forms of the modal *können* 'can' plus infinitive. The caretakers of Kerstin use *Perfekt* forms (inflected forms of *haben* 'have' or *sein* 'be' together with past participles with *ge-* prefix) about one third more than inflected forms of *können* 'can' + infinitive (2.95% of the time, i.e. in 647 out of 21965 utterances vs. 2.18%, i.e. 479 out of 21965). The caretakers of Arno use the *Perfekt* more than twice as often as *können* + infinitive constructions (5.97% [679/11381] vs. 2.72% [310/11381]). On average, the *Perfekt* is used 4.46% of the time, and *können* + infinitive constructions are used 2.45% of the time, i.e. the *Perfekt* is used almost twice as often as *können* + infinitive constructions.

DISCUSSION

This study investigated German-speaking children's productivity with tense marking. Novel verbs were either introduced only in the infinitival form or only with the *Perfekt* marking, and children were then tested on their ability to produce the form they had not heard. The novel verbs were used in two different ways: either to specify situations in which location changes of toy characters were involved (endpoint condition), or to specify situations in which the actions performed by toy characters did not result in a change (no-endpoint condition).

The results suggest that children aged 2;6 to 3;0 are better at providing past time (i.e. the *Perfekt*, *Perfekt* Target condition) than infinitive marking (Infinitive Target condition) on the novel verbs, independent of situation type. These results thus go against the claims that have been made in the literature (see the Introduction) about children's preference to use past time marking on verbs when used to describe situations with a terminal point. One issue is the fact that, due to practical limitations, children were tested with only two verbs per condition. It is thus possible that the particular verbs chosen had some influence on the results.

Further, performance improves significantly with increasing age in the Infinitive Target, but not in the *Perfekt* Target condition. In the *Perfekt* Target condition this might be due to a ceiling effect, i.e. even the youngest children were good at providing the *Perfekt* marking (62.5% and 75% of the children were productive in the endpoint and no-endpoint condition, respectively). Note that in the no-endpoint condition three quarters of the children of all age groups were productive with the *Perfekt* at least once, see Table 2.

Why was performance so much better in the *Perfekt* Target than in the Infinitive Target condition especially at younger ages? One explanation

could be that children have problems conceptualizing the scenes in the way that is necessary to be able to use the *können* + infinitive constructions, and so they have problems with these constructions. Appropriate use of these constructions requires being able to view observed scenes from a more abstract irrealis perspective. Children might find it more difficult to describe the action an agent has just performed in terms of the agent's general abilities (which requires being able to abstract away from a particular exemplar) than by simply describing this past event using past time.

It could also be, however, a more linguistic problem, having to do with the nature of the two linguistic structures under discussion together with their input frequencies. With respect to the nature of the two linguistic structures, recall that the tense forms in both conditions were composite forms: the *Perfekt* takes an inflected form of an auxiliary as well as the past participle of the main verb, and the infinitive as employed in this study takes the modal *kann* 'can' as well as the infinitive of the main verb. In the case of the *Perfekt* the participle co-occurs with one of the two auxiliaries *haben* 'have' or *sein* 'be'. The infinitive, on the other hand, can co-occur with a whole range of modals besides the one used in Study 1, e.g. *wollen* 'want to', *sollen/müssen* 'have to, must', *dürfen* 'be allowed to', *tun* 'do' *werden* 'will' (future). Hence, unlike the two components of modal plus infinitive constructions, the two components of the *Perfekt* can be viewed more as a unit ('discontinuous morpheme', see MacWhinney, 1978); the *Perfekt* is more consistent as a construction. Children will thus hear the past participle only with the auxiliaries *haben* 'have' or *sein* 'be', but they may well hear the infinitive with many different modals besides *können* 'can'. The greater consistency of the *Perfekt* construction might make it easier for children to store and retrieve it than a modal + infinitive construction.

In addition, as the analysis of two large corpora showed, children in the relevant age range hear *Perfekt* more often than *können* + infinitive constructions, which might result in greater familiarity and then in greater productivity with the *Perfekt*. Overall, then, it is likely, that children's better performance with *Perfekt* than with *können* + infinitive constructions is due to the greater consistency of the *Perfekt* constructions together with more frequent exposure to it in the input.

Can we conclude, then, that German-speaking children between two and three and a half years of age can more creatively use *Perfekt* than infinitive constructions? There is one feature about the procedure of the experiment that keeps us from actually drawing this conclusion. Recall that it was foreseen in the procedure that children might not respond or not respond immediately. In such cases, one of the experimenters started the answer for the child, who could in turn fill in the required form of the novel verb. It turned out that children only rarely answered the question immediately: only in 73 out of the 288 trials (25% of the time). Rather, the experimenter often

had to start the answer, which means that she provided the auxiliary in the *Perfekt* Target condition or the modal *kann* ‘can’ in the Infinitive Target condition. The remaining task for the subjects was thus to change the morphological form of the main verb.

This means that children might not be more productive with the *Perfekt* than with *können* + infinitive constructions *per se*, but better at coming up with a past participle when prompted with an auxiliary than at coming up with an infinitive when prompted with the modal *kann* ‘can’ – despite the fact that the infinitive is considered the most basic verb form (Mills, 1985).⁴ One explanation for this might be connected to the nature of the two constructions as discussed above. In particular, the greater consistency of the *Perfekt* construction might lead children to store and retrieve its components together. This would explain why it is easier for children to retrieve a past participle when the auxiliary is given than to retrieve an infinitive when a modal is given. We would then expect a similar asymmetry in performance with other modal + infinitive constructions as compared to the *Perfekt*, an issue which is yet to be tested.

It is then very likely that hearing *hat* ‘had’ or *ist* ‘is’ might have cued children into providing the participle. Evidence for this is that some children, after the experimenter had started the answer (e.g. *Der Elefant hat ...* ‘The elephant has ...’), continued with *ge ... ge ...*, without being able to retrieve the novel verb, but showing that the auxiliary and the *ge-* prefix are closely connected for them. In contrast, hearing the modal apparently did not have such an effect, which suggests that children do not associate the infinitive as closely with the modal as the participle with an auxiliary.

If it is indeed the case that providing the auxiliary cued children into retrieving the participle, then the question arises of whether they really have good command of the *Perfekt* construction as a whole. A child’s ability to produce the past participle of a novel verb does not necessarily mean that this child has developed some abstract schema or rule for the German *Perfekt*, unless the child is able to provide the appropriate inflected auxiliary as well. To examine whether children can supply the inflected auxiliary of a *Perfekt* form constructed from a newly learned verb, we conducted a follow-up study. Since it proved difficult in Study 1 to make children produce the auxiliary as well as the participle, in Study 2 a cloze-task was employed. Specifically, the *ge-* prefix was provided by the experimenter and subjects

[4] In addition, greater productivity with participles than with infinitives could be due to ‘mechanical’ morphological reasons. In particular, the morphological operations called for in the *Perfekt* Target condition might be easier to handle for children than those called for in the Infinitive Target condition. While in the latter condition subjects were required to strip off the prefix *ge-* and instead add the infinitival *-en* (e.g. *gemiekt* → *mieken*), in the former they were required only to add the prefix *ge-* (e.g. *mieken* → *gemieken* or *gemiekt*). Note that it is not always necessary to replace the *-en* ending by *-t*, e.g. *gelaufen* ‘walked’.

were requested to complete the sentence by providing the main verb and an auxiliary (*haben* 'have' or *sein* 'be').

STUDY 2

METHOD

Subjects

Twenty-four children (16 girls, 8 boys) participated in this experiment, ranging in age from 3;4 to 3;8 (mean 3;6). The children were recruited and tested at several preschools in Leipzig. Ten additional children also served as participants in the study but were excluded from the analysis, because they neither responded appropriately in the warmups (see the Procedure), nor showed productivity with any of the novel verbs.

Materials and design

Four novel verbs were used to describe four novel actions (see Table 4 for the linguistic models containing the novel verbs and the descriptions of the novel actions).

Two of the novel verbs were introduced in a way such that a *Perfekt* with the auxiliary *haben* 'have' was expected from an adult point of view (*Haben* Target condition, items 1 and 2 in Table 4), for the other two the *sein* 'be' *Perfekt* was expected (*Sein* Target condition, items 3 and 4 in Table 4, see the Introduction for how auxiliary selection is determined in German).

To find out whether adults behave in the expected way, 6 adults were tested. All of them selected the auxiliaries as expected, except one, who was unsure about the auxiliary for *umbaffeln* (in the experiment, the subject used *haben* 'have', but when talking about the experiment afterwards, the subject used *sein* 'be').

Each child learned each of the novel verbs introduced in the infinitive, together with a modal (*möchte* 'wants to' or *wird* 'will', and not *kann* 'can' as in Study 1, because of the problems children might have with this modal, see the Discussion of Study 1) and in the third person singular. The third person singular could be used in Study 2 – unlike in Study 1 – because this time the aim was to examine whether subjects could produce auxiliaries together with newly learned verbs, and not participles. The order of presentation of the test items was counterbalanced across subjects.

Procedure

Children were tested individually in a separate room of their kindergarten. Sessions lasted about 25–35 minutes. The sessions were recorded in the same way as done for Study 1.

The novel verbs were introduced in a similar way as in Study 1, except that there were two types of models instead of only one (see columns 2 and 3 of

TABLE 4. *Novel verbs used in Study 2, and description of the novel actions*

Type	Models		Description
1. Prototypical <i>haben-Perfekt</i> : transitive verb (introduced without prepositional phrase)	<i>X möchte Y dupen</i> 'X wants to dup Y'	<i>X dupt Y</i> 'X dups Y'	A large spring (same as in Study 1). Toy animal is attached to the spring. A hand puppet pushes the animal into the spring
2. Less prototypical <i>haben-Perfekt</i> : intransitive (introduced with prepositional phrase)	<i>X möchte an der Schnur mieken</i> 'X wants to miek on the cord'	<i>X miekt an der Schnur</i> 'X mieks on the cord'	Same as <i>baffen</i> in Study 1 (see Table 1), except that animals are acting more 'agentively'
3. <i>sein-Perfekt</i> , intransitive (introduced with prepositional phrase)	<i>X wird auf das Kissen tammen</i> 'X is going to tam onto the pillow'	<i>X tammt auf das Kissen</i> 'X tams onto the pillow'	Same as in Study 1
4. <i>sein-Perfekt</i> , intransitive (introduced without prepositional phrase, but with separable particle)	<i>X wird gleich um-baffen</i> 'X is going to over-baff'	<i>X bafft um</i> 'X baffs over'	An apparatus with a horizontal stick that is covered with velcro, animals with velcro under their feet. Animal is placed on stick, stick turns, animal falls over and in the end, is hanging upside-down

All models contain some linguistic material in addition to the verb and the subject: a direct object (item 1), a prepositional phrase (2 and 3), or a separable particle (4). In the auxiliary + infinitive model, the auxiliary is *möchte* 'wants' for test items 1 and 2, and *wird* 'will' for test items 3 and 4.

Table 4 for the details) and that optional linguistic material (i.e. the prepositional phrases, see items 2 and 3 of Table 4) was left out in about one third of the cases to keep the language natural.

Also as in Study 1, subjects were given a chance to use each of the novel verbs twice, after 9 and after 18 models. To encourage children to use auxiliaries, the experimenter who kept the log asked the child what had happened, pretending that she had not seen and not heard what had just happened (e.g. *Was war los?* 'What happened?'). Immediately after that one of the experimenters started the answer, including the *ge-* prefix (see Randall et al., in press, for introducing this method), e.g. *Du weißt doch, dass der Clown auf das Kissen ge ... ge ...* 'But you know that the clown onto the pillow ge ... ge ...', but pausing right after that, thus giving the child the chance to continue with the required form of the novel verb and the auxiliary (... *tammt ist*. '... tammed is.'). To achieve this type of word order in which the finite verb (the auxiliary) appears after the past participle at the end of the sentence, a subordinate clause configuration was employed.

If children did not respond to this prompt, one of the experimenters followed up with a pair of questions, one containing *haben* 'have', the other *sein* 'be', e.g. *Was ist mit dem Clown gewesen, was hat der gemacht?* 'What is with the clown been, what has he done?' (i.e. What happened with the clown? What did he do?). Both *haben* 'have' and *sein* 'be' were used, to avoid biasing subjects towards using a particular auxiliary. The order of the questions was counterbalanced across subjects, such that half of the children heard the question with *sein* 'be' first, and the other half the question with *haben* 'have' first.

Before each session, there were four warmups with familiar verbs (e.g. *in das Haus rollen* 'roll into the house') which were similar in structure to the actual test items. A child was included in the analysis, if he or she produced at least one *haben* 'have' and one *sein* 'be' auxiliary in these warmup sessions. Second, if a child did not respond appropriately in the warmups, but showed productivity with at least one novel verb nevertheless, he or she was also included in the analysis.

RESULTS

The number of children who provided auxiliaries for particular novel verbs is presented in Table 5. Each child was given two chances per trial to provide a productive answer (as in Study 1). Table 5 includes those children who provided an auxiliary in at least one of the two possible cases.

In three out of four cases (test items 1 to 3) only about half of the children provided an auxiliary. Only in one case (test item *umbaffeln*, see 4), did three quarters of the children (i.e. 18 children) provide an auxiliary.

With respect to selecting a particular auxiliary, children in general preferred

TABLE 5. Study 2, number of children productive with auxiliary, broken down by test item

	<i>Haben</i> 'have'	<i>Sein</i> 'be'
<i>Haben</i> target		
1. <i>Dupen</i>	14*	0
2. <i>Mieken</i>	12*	0
<i>Sein</i> target		
3. <i>Tammen</i>	6	4
4. <i>Umbaffen</i>	7	11

$N = 24$ with each of the test items. * $P < 0.05$, Binomial test.

to use *haben* 'have' over *sein* 'be'. In the *Haben* Target condition, all of the children who provided an auxiliary, provided *haben* 'have'. In contrast, in the *Sein* Target condition, children continued to use *haben* 'have' even though the semantics of the verbs were such that adults would use *sein* 'be'. Binomial tests for each verb showed that children were above chance in using *haben* 'have' correctly, but at chance for the two verbs requiring *sein* 'be'.

The children who did not use auxiliaries fell into three categories. First, they only provided the novel verb and not the auxiliary. Second, they used an existing verb, most often with the appropriate auxiliary. Third, they did not answer at all.

Frequency of haben- vs. sein-Perfekt in child-directed speech

Because children had more problems producing *sein* 'be' than producing *haben* 'have', we checked whether there is an asymmetry in the language children hear, i.e. whether caretakers use the *haben-Perfekt* more often than the *sein-Perfekt* in their speech to children.

A search was conducted through the same portions of adult utterances of the Kerstin-corpus and the Arno-corpus as was done for Study 1 (see Study 1 for the details). The results suggest that caretakers in their speech to children indeed use the *haben-Perfekt* more often than the *sein-Perfekt*. The caretakers of Kerstin use the *haben-Perfekt* (inflected forms of *haben* 'have' together with past participles with *ge-* prefix) more than 6 times as often as the *sein-Perfekt* (inflected forms of *sein* 'be' together with past participles with *ge-* prefix) (87% of the time, i.e. in 565 out of the 647 utterances containing *Perfekt*-forms vs. 13%, i.e. 82 out of 647). The caretakers of Arno use the *haben-Perfekt* more than 3 times as often as the *sein-Perfekt* (76% [518/679] vs. 24% [161/679]). On average, the *haben-Perfekt* is used 81.5% of the time, and the *sein-Perfekt* 18.5% of the time, i.e. the *haben-Perfekt* is used about 4 times as often as the *sein-Perfekt*.

DISCUSSION

In Study 1, German-speaking children aged 2;6 to 3;6 were better at forming past participles with novel verbs in an adult-scaffolded conversation than they were at forming infinitives with novel verbs in an adult-scaffolded conversation. This somewhat surprising finding was further explored in Study 2, which investigated the ability of German children at the upper end of this age range to form the full *Perfekt* construction productively with a novel verb – including both the appropriate auxiliary and the past participle. As compared with their performance in Study 1, children were not very skilful in Study 2. Only about half the children produced a productive *Perfekt* with both auxiliary and past participle, and when the less frequent auxiliary *sein* ‘be’ was required, children used the incorrect *haben* ‘have’ as frequently as they used *sein* ‘be’ – perhaps because *haben* ‘have’ is the more frequent *Perfekt* auxiliary in children’s experience overall (by 4 times).

Most children (three quarters) provided auxiliaries for the novel verb that was introduced with a particle (*umbaffeln*). One explanation for this high number could be that in the probe sentence, the experimenter provided the particle (e.g. *Du weißt doch, dass der Clown umge ... umge ...* ‘But you know that the clown over-ge ... over-ge ...’), i.e. part of the verb stem, which might have helped children to complete the sentence. Another explanation (as suggested by an anonymous reviewer) could be that the novel action and the particle reminded children of a verb they have heard before: *umfallen* ‘over-fall’ (i.e. fall over). This would not explain, however, why so many children used *haben* ‘have’ instead of the adultlike auxiliary *sein* ‘be’.

The overall results would seem to indicate that mastery of the full *Perfekt* construction in a verb-general, rule-based way – as opposed to mastering individual *Perfekt* forms one by one – is difficult and requires a good deal of linguistic experience.

There are at least two very good reasons why this construction is difficult. First, it is, in a sense, a ‘discontinuous morpheme’ (MacWhinney, 1978). Not only is the function of past tense expressed with two words in this construction – one of which must be declined for person and number agreement with the subject – but they are quite often separated by other words and phrases as well. Mastery of this construction would thus seem to require impressive skills of information processing to keep track of the discontinuous parts. Second, the choice of the auxiliary is far from straightforward. *Haben* is the more frequent auxiliary by far in children’s (and adults’) experience, and is typically used for all transitive verbs and many intransitives. *Sein* ‘be’, on the other hand, is prototypically used with verbs of motion only, quite often intransitives. The semantics of the choice of auxiliaries is thus exactly the kind of lexical choice that should take much experience to master. Randall *et al.* (in press) provide evidence that most

children have productive control over appropriate auxiliary selection by about four years of age.

As always, it is possible that some peculiarities of our experimental procedure may have masked children's skills by creating unintended difficulties. The fact that in the first elicitation procedure children experienced in this study they had to produce the auxiliary after the past participle – as required in subordinate clauses – may have been one such difficulty. However, for children who balked at this procedure, we also provided the opportunity to answer with a more common main clause configuration. About half the children answered not to the first elicitation procedure but to the second. But out of the 54 cases in which auxiliaries were provided (Table 5), only 18 (one third) were responses to the main clause configuration. Although it is possible that the first elicitation procedure somehow influenced children's response to the second, we have no evidence that this was the case, and indeed children gave every indication of trying to answer the second set of questions in the most straightforward way they could (e.g. sometimes using a familiar verb in a canonical *Perfekt* construction).

GENERAL DISCUSSION

The results of Study 1 established that the majority of German-speaking children can produce regular past participles productively by the time they are two and a half to three years old – somewhat earlier than they can produce regular infinitive forms productively. Surprisingly, situation type (endpoint or no-endpoint) does not seem to make a big difference to children of this age. The past participle is only one half of the German *Perfekt*, however, and the results of Study 2 established that mastery of the full *Perfekt* construction, including appropriate auxiliary selection, takes another year or more of linguistic experience.

The current results thus add to a growing body of research suggesting that young children begin their linguistic careers by mastering concrete linguistic items and constructions, only gradually forming more abstract and word-general linguistic constructions (see Tomasello, 2000, for a review). At the same time that German-speaking children are using many different infinitival and *Perfekt* forms in their spontaneous speech, they struggle in experimental settings in which they must extract a general principle (schema, rule) from these already-mastered forms and apply it to a nonce form. This procedure is undoubtedly a stringent measure of children's productivity with linguistic forms, but similar studies with English speaking children suggest that it is unlikely that children's difficulties in these experiments are due to their general shyness with newly learned language or other experimental artifacts because: (1) when they learn a novel noun they immediately use it creatively in all kinds of syntactic constructions (Tomasello, Akhtar, Dodson & Rekau, 1997); and (2) when they are tested for comprehension of novel verbs in

various syntactic constructions they perform no better than on tests of production (Akhtar & Tomasello, 1997).

The specifics of the current experiments suggest some of the factors that may be involved as children proceed from more item-based to more word-general constructions. Although not surprising, it would seem that discontinuous morphemes might create special problems for children, as might distinguishing the semantics of subtly different verbs that take different auxiliary forms. But perhaps most importantly, to construct a more abstract understanding of a linguistic construction requires a certain frequency of experience with that construction, perhaps with a certain degree of 'cue validity', i.e. 'cue availability' (e.g. how likely is it that the *Perfekt* is expressed by an auxiliary and a participle prefixed with *ge-*?) and 'cue reliability' (e.g. how likely is it that a construction consisting of an auxiliary and a participle prefixed with *ge-* is a *Perfekt* construction?) as well (Bates & MacWhinney, 1987; 1989). Thus, in the current study '*haben/sein* + past participle' was found to be more frequent in the language children hear than '*können* + infinitive', and also, because the *Perfekt* only has two auxiliary forms whereas modal constructions can have many, the relationship between the two parts of the discontinuous morpheme in the case of the *Perfekt* is more reliable as well. (Cue reliability is nearly perfect with both constructions.) Within the *Perfekt*, the greater frequency of *haben* 'have' over *sein* 'be' as auxiliary in child directed speech was also established in the current study (and is also well-known in adult speech), and so again frequency of exposure would seem to be an important factor in this case as well. Establishing with more precision the exact frequencies of all of the different possibilities for the *Perfekt* and modal constructions that children experience – and thus working out their respective cue strengths – is an important task for future research.

Interestingly, children seem to acquire productive control of the seemingly much simpler English past tense (the regular form requiring only a single morphological operation) in the same general age range as the children in the current study. Some children produce some overregularizations before their third birthdays and continue to do so into schoolage (Marcus, Pinker, Ullmann, Hollander, Rosen & Xu, 1992). In experimental studies with nonce verbs, the findings are as follows: (1) when they hear a nonce verb in the present progressive, English-speaking children below 3 years of age basically never produce a novel past tense form when an adult attempts to induce it (0 of 16 children below 3;4 were productive; 8 of 14 children over 3;4 were productive; Akhtar & Tomasello, 1997); and (2) when they hear a nonce verb with no inflections, 3 of 10 children below 3 years of age produced a novel past tense form and 9 of 10 children at around 3;6 produced a novel past tense form; Akhtar & Tomasello, 1997). The problem in the case of the English past tense, of course, is not discontinuous

morphemes, auxiliary choice, and the like, but rather that many high frequency verbs are irregular and so the *-ed* past tense morpheme has very little cue availability early in development. To make a more complete comparison what are needed are languages with various types of syntactic complexity in combination with different types of cue strength.

To solve all of the scientific problems presented by the acquisition of language multiple methods will be needed. The analysis of spontaneous speech, as is traditional in the field, is and should be the primary methodology, as the observation of behaviour in its natural setting defines the set of phenomena to be explained. But to go beneath the behaviour that children produce spontaneously to reveal the actual mechanisms at work – for example, to answer the question of whether they are operating with specific linguistic items or with more abstract categories and schemas – requires experimental investigation. And, of course, to reveal the skills of language acquisition for the species as a whole, we will need to have such investigations in a whole host of different languages (Bates & MacWhinney, 1989). In the current case, we provide one of the few experimental studies (i.e. using nonce forms) of children's acquisition of a syntactic construction in a language other than English. And indeed German – as a language very close to English historically but with a number of important differences typologically (e.g. more complex morphology, freer word order) – makes for a very interesting comparison. Ideally, a single linguistic function (e.g. expressing past tense) should be experimentally investigated in a number of carefully chosen languages, and issues should be explored involving such things as continuous versus discontinuous morphemes, verb semantics, cue validity, and type and token frequency. This procedure would provide important information that could be obtained in no other way to help us to gain insight into the underlying mechanisms of child language acquisition.

REFERENCES

- Akhtar, N. & Tomasello, M. (1997). Young children's productivity with word order and verb morphology. *Developmental Psychology* **33**, 952–65.
- Antinucci, F. & Miller, R. (1976). How children talk about what happened. *Journal of Child Language* **3**, 167–89.
- Bates, E. & MacWhinney, B. (1987). Competition, variation, and language learning. In B. MacWhinney (ed.), *Mechanisms of language acquisition*. Hillsdale, NJ: Erlbaum.
- Bates, E. & MacWhinney, B. (1989). Functionalism and the competition model. In B. MacWhinney & E. Bates (eds), *The cross-linguistic study of sentence processing*. Cambridge: CUP.
- Behrens, H. (1993). *Temporal reference in German child language: form and function in early verb use*. Ph.D. thesis, University of Amsterdam.
- Berko, J. (1958). The child's learning of English morphology. *Word* **14**, 150–77.
- Bloom, L., Lifter, K. & Hafitz, J. (1980). Semantics of verbs and the development of verb inflection in child language. *Language* **56**, 386–412.
- Bronckart, J. P. & Sinclair, H. (1973). Time, tense, and aspect. *Cognition* **2**, 107–30.

- Clahsen, H. (1997). The representation of participles in the German mental lexicon: evidence for the dual-mechanism model. In Booij G. & van Marle J. (eds), *Yearbook of morphology 1996*. Dordrecht: Kluwer.
- Comrie, B. (1985). *Tense*. Cambridge: CUP.
- Duden, Grammatik der deutschen Gegenwartssprache. 4., neu bearb. Aufl. Mannheim: Dudenverlag, 1984 (Der Duden; Bd. 4).
- Helbig, G. & Buscha, J. (1972). *Deutsche Grammatik. Ein Handbuch für den Ausländerunterricht*. Leipzig: VEB Verlag Enzyklopädie.
- Lindner, K. (1998). Overgeneralization revisited: the case of German past participles. In Fabri R., Ortman A. & Parodi T (eds), *Models of inflection*. Tübingen: Niemeyer.
- MacWhinney, B. (1978). The acquisition of morphophonology. *Monographs of the Society for Research in Child Development* **43** (serial no. 174).
- Marchman, V. (1997). Children's productivity in the English past tense: the role of frequency, phonology, and neighbourhood structure. *Cognitive Science* **21**, 283–304.
- Marcus, G., Pinker, S., Ullmann, M., Hollander, M., Rosen, T. & Xu, F. (1992). Overregularization in language acquisition. *Monographs of the Society for Research in Child Development* **57** (4, Serial No. 228).
- Miller, M. (1976). *Zur Logik der frühkindlichen Sprachentwicklung: Empirische Untersuchungen und Theoriediskussion*. Stuttgart: Klett.
- Mills, A. (1985). The acquisition of German. In D. I. Slobin (ed.), *The crosslinguistic study of language acquisition, Vol. 1: The data*. Hillsdale, NJ: Erlbaum.
- Olguin, R. & Tomasello, M. (1993). Twenty-five month old children do not have a grammatical category of verb. *Cognitive Development* **8**, 245–72.
- Perez-Pereira, M. (1989). The acquisition of morphemes: some evidence from Spanish. *Journal of Psycholinguistic Research* **18**, 289–312.
- Piaget, J. (1946). *Le développement de la notion du temps chez l'enfant*. Paris: Presses Universitaires de France.
- Randall, J., van Hout, A., Weissenborn, J. & Baayen, H. (in press). Acquiring unaccusativity: a cross-linguistic look. In A. Alexiadou, E. Anagnostopoulou & M. Everaert (eds). *The Unaccusativity Puzzle: studies on the syntax-lexicon interface*. Oxford University Press.
- Shannon, T. (1990). The unaccusative hypothesis and the history of the perfect auxiliary in Germanic and Romance. In H. Andersen & K. Körner (eds), *Historical linguistics 1987*. Amsterdam: Benjamins.
- Szagun, G. (1976). *A cross-cultural study of the acquisition of tense forms and time concepts in young children*. PhD. thesis, University of London.
- Szagun, G. (1979). *The development of spontaneous reference to past and future: a cross-linguistic study*. Forschungsbericht Nr. 79-4, Institut für Psychologie, TUB. Berlin: Technische Universität.
- Talmy, L. (1985). Lexicalization patterns: semantic structure in lexical forms. In T. Shopen (ed.), *Grammatical categories and the lexicon, Vol. 3*. Cambridge: CUP.
- Tomasello, M. (2000). Do young children have adult syntactic competence? *Cognition* **74**, 209–53.
- Tomasello, M., Akhtar, N., Dodson, K. & Rekau, L. (1997). Differential productivity in young children's use of nouns and verbs. *Journal of Child Language* **24**, 373–87.
- Tomasello, M. & Brooks, P. (1998). Young children's earliest transitive and intransitive constructions. *Cognitive Linguistics* **9**, 379–95.
- Weist, R. M., Wysocka, H., Witkowska-Stadnik, K., Buczowska, E. & Konieczna, E. (1984). The defective tense hypothesis: on the emergence of tense and aspect in child Polish. *Journal of Child Language* **11**, 347–74.
- Weyerts, H. & Clahsen, H. (1994). Netzwerke und symbolische Regeln im Spracherwerb: Experimentelle Ergebnisse zur Entwicklung der Flexionsmorphologie. *Linguistische Berichte* **154**, 430–460.