Young German Children's Early Syntactic Competence: A Preferential Looking Study

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Abstract

Using a preferential looking methodology with novel verbs, Gertner, Fisher, & Eisengart (2006) found that 21-month-old English children seemed to understand the syntactic marking of transitive word order in an abstract, verb-general way. In the current study we tested whether young German children of this same age have this same understanding. Following Gertner et al. (2006), one group of German children was tested only after they had received a training/practice phase containing transitive sentences with familiar verbs and the exact same nouns as those used at test. A second group was tested after a training/practice phase consisting only of familiar verbs, without the nouns used at test. Only the group of children with the training on full transitive sentences was successful in the test. These findings suggest that for children this young to succeed in this test of syntactic understanding, they must first have some kind of relevant linguistic experience immediately prior to testing - which raises the question of the nature of children's linguistic representations at this early point in development. (*172 words*)

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A fundamental task in acquiring a natural language is to learn how that language marks its subjects and objects. In most European languages, this is done with case marking, word order, or some combination of the two. For example, in German subjects are often marked with nominative case marking and objects with accusative case marking (on the determiner in both cases); in addition, subjects are typically but not always pre-verbal and objects are post-verbal. In English, subjects are canonically pre-verbal and objects post-verbal, and there is case marking only in the pronominal system (I-me, he-him, etc.).

There are currently two theories of how children learn the subject-object marking characteristic of the language they are learning - with most research focused on the transitive construction in which subjects are agents and objects are patients. First, in the usage-based account young children comprehend and store utterances directed to them as exemplars (Abbot-Smith & Tomasello, 2006). Over multiple instances of exemplars of a certain type (functionally defined) they make abstractions. Many early abstractions are made across utterances with one or a few lexical items in common, leading to item-based constructions, e.g., verb island constructions such as ____ *kiss* ___, Tomasello (1992; 2003) or other low-scope constructions such as *I'm*___*-ing it* in which a sub-group of verbs are placed in the slot (Pine, Lieven, & Rowland, 1998). As children are abstracting in this way, they are learning how to mark syntactic roles for whatever item-based and other constructions they have mastered via such things as case marking and word order. Gradually, children start to generalize across these item-based constructions using mechanisms such as semantic analogy (e.g. Goldberg, 1999). And gradually, as children are exposed to a wide variety of different construction types, in which different semantic roles (e.g., agent and patient) are marked in similar ways (e.g., nominative case marking

or preverbal position) the syntactic categories involved turn into such things as subjects and objects. Because everything in this approach comes down, in the end, to exemplars, in the usage-based approach it is possible to talk about "graded representations" of different strengths following Munakata, McClelland, Johnson & Siegler (1997).

Alternatively, in the rule-based account children are given some kind of head start - some kind of linguistic rules or principles - before the learning/abstraction process begins, with the type of head start differing in different accounts. Most radically, some theorists believe that subject and object are innate linguistic categories, and so the problem for young children is only to link these innate categories to the syntactic marking that occurs in their language based on a small amount of linguistic experience (e.g., Fernandes, Marcus, DiNubila, & Vouloumanos, 2006; Pinker, 1984, 1989). Other theorists claim, less radically, that young children are "constrained to represent knowledge of sentence structure in terms of a more abstract mental vocabulary", such as AGENT - TRANSITIVE VERB - PATIENT (Gertner et al., 2006, p.685; see also Gleitman, 1990; Gillette, Gleitman, Gleitman, & Lederer, 1999; Fisher, 2002), with the linking to subject and object categories presumably also based on innate linguistic principles.

In general, the usage-based account predicts that children should take some time to construct verb-general syntagmatic categories such as agent-patient and subject-object, whereas the rule-based account predicts quicker and earlier acquisition. The problem is that these theoretical predictions are tied up with methodological issues. First, it is a fact that children do indeed acquire knowledge of canonical transitive word order in English fairly early in development with frequent and familiar verbs (Golinkoff, Hirsh-Pasek, Cauley, & Gordon, 1987; Roberts, 1983). But research with familiar verbs does not distinguish between the two theories, as it is not clear if this early learning is taking place on a verb-specific or a verb-general basis. Most crucial, then, are studies with novel verbs. The basic logic is that if a child learns a novel verb, such as *tamming*, in the

absence of subject-object marking (e.g., she hears it as an individual lexical item or in some other construction), but then produces or comprehends that novel verb with canonical subject-object marking, then she must have come to the experiment with a verb-general, abstract understanding of this syntactic marking.

Another methodological issue concerns production versus comprehension, and indeed different ways of measuring comprehension. Thus, many studies have shown that when children below 2.5 to 3 years of age are taught a novel verb in the absence of canonical subject-object marking, they do not then generalize and use their newly learned verb with this marking - and this is found across a number of different languages including both English and German (e.g., Brooks & Tomasello, 1999; Wittek & Tomasello, 2005; see Tomasello, 2000; 2003 for reviews). Other production methods, such as syntactic priming and the so-called weird word order methodology, show similar results (e.g., Akhtar, 1999; Matthews, Lieven, Theakston, & Tomasello, 2005; Savage, Lieven, Theakston, & Tomasello, 2003). Similar ages for adult-like performance are found in comprehension using the traditional act out task in which the adult tells the child something like "Show me: The cat is tamming the bird" (e.g., Akhtar & Tomasello, 1997; Chan, Meints, Lieven, & Tomasello, submitted, for English; Dittmar, Abbot-Smith, Lieven, & Tomasello, submitted, for German). Overall, then, there are no experimental findings in either production tasks or act out comprehension tasks of children using novel verbs productively in any language before about 2.5 years of age. Some evidence, however, for children's earlier ability to link grammatical to thematic roles comes from a study by Fernandes et al. (2006). While this study is potentially relevant to the concerns of the present study, the fact that the overall mean age of children was 2;6, the range very wide (2;3 – 2;11) and no mean ages given for the between subjects groups makes it hard to assess its significance.

Further discrepant results have come from the relatively new methodology (i.e., new to research on syntactic development) of preferential looking. The method was

pioneered by Golinkoff et al. (1987) using familiar verbs, and has also been used by Naigles (1990) to test children's ability to discriminate transitive and intransitive constructions using novel verbs (see also Bavin & Growcott, 2000). The method is based on the supposition that children will look preferentially to a video screen or live materials that match some linguistic material, word or sentence, that they hear coming from a speaker between the two video displays. Recently, a revised version of this method has been used to focus directly on the question of children's understanding of verb-general syntactic marking. Gertner et al. (2006) exposed children 21 and 25 months of age to two video screens depicting caused-motion transitive actions. On one screen, a duck was performing some action on a bunny, and on the other screen the roles were reversed and the same bunny was performing an action - a different action - on the same duck. The linguistic stimulus was sentences like "The duck is gorping the bunny! Find gorping!" Because children did not know the specific action associated with the word *gorping*, the only way to find gorping would be to know that the agent of the action is the one mentioned first, and the patient second. The finding was that across a series of four studies, children of both ages looked longer to the matching screen, suggesting that they did indeed recognize the syntactic roles of the two characters on the different screens based on how those are marked in English.

Crucially, Gertner et al. (2006) also employed an initial practice phase in which crucial elements of the child's task could potentially have been learned before the test. Specifically, in the practice phase several transitive sentences using familiar transitive verbs were presented along with their respective events, for example, when hearing "The bunny's hugging the duck" the child saw on both screens the bunny acting on the duck as the agent of a causative action (one screen matched the action "hugging", the other screen showed a different familiar action, e.g. "feeding"). In a second practice trial the child saw the duck as the agent acting in two familiar causative actions on the bunny as the patient while hearing a transitive sentence with the duck in pre-verbal position. The characters

used in these practice trials (duck and bunny) were the exact same characters used in the subsequent test trials, so that, without necessarily knowing the familiar verbs in these trials, the children had the opportunity in the practice before the test to learn that the word *duck* used in sentence-initial position indicated the duck causing the action and when that same word *duck* was used in sentence-final position it indicated the duck as patient of the action (and the same for the word *bunny*).[1] It is important to note that the use of some kind of familiarization phase is used in all kinds of looking time studies - in order to familiarize children with the materials and procedure - but this phase should not enable children to learn crucial elements of the task.

In the current study, we used the method of Gertner et al. (2006) to address two questions. The first was whether the findings would extend to a different language, specifically German, in which both word order and case marking were available to indicate syntactic roles. This extension is interesting as the linguistic evidence available to German children is fairly different from that available to English children, as case marking in German actually takes on different forms depending on the gender of the noun involved, and word order is much less reliable than in English (with objects coming before the verb and subjects after reasonably frequently). The second question was whether the practice phase in the Gertner et al. (2006) study actually taught the children important things about the task, or whether children would be just as skillful with a different practice phase using materials different from those used in the test. If children experiencing a more neutral practice phase still performed successfully in the test, it would suggest that indeed young children do come to the experiment with some kind of abstract, verb-general knowledge of syntactic marking. On the other hand, if children only performed successfully after having had training with the specific objects/nouns used in the test - syntactically marked in the same ways as in the test - it would suggest

[1] The same basic argument applies even in Gertner et al.'s second and fourth study in which only one full noun phrase was used.

that in the practice phase the children are very quickly learning important information relevant to the test phase. In this case, it would not be legitimate to claim that children come to the experiment with abstract knowledge of syntactic marking - or at least this claim would need to be tempered substantially.

Method

Participants

All children were monolingual speakers of German, who were brought by a caregiver to a child lab in a medium-sized German city. Of these were forty-eight 21-month-olds (range = 20 – 22 month; 25 girls, 23 boys) included in the study. A further 18 children were tested but excluded from the study due to either showing a side bias (3), fussiness (11), bilingualism (1), experimenter error (1), or because they did not participate in the additional vocabulary comprehension test (2).

Apparatus

The children sat on their parent's lap in front of two 30 x 47 cm monitors which were 76 cm away from the child. The monitors were 30.5 cm apart from each other and at eye level of the child. A centre light and a hidden camera to record the child's eye movements were placed between the screens. The sound tracks were presented centrally from behind the wall. The parents were asked to close their eyes during all training and test trials which the experimenter controlled through the camera.

Materials

The children watched two videos simultaneously which depicted people costumed as a frog and a monkey. We chose these animals because they are of masculine gender in German and therefore unambiguously case marked with nominative in subject position and accusative in object position, e.g. '*Der Frosch wäscht den Affen*.' (The(+NOM) frog

is washing the(+ACC) monkey) and this kind of transitive sentence is found to be easier for young German children to interpret than transitive sentences in which the children have to rely on word order alone (Dittmar et al., submitted). The pre recorded sound tracks were spoken by a female native German speaker. Four German familiar verbs and two novel verbs with German sound patterns were used in the experiment. All verbs referred to causative-transitive actions, involving direct contact between a volitional agent and an affected patient. The four familiar verbs and actions were '*waschen*' (to wash), '*füttern*' (to feed), '*küssen*' (to kiss) and '*kitzeln*' (to tickle), the two novel verbs were '*wiefen*' and '*tammen*'. The novel verb '*wiefen*' referred either to an animal wheeling the other animal which lay on a wagon back and forth or to an animal tipping the other animal in a funny looking rocking chair. These were the same events Gertner et al. (2006) used in their first and second experiment. The novel verb '*tammen*' referred either to an animal bending the other animal back and forward by pulling and pushing his shoulders or to an animal rotating the other animal on an office chair by pulling a band around his waist. These were the same events Gertner et al. (2006) used in their third and fourth experiment. All children were tested on full transitive sentences containing a novel verb.

Design

Before testing the children were assigned randomly to one of two conditions so that finally twenty-four subjects participated in each condition. One group of children were presented with familiar verbs in full transitive constructions, e.g., *the frog is washing the monkey* [condition TRAINING], the other group of children were presented with familiar verbs only in citation form, e.g., *this is called washing* [condition NO TRAINING]. Children of both between subject conditions had exactly the same mean age of 21.5 months.

After the experiment all children got an additional vocabulary comprehension test

in which they had to point to one out of four objects and we also asked the parents to fill out the ELFRA-1 (Grimm & Doil, 2001), a shortened German version of the MacArthur Communicative Development Inventory (Fenson, Dale, Reznick, Bates, Thal, & Pethnick, 1994). The children achieved a mean score of 285 (TRAINING = 298; range 170 - 381 / NO TRAINING = 271; range 147 – 375) from a maximal score of 395 in the ELFRA-1 and a mean score of 5 (both conditions; range 1 – 9) from a maximal score of nine in the vocabulary comprehension test.

Procedure

Following Gertner et al. (2006) we presented the stimuli in three phases: character identification, training on familiar verbs and test on novel verbs. All children got the same order of phases. During the character identification phase first one of the animal characters appeared waving on one screen while the other screen remained blank and the child heard the name of the animal labeled ones: '*Guck mal, das ist der Frosch*.' (Look, that's the frog.). After a two seconds break with both screens remaining blank, the other animal appeared waving on the other screen: '*Guck mal, das ist der Affe*.' (Look, that's the monkey.) These videos lasted five seconds. In the next two trials which lasted eight seconds each the waving monkey and frog appeared simultaneously and the children heard in one trial: '*Wo ist der Frosch? Such mal den Frosch*.' (Where is the frog? Find the frog.), and in the other trial: '*Wo ist der Affe? Such mal den Affen*.' (Where is the monkey? Find the monkey.).

During the training on familiar verbs the child saw two different familiar actions with the same agent and patient performing the actions. Initially, the children watched a preview of the two events individually and they heard '*Guck mal da*!' (Look, there!) to familiarize them with the events they are going to see. These videos lasted five seconds. Then both screens remained blank for five seconds and the child heard depending on her condition either: '*Der Frosch wird gleich den Affen waschen*.' (The frog is going to wash

the monkey.) [TRAINING] or: '*Du wirst gleich waschen sehen*.' (You are going to see washing.) [NO TRAINING]. While the child heard the sentence modeled in the future form the centre light flashed three times. Afterwards the two different familiar events ran simultaneously on both screens for eight seconds and the child heard either: '*Der Frosch wäscht den Affen. Der Frosch wäscht den Affen*.' (The frog is washing the monkey.(x2)) [TRAINING] or: '*Das heißt waschen. Das heißt waschen*.' (This is called washing. (x2)) [NO TRAINING] while seeing on one screen the frog washing the monkey and on the second screen the frog feeding the monkey so that the child needed to use knowledge of the verb to identify the matching screen. Then the screens remained blank again for another five seconds and the child heard the sentence modeled in past tense: '*Der Frosch hat den Affen gewaschen*.' (The frog washed the monkey) in the TRAINING condition and '*Du hast waschen gesehen*.' (You saw washing) in the NO TRAINING condition and the centre light flashed again three times. Finally the both scenes appeared again simultaneously for eight seconds and the child heard either: '*Der Frosch wäscht den Affen. Such mal waschen*!' (The frog is washing the monkey. Find washing!) [TRAINING] or '*Das heißt waschen. Such mal waschen*!' (This is called washing. Find washing!) [NO TRAINING]. In a second familiar verb trial a different familiar verb was presented to the child (kissing or tickling) and the other animal (the monkey) was now the agent in both familiar actions (and the frog the patient). The procedure was the same as described above. Thus, the children in the TRAINING condition heard a total of ten transitive sentences over both familiar verb trials (five with the frog as subject and five with the monkey as subject).

During the test on novel verbs all children independent of training condition got the same two test trials in counterbalanced order. Following the procedure as described above for the training phase children saw a pair of different novel caused-motion events but now with reverse semantic roles, i.e., one screen depicted an event in which the frog was the agent and the monkey the patient and vice versa on the second screen. All

children heard the novels verbs modeled in full transitive sentences with the frog and the monkey as participants of the event (see figure 1). In the second test trial the children saw a different pair of novel caused-motion events with again the frog and the monkey as agents and patients.

Figure 1

Counterbalancing

We counterbalanced within subjects the side of the matching screen (left vs. right), the direction of the action (50% of the trials the agent acted from the left to the right and 50% of the trials vice versa) and which animal was agent in the target event.

We counterbalanced between subjects the order of verb pairs within each phase, the order of which animal was agent first within each phase, which familiar action was target (50% of the children got washing and 50% feeding as the target action and the same for the familiar verb pair kissing and tickling) and which novel verb event was target so that we could be sure that the looking results could not be influenced by one scene being more salient than the other. However, we did not find any item effects at all.

Coding

The eight second trials were coded frame by frame (each frame = .04 seconds), in terms of whether the child looked to the left or to the right screen. All children were coded by the first author, and a second coder coded 17% of the data for reliabilities with high agreement with the first author (Cohen's Kappa = .9850). We calculated the proportion of time spent looking to the matching screen, out of total looking time to the two screens. An individual trial was treated as missing if the child looked away for more than half of the trial or recording failed. Due to this reason we had to exclude 13 trials out of 480, these were two animal identification trials, eight familiar verb trials and 3 novel

verb trials. Empty cells were filled with 0.5 which is assumed to be chance level.

Results

We tested the proportion of total looking time of both groups (TRAINING and NO TRAINING) against chance and found that only the group of children who got the training on full transitive sentences with familiar verbs were able to perform above chance in the preferential looking task (mean = .55, $t(23) = 2.266$, $p < .05$) whereas the group of children who heard the familiar verb merely modeled in the citation form while watching the familiar transitive events did not show above chance looking in the novel verb test trials (mean = .51, $t(23) = .307$, n.s.). Similarly to Gertner et al. (2006) we did not find any correlation between the children's performance in this task and vocabulary scores and also no group differences when comparing high and low vocabulary children.

Following Gertner et al. (2006) we wanted to know how quickly German children were able to detect a corresponding event when hearing a transitive sentence with a novel verb and therefore analyzed the proportion of looking to the matching screen in each two-seconds segment of the both test trials. The children who received the training on full familiar verb transitives showed a stronger preference for the matching screen than expected by chance during the last two-seconds (mean = .64, $t(23) = 2.876$, $p < .05$) but for the children who heard familiar verbs only in the citation form during training no above chance looking was found at any two-second segment (see table 1).

Insert Table 1

Furthermore, we were interested, whether the children showed a learning effect between the novel verb trials. Therefore we analyzed for order effects and found that the children in the TRAINING condition indeed showed above chance performance with the second novel item they were tested on (mean = .57, $t(23) = 2.552$, $p < .05$) but not with

the first novel item. Children in the NO TRAINING condition did not show this order effect (see table 2).

Insert Table 2

Discussion

The results of the current study were very clear. First, using a novel verb methodology almost identical to that of Gertner et al. (2006), we extended their English results to young children learning German. This is significant because German transitive sentences, as heard in normal child directed speech, provide different information about syntactic marking than do English transitive sentences. In approximately 21% of the transitive sentences that German children hear, the object/patient comes before the verb, and the subject/agent comes after the verb - with the only cue to syntactic role being case marking. In addition, another 11% have case marking that is ambiguous (because of homophonous forms), and so the only cue is word order (Dittmar et al., submitted). What we presented to children here was the prototype with both cues present, which they hear about two-thirds of the time. The basic finding was that 21-month-old German children also looked more to the matching screen in the Gertner et al. (2006) experimental paradigm, thus suggesting a quite young age of sensitivity to abstract, verb-general syntactic marking for a newly tested language.

However, the second finding was that for this experimental paradigm to work children had to undergo an initial practice/training phase in which they heard the same nouns they would later hear at test used for the same syntactic roles with the same syntactic marking (only with familiar verbs). Specifically, the current results were that when this practice/training phase was absent - that is, when a more neutral training phase exposing children to the general materials and methods of the study was used instead (language models comprising only verbs) - children did not look more to the matching

video during the test phase. Moreover, even with the practice/training phase, children were only above chance in looking at the matching video with their second test verb. What these findings suggest is that the children had to go through some kind of learning or priming period in which the additional linguistic experience somehow prepared them for the test.

There are two main types of possible explanations for how this additional linguistic experience in the practice/training phase facilitated children's performance: learning and priming. First, recall that the sentences used in the practice/training phase were identical to those used in the test phase except for the verb. During the practice/training phase when the child heard "the frog" in sentence-initial position, she also saw that it was the frog that was moving or acting because both events watched by the child on the two screens during that phase depicted the frog acting on the monkey - and so on for the other training sentences in which the frog was the patient, the monkey was the agent, and so forth. The child learned these connections. Then later, in the test trial, the child saw the frog acting on the monkey again - this time on only one of the two screens. Hearing, for example, "the frog" again in sentence-initial position directed the child's attention again to the screen in which the frog is actor - based on having learned this connection in the practice/training phase. Furthermore, the noun in the sentence-final position might have directed the child's attention in particular to the patient during the practice/training phase. (This would apply also for Gertner et al.'s (2006) second and fourth study in which only the patient argument was available.) In this explanation, syntactic knowledge is not needed for children to succeed in the test, only the learning of the connection between sentence position and causal source during the practice/training phase. A second possible learning explanation is that the children actually learned the full transitive construction and its marking patterns from the practice/training phase. This seems unlikely, but not impossible as focused training with multiple exemplars close together in time can lead to learning of the transitive construction in children about six

months older (albeit with many more exemplars: Childers & Tomasello, 2001; Abbot-Smith, Lieven, & Tomasello, 2004).

Also possible are priming explanations; that is, the basic idea is that children come to the experiment with some kind of syntactic knowledge which is somehow activated by the practice/training trials. In the Gertner et al. (2006) studies and the current study this priming could have been based at least partly on the particular nouns used, since, again, the same nouns were used in training and test. Or possibly the priming was of the transitive construction on a purely structural level (so-called structural priming, Bock & Loebell, 1990), with the matching of the nouns across training and test being irrelevant. To test this possibility one would need to have a training phase with full transitive sentences with no lexical overlap to any of the test sentences. Previous syntactic priming studies have only used elicited production with older children (Huttenlocher, Vasilyeva, & Shimpi, 2004; Savage et al., 2003). Therefore it is difficult to make precise predictions as to the outcome of a priming-in-comprehension paradigm with children below the age of two.

One can also formulate a kind of hybrid account based on the insight that learning and priming may not be as different as is typically thought. Recent formulations of the usage-based account have employed an exemplar model in which children's syntactic abstractions are based on accumulating individual exemplars, in this case of transitive sentences of different kinds (e.g., Abbot-Smith et al., 2004; Abbot-Smith & Tomasello, 2006). In this account, children would begin abstracting from the beginning of meaningful linguistic experience based on patterns they discern in this linguistic experience, with the resulting representations becoming fully abstract only very gradually (see, for instance, McClure, Pine, & Lieven, 2006). Different experimental methodologies require children to have representations of different "strengths" - that is, abstractions based on different numbers of exemplars (Munakata et al., 1997) - so that, for example, preferential looking requires only fairly weak representations, whereas

elicited production requires fairly strong representations. The current results would suggest that, in addition, the exposure children have to linguistic material immediately before they are tested could also have special importance in the acquisition process due to some kind of recency effect (see Chang, Dell, Bock, & Griffin, 2000; Bock & Griffin, 2000; Savage, Lieven, Theakston, & Tomasello, 2006 for the argument that priming is implicit learning).

It is important to note, however, that these results also suggest that much more needs to be done to work out the precise implications of varying methodologies and results in the preferential looking paradigm. Thus, mean proportion of looking time to the matching screen in the test conditions differed between the Gertner et al. (2006) study and our own: In our study children looked to the matching screen for a mean looking time of 55% which, although this is significantly better than chance, is not as high as the looking time of the children (70%), in Gertner et al.'s study 3. This study tested the same age group as ours (21-month-olds) but used different video stimuli in which real persons (boy and girl) acted instead of costumed ones. However, when Gertner et al. tested children using video stimuli in which persons in animal costumes performed the action, those children (aged 25 months) performed equally to ours and showed only 56% looking time to the target. In addition, we only found a significant looking preference in the last two seconds of the trial whereas Gertner et al.'s children's best performance was on the first two seconds. Finally our significant effect was on the second test item whereas Gertner et al.'s was present on the first test item. These differences could, of course, be due to the fact that we were testing German children using sentences marked for both case and word order. As noted above, it is possible that since neither of these is a perfect cue and they can sometimes conflict, it takes German children longer to become sensitive to them. However, it might also be the case that the preferential looking methodology per se is sensitive to many factors other than the linguistic stimuli (for instance, duration of trials, number of trials, and the video stimuli, e.g., persons in animal costumes or real

persons). Therefore, much more needs to be done to interpret differences in the extent of these sensitivities and their time course.

What kinds of linguistic experience children need to perform well in different experimental assessments - including as a special case linguistic experience in some training phase just prior to test - is an empirical question that may in fact have different answers for different specific syntactic constructions in different languages. There are thus many different practice/training phases that could be used to investigate precisely what information children of this age need during this initial phase to learn what they need to perform accurately in the test phase. For example, as noted above, one could use the Gertner et al. (2006) training materials but with different nouns/objects to see if perhaps they could attune to the transitive pattern just on the basis of hearing a number of transitive sentences of the type that they hear in their everyday linguistic interactions with others (structural priming). Or one could give them a practice/training phase with transitive sentences containing only pronouns, which, in English, would give them a practice with case marking – a different grammatical cue than in the test condition. This could either help or hinder them when encountering the test phase. Furthermore, using ambiguous pronouns (e.g, '*Sie wäscht sie*' (She is washing her.) in German or '*It is washing it*.' in English) in the practice/training phase would allow children to be trained on full transitive sentences but without giving them the possibility either to detect agents and patient or to learn grammatical marking in particular from the practice/training phase. In any case, the use of a practice/training phase presents the opportunity of exploring what kinds of immediate experience and/or learning contribute to children's syntactic competence as expressed in this preferential looking methodology.

It is important to recognize in all of this that there is no support for the radical theory that children have innate categories of subject and object and only need to link these to their particular language, on the basis of just one or a few exemplars, in order to have full syntactic competence. In both the usage-based account and rule-based account,

children are constructing linguistic categories based on their linguistic experience in their particular language. The point of contention is simply what kind of "head start" they have in the abstraction process in terms of general conceptual categories concerning transitive actions, semantic roles, and so forth (Fisher, 2002). The current study contributes to this debate by helping to investigate what kinds of linguistic experience are necessary for children to acquire and display their syntactic knowledge.

References

Abbot-Smith, K., Lieven, E., & Tomasello, M. (2004). Training 2;6-year-olds to produce the transitive construction: The role of frequency, semantic similarity and shared syntactic distribution. *Developmental Science, 7*(1), 48-55.

Abbot-Smith, K., & Tomasello, M. (2006). Exemplar-learning and schematization in a usage-based account of syntactic acquisition. *The Linguistic Review, 23*(3), 275 - 290.

Akhtar, N. (1999). Acquiring basic word order: Evidence for data-driven learning of syntactic structure. *Journal of Child Language, 26*(2), 339-356.

Akhtar, N., & Tomasello, M. (1997). Young children's productivity with word order and verb morphology. *Developmental Psychology, 33*(6), 952 - 965.

Bavin, E. L., & Growcott, C. (2000). Infants of 24-30 months understand verb frames. In M. Perkins & S. Howard (Eds.), *New directions in language development and disorders* (pp. 169 - 177). New York: Kluwer.

Bock, K., & Griffin, Z. M. (2000). The persistence of structural priming: Transient activation or implicit learning? *Journal of Experimental Psychology: General, 129*(2), 177 - 192.

Bock, K., & Loebell, H. (1990). Framing sentences. *Cognition, 35*(1), 1 - 39.

Brooks, P. J., & Tomasello, M. (1999). Young children learn to produce passives with nonce verbs. *Developmental Psychology, 35*(1), 29 - 44.

Chan, A., Meints, K., Lieven, E., & Tomasello, M. (submitted). Young children's comprehension of English word order in act-out and preferential looking tasks.

Chang, F., Dell, G. S., Bock, K., & Griffin, Z. M. (2000). Structural priming as implicit learning: A comparison of models of sentence production. *Journal of Psycholinguistic Research, 29*(2), 217 - 229.

Childers, J., & Tomasello, M. (2001). The role of pronouns in young children's acquisition of the English transitive construction. *Developmental Psychology, 37*(6), 730-748.

Dittmar, M., Abbot-Smith, K., Lieven, E., & Tomasello, M. (submitted). Comprehension of case marking and word order cues by German children.

Fenson, L., Dale, P., Reznick, J., Bates, E., Thal, D., & Pethnick, S. (1994). *Variability in early communicative development*. Chicago, IL: University of Chicago Press.

Fernandes, K., Marcus, G. F., DiNubila, J. A., & Vouloumanos, A. (2006). From semantics to syntax and back again: Argument structure in the third year of life. *Cognition, 100*(2), B10-B20.

Fisher, C. (2002). The role of abstract syntactic knowledge in language acquisition: A reply to Tomasello (2000). *Cognition, 82*, 259 - 278.

Gertner, Y., Fisher, C., & Eisengart, J. (2006). Learning words and rules: Abstract knowledge of word order in early sentence comprehension. *Psychological Science, 17*(8), 684 - 691.

Gillette, J., Gleitman, H., Gleitman, L. R., & Lederer, A. (1999). Human simulation of vocabulary learning. *Cognition, 73*, 135 - 176.

Gleitman, L. R. (1990). The structural sources of verb meaning. *Language Acquisition, 1*(1), 3-55.

Goldberg, A. (1999). The emergence of the semantics of argument structure constructions. In B. MacWhinney (ed.) *The emergence of language*. Mahwah, N.J.: Lawrence Erlbaum.

Golinkoff, R. M., Hirsh-Pasek, K., Cauley, K. M., & Gordon, L. (1987). The eyes have it: Lexical and syntactic comprehension in a new paradigm. *Journal of Child Language, 14*(1), 23-45.

Grimm, H., & Doil, H. (2001). *Elternfragebogen für die Früherkennung von Risikokindern*. Göttingen: Hogrefe.

Huttenlocher, J., Vasilyeva, M., & Shimpi, P. (2004). Syntactic priming in young children. *Journal of Memory and Language, 50,* 182 - 195.

Matthews, D., Lieven, E., Theakston, A., & Tomasello, M. (2005). The role of frequency in the acquisition of English word order. *Cognitive Development, 20*(1), 121-136.

McClure, K., Pine, J. M., & Lieven, E. (2006). Investigating the abstractness of children's early knowledge of argument structure. *Journal of Child Language, 33,* 693 – 720.

Munakata, Y., McClelland, J. L., Johnsons, M. H., & Siegler, R. S. (1997). Rethinking infant knowledge: Toward an adaptive process account of successes and failures in object permanence tasks. *Psychological Review, 104*(4), 686 - 713.

Naigles, L. R. (1990). Children use syntax to learn verb meaning. *Journal of Child Language, 17,* 357 - 374.

Pine, J. M., Lieven, E., & Rowland, C. (1998). Comparing different models of the English verb category. *Linguistics, 36*(4), 807 - 830.

Pinker, S. (1984). *Language learnability and language development*. Cambridge, MA: Harvard University Press.

Pinker, S. (1989). *Learnability and cognition: The acquisition of verb-argument structure*. Cambridge, MA: Harvard University Press.

Roberts, K. (1983). Comprehension and production of word order in stage-I. *Child Development, 54*(2), 443 - 449.

Savage, C., Lieven, E., Theakston, A., & Tomasello, M. (2003). Testing the abstractness of children's linguistic representations: Lexical and structural priming of syntactic constructions in young children. *Developmental Science, 6*(5), 557-567.

Savage, C., Lieven, E., Theakston, A., & Tomasello, M. (2006). Structural priming as implicit learning in language acquisition: The persistence of lexical and structural priming in 4-year-olds. *Language Learning and Development, 2*(1), 27 - 49.

Tomasello, M. (1992). *First verbs: a case study of early grammatical development*. Cambridge: Cambridge University Press.

Tomasello, M. (2000). Do young children have adult syntactic competence? *Cognition, 74*, 209 - 253.

Tomasello, M. (2003). *Constructing a language*. Cambridge, MA; London: Harvard University Press.

Wittek, A., & Tomasello, M. (2005). German-speaking children's productivity with syntactic constructions and case morphology: Local cues act locally. *First Language, 25*(1), 103 - 125.

Tables

Table 1: Mean proportion of looking time to the matching screen during the test trials collapsed over both trials and both items (total look) and within each of the eight two-second-intervals of the first and the second trial (collapsed over both items)

		interval analysis							
		first trial				second trial			
condition	total look (both trials)	0-2 s	2-4 s	4-6 s	6-8 s	0-2 s	2-4 s	4-6 s	6-8 s
TRAINING	.**55***	.47	.50	.57	.52	.57	.54	.56	.**64***
NO TRAINING	.51	.43	.39	.60	.55	.50	.54	.57	.51

*significant above chance, $p < .05$

Table 2: Mean proportion of looking time to the matching screen during the test trials with the first novel item and the second novel item

condition	item 1	item 2
TRAINING	.52	.**57***
NO TRAINING	.51	.51

*significant above chance, $p < .05$

Figures

Blank screen + center light (5s):

Der Frosch wird gleich den Affen tammen

(*The frog is going to tam the monkey*.)

First test trial (8s):

Der Frosch tammt den Affen. (x2)

(*The frog is tamming the monkey.* (x2))

Blank screen + center light (5s):

Der Frosch hat den Affen getammt

(*The frog tammed the monkey*.)

Second test trial (8s):

Der Frosch tammt den Affen. Such mal tammen!

(*The frog is tamming the monkey. Find tamming*!)

Figure 1: Procedure of test trials