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Do young children have adult syntactic competence?

Michael Tomasello*

Max Planck Institute for Evolutionary Anthropology, Inselstrasse 22, D-04103 Leipzig, Germany

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Abstract

Many developmental psycholinguists assume that young children have adult syntactic competence, this assumption being operationalized in the use of adult-like grammars to describe young children's language. This ''continuity assumption'' has never had strong empirical support, but recently a number of new findings have emerged - both from systematic analyses of children's spontaneous speech and from controlled experiments - that contradict it directly. In general, the key finding is that most of children's early linguistic competence is item based, and therefore their language development proceeds in a piecemeal fashion with virtually no evidence of any system-wide syntactic categories, schemas, or parameters. For a variety of reasons, these findings are not easily explained in terms of the development of children's skills of linguistic performance, pragmatics, or other ''external'' factors. The framework of an alternative, usage-based theory of child language acquisition - relying explicitly on new models from Cognitive-Functional Linguistics - is presented.

Keywords: Language; Language acquisition; Cognitive development; Syntax

1. Introduction

To become a competent speaker of a natural language it is necessary to be conventional: to use language the way that other people use it. To become a competent speaker of a natural language it is also necessary to be creative: to formulate novel utterances tailored to the exigencies of particular communicative circum-

* Tel.: + 49-341-9952-400; fax: + 49-341-9952-119.
E-mail address: tomas@eva.mpg.de (M. Tomasello)

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stances. From the beginnings of modern cognitive science (and further traceable at least back to Kant), this paradoxical ability to be simultaneously conventional yet creative has been explained in terms of the human capacity to operate with abstract cognitive entities such as categories, schemas, structures, or rules.

Interestingly, young children show evidence of operating with at least some linguistic abstractions from very early in ontogeny. Thus, from the very beginnings of multi-word speech children create novel utterances that they have never before heard, for example, the famous *Allgone sticky* as reported by Braine (1971). Based on this fact - and on some logical arguments about ''learnability'' - many researchers in the Generative Grammar (Chomskian) tradition have even gone so far as to posit that young children operate with adult-like linguistic competence. The milder version of this ''continuity assumption'' states:

> In the absence of compelling evidence to the contrary, the child's grammatical rules should be drawn from the same basic rule types, and be composed of primitive symbols from the same class, as the grammatical rules attributed to adults in standard linguistic investigations. (Pinker, 1984, p. 7).

The most extreme version of the continuity assumption, asserts that young children from the beginning have essentially ''full linguistic competence''.

> A survey of recent influential contributions to the field [Generative Grammer - MT]... suggests that the proposal that the child embarks on grammatical development with a complete (in some sense) system of syntactic representation is widely supported. (Atkinson, 1996, p. 451).

The continuity assumption is in many ways the fundamental theoretical postulate of generative approaches to language acquisition because it, and only it, enables linguists to describe young children's language with adult-like formal grammars.

Recently, however, some new data have emerged that invite a new look at the continuity assumption in both its milder and more extreme forms. Basically, the data show that young children's creativity - productivity - with language has been grossly overestimated; beginning language learners produce novel utterances in only some fairly limited ways. Specifically, beginning language learners quite readily substitute nominals for one another, and so generalize from such things as *Allgone juice* and *Allgone paper* to *Allgone sticky* ('sticky' being conceived as a substance). Such creativity is convincing evidence that these children have something like an abstract category of 'nominal' (perhaps limited to concrete objects, people, and substances) from very early in development. However, beginning language learners are not creative or productive with their language in some other basic ways. For example, they do not use a verb in a sentence frame in which they have not heard it used. Thus, on the basis of hearing just *The window broke* (and no other uses of this verb) they cannot go on to produce *He broke it* or *It got broken*, even though they are producing simple transitive and passive utterances with other verbs. This lack of productivity suggests that young children do not yet possess abstract and verb-general argument structure constructions into which different verbs may be substituted for one another as needed, but rather they are working more concretely with verbs as individual

lexical items whose syntactic behavior must be learned one by one. Overall, children's limited creativity with their early language calls into question the practice of describing their underlying syntactic competence in terms of abstract and adult-like syntactic categories, schemas, and grammars.

In this paper, I do three things. First, I present some new data suggesting that young children's early language is more concrete and item-based than is generally recognized. Second, I discuss the implications of these new data for generative (Chomskian) approaches to language acquisition, which routinely make the continuity assumption and so use adult-like formal grammars to describe early language. Third, I attempt to spell out the general outlines of an alternative theory of language acquisition that does not attribute to young children adult-like syntactic competence. This alternative theory is a usage-based theory inspired by the new models of linguistic competence from Cognitive-Functional Linguistics, and it attempts to account for the new data in a very specific manner.

2. Some new data on child language acquisition

Most of children's early language is ''grammatical'' from the adult point of view. But there are at least two very different explanations for this fact. One is that children are operating from the beginning with adult-like grammatical categories and schemas. The other is that children are learning to use specific linguistic items and structures (e.g. specific words and phrases) in the way that adults are using them - with the proviso that they can substitute nominals for one another relatively freely. In other words: young children may be using language like adults either because they have the same underlying linguistic competence as adults or because they are imitatively learning from them.

Given that children's use of language in adult-like ways does not differentiate between these two explanations - not even when they are able to meet Brown (1973) criterion of 'use of a grammatical structure in 90% of its obligatory contexts' (since this may still simply reflect reproduction of adult usage) - deeper analyses of children's linguistic competence are needed. The key requirement is to find some way to differentiate between utterances the child is generating on the basis of specific words and phrases and those she is generating on the basis of more abstract linguistic categories and schemas. There are two basic methods, both of which focus on children's productivity, that is, their use of language in ways that go beyond what they have heard from adults. The first method is the analysis of children's spontaneous speech, but with the stipulation that we look at **all** of a child's uses - and most especially non-uses - of a particular set of linguistic items or structures. Thus, a Spanish-speaking child might produce *Te amo* a thousand times correctly, but a systematic analysis might also reveal that she uses this verb in none of its other forms for different persons or numbers. If indeed there have been opportunities to use this verb in these other ways - and there are no other external factors preventing such usage - this limited facility with this verb tells us much about this child's overall syntactic competence.

The second method involves teaching children novel linguistic items and seeing what they do with them (Berko, 1958). For instance, if we teach a Spanish-speaking child a novel verb *ponzar*, for some novel made-up action, the question would be: Can she immediately use this newly learned verb in all of its persons, numbers, tenses, and modalities - or can she use it only in the way she has heard it used? Like the experimentally introduced 'tracer' elements used in medical diagnoses, if the novel word is used in creative yet canonical ways, the inference is that it has indeed been taken up by some kind of internal system - in the current example, abstract syntactic categories and schemas concerning verb person and number. If it is not used in any creative ways, but only in ways the child has already heard, the inference is either that: (i) there is no abstract system to take up the new element (and the child is simply learning a specific linguistic item or structure); or (ii) for some reason the existing abstract system is unable to take up the new element. This latter possibility means, for the most part, the possibility that there are performance factors (e.g. limited processing or memory skills) that prevent the child from demonstrating her syntactic competence in the experiment.

Recent data collected by each of these two methods helps to specify which aspects of children's language are generated on the basis of concrete linguistic items and structures and which aspects of their language are generated on the basis of abstract linguistic categories and schemas. I first review the observational data and then the experimental data.

2.1. Observational studies

Even in the earliest modern analyses there were suggestions that young children were using at least some of their language in item-specific ways, that is, that individual children were not showing great systematicity across different aspects of their early language development even when, from an adult perspective, they should have been. For example, a given child might use a lexical item like *up* in all kinds in interesting ways in all kinds of interesting combinatorial patterns, but then use the very similar lexical items *down* and *on* only as single word utterances, even when it would be to their communicative benefit to use them in word combinations. Bowerman (1976) suggested that one of her two English-speaking children had many such item-specific constructions, MacWhinney (1978) suggested the same for at least some of his Hungarian-speaking children, and Braine (1976) found many item-specific patterns in the spontaneous speech of several children learning a number of different languages. All of these researchers, however, concluded that most of the children also had some more general patterns, as evidenced by the fact that they sometimes used semantically similar items in similar ways at a given developmental period; for example, a particular child might use the verbs *eat* and *drink* in similar ways at a given time. The problem with this kind of data, however, is that we do not know if adults talking to this child used these particular lexical items in this same way - and so we cannot know whether the child's similar use of these items is due to her abstract linguistic competence or to her imitative learning from adults.

Tomasello (1992) performed analyses aimed at these questions using diary data that, for all practical purposes, included all of the different ways his English-speaking child, T, used each of her verbs during the period from 15 to 24 months of age. The advantage of continuous diary data over all other kinds of child language data is that they include information about what the child did **not** do - an inference that is always extremely weak when periodic sampling is used (e.g. one hour every two weeks, as in most studies). The major findings of this study may be summarized as follows.

- Of the 162 verbs and predicate terms used, almost half were used in one and only one construction type, and over two-thirds were used in either one or two construction types - where construction type means verb-argument configuration (e.g. *Mommy break* and *Daddy break* are the same construction type, whereas *Break cup, Mommy break cup,* and *Break with stick* are three additional construction types).
- At any given developmental period, there was great unevenness in how different verbs, even those that were very close in meaning, were used - both in terms of the number and types of construction types used. For example, at 23 months of age the verb *cut* was used in only one simple construction type (*Cut __*) whereas the similar verb *draw* was used in many different construction types, some with much complexity (e.g. *I draw on the man, Draw it by Santa Claus*). Where information on adult usage was available for a given verb, there was a very good match with child usage (see also DeVilliers, 1985; Naigles & Hoff-Ginsburg, 1998).
- There was also great unevenness in the syntactic marking of the ''same'' argument across verbs such that, for example, at a given developmental period, one verb would have its instrument marked with *with* or *by* but another verb, even when used in utterances of the same length and complexity, would not have this marker. Some verbs were used with lexically expressed subjects whereas others at the same time were not, even though they were used in comparable construction types and in comparable pragmatic contexts (e.g. T produced subjects for *take* and *get* but not for *put*).
- Morphological marking on verbs was also very uneven, with roughly two-thirds of all verbs never marked morphologically for tense or aspect, one-sixth marked for past tense only, one-sixth marked for present progressive only, and only 4 verbs (2%) marked for both of these functions during the second year of life (see Bloom, 1992; Clark, 1996).
- On the other hand, within any given verb's development, there was great continuity such that new uses of a given verb almost always replicated previous uses and then made one small addition or modification (e.g. the marking of tense or the adding of a new argument). By far the best predictor of T's use of a given verb on a given day was not her use of other verbs on that same day, but rather her use of that same verb on immediately preceding days.

The resulting hypothesis, the Verb Island Hypothesis, was that children's early language is organized and structured totally around individual verbs and other

predicative terms; that is, the 2-year-old child's syntactic competence is comprised totally of verb-specific constructions with open nominal slots. Other than the categorization of nominals, nascent language learners possess no other linguistic abstractions or forms of syntactic organization. This means that the syntagmatic categories with which children are working are not such verb-general things as 'subject' and 'object', or even 'agent' and 'patient', but rather such verb-specific things as 'hitter ' and 'hittee', 'sitter' and 'thing sat upon'.

Using a combination of periodic sampling and maternal diaries, Lieven, Pine and Baldwin (1997) (see also Pine & Lieven, 1993; Pine, Lieven & Rowland, 1998) found some very similar results in a sample of 12 English-speaking children from 1 to 3 years of age. In particular, they found that virtually all of their children used most of their verbs and predicative terms in one and only one construction type early in language development - suggesting that their syntax was built around these particular lexical items. In fact, fully 92% of these children's earliest multi-word utterances emanated from one of their first 25 lexically-based patterns, which were different for each child. Following along these same lines, Pine and Lieven (1997) found that when these same children began to use the determiners *a* and *the* in the 2 to 3 year period, they did so with almost completely different sets of nominals (i.e. there was almost no overlap in the sets of nouns used with the two determiners) - suggesting that the children at this age did not have any kind of abstract category of Determiner that included both of these lexical items.

A number of systematic studies of children learning languages other than English have found very similar results. For example, Pizutto and Caselli (1994) investigated the grammatical morphology used by 3 Italian-speaking children on their simple, finite, main verbs, from approximately 1.5 to 3.0 years of age (see also Pizutto & Caselli, 1992). Although there are six forms possible for each verb root (first-person singular, second-person singular, etc.), 47% of all verbs used by these children were used in 1 form only, and an additional 40% were used with 2 or 3 forms. Of the 13% of verbs that appeared in 4 or more forms, approximately half of these were highly frequent, highly irregular forms that could only be learned by rote. The clear implication is that Italian children do not master the whole verb paradigm for all their verbs at once, but rather they only master some endings with some verbs - and often different ones with different verbs. In a similar study of one child learning to speak Brazilian Portugese at around 3 years of age, Rubino and Pine (1998) found a comparable pattern of results, including additional evidence that the verb forms this child used most frequently and consistently corresponded to those he had heard most frequently from adults. That is, this child produced adult-like subject-verb agreement patterns for the parts of the verb paradigm that appeared with high frequency in adult language (e.g. first-person singular), but much less consistent agreement patterns in low frequency parts of the paradigm (e.g. third-person plural). (For additional findings of this same type, see Serrat, 1997, for Catalan; Behrens, 1998, for Dutch; Allen, 1996, for Inuktitut; Gathecole, Sebastián & Soto, 1999, for Spanish; and Stoll, 1998, for Russian). Finally, in a study of 6 Hebrew-speaking children - a language that is typologically quite

different from most European languages - Berman and Armon-Lotem (1995) (see also Berman, 1982) found that children's first 20 verb forms were almost all ''rote-learned or morphologically unanalyzed'' (p. 37).

Of special note in spontaneous speech are so-called overgeneralization errors because, presumably, children have not heard such forms used in adult speech. In the context of a focus on syntax, the overgeneralizations of most interest are those involving argument structure constructions, for example, *She falled me down* or *Don't giggle me* in which the child uses verbs in syntactic constructions in non-canonical ways that seem to indicate that she has some abstract, verb-general schema for such things as a transitive SVO construction. Bowerman (1982, 1988) in particular documented a number of such overgeneralizations in the speech of her two English-speaking children, and Pinker (1989) compiled examples from other sources as well. The main result of interest in the current context is that these children produced very few argument structure overgeneralizations before about 3 years of age and virtually none before 2.5 years of age (see Pinker, 1989, pp. 17–26).

These data-intensive studies from a number of different languages together show a very clear pattern. First, young children's earliest linguistic productions revolve around concrete items and structures; there is virtually no evidence of abstract syntactic categories and schemas. Second, each of these items and structures undergoes its own development - presumably based on individual children's linguistic experience and other factors affecting learning - in relative independence of other items and structures. Third, this pattern persists in most cases until around the third birthday, at least for relatively large structures such as transitive SVO utterances and other verb-argument constructions, and so suggests that children's earliest syntagmatic categories are lexically specific categories such as 'kisser', 'kissee', 'seer', 'thing seen', and so forth and so on. In light of these findings, the claim that young children possess abstract, adult-like categories such as 'subject', 'object', 'agent', or 'patient', is tantamount to the claim that their naturally occurring language does not reflect their underlying syntactic competence. Data from spontaneous speech by itself cannot decide the issue, of course, because we never know for certain what the child has and has not heard, and so inferences about child productivity are always indirect (i.e. they are based on what the child most likely has heard given 'typical' adult usage). Experimental observations, on the other hand, control the language that children hear and so can potentially remedy this weakness of natural observations for answering the basic question of child productivity.

2.2. Experimental studies

There is no question that young children learn and use the linguistic items and structures to which they are exposed with amazing facility. Thus, in their spontaneous speech young English-speaking children use canonical word order for most of their verbs, including transitive verbs, from very early in development (Bloom, 1992; Braine, 1971; Brown, 1973). In comprehension tasks, children as young as

two years of age respond appropriately to requests that they ''Make the doggie bite the cat'' (reversible transitives) that depend crucially on a knowledge of canonical English word order (e.g. Bates & MacWhinney, 1989; Bates, MacWhinney, Caselli, Devoscovi, Natale & Venza, 1984; Chapman & Miller, 1975; DeVilliers & DeVilliers, 1973; Roberts, 1983; Slobin & Bever, 1982), and successful comprehension is found at even younger ages if preferential looking techniques are used (Hirsh-Pasek & Golinkoff, 1991, 1996). But, as noted earlier, if we do not know what children have and have not heard, adult-like production and comprehension of language is not diagnostic of the underlying processes involved.

The main way to test for underlying process is to introduce children to novel linguistic items that they have never before heard (''tracer elements''), and then see what they do with them. For questions of syntax in particular, the method of choice is to introduce young children to a novel verb in one syntactic construction and then to see whether and in what ways they use that verb in other, non-modeled syntactic constructions - perhaps with some form of discourse encouragement involving leading questions and the like. As in all behavioral experiments, care must be taken to control factors other than those of direct interest. In the current instance special care must be taken that external performance factors, such as the memory and processing demands of the experimental task, do not adversely affect children's linguistic performance.

Experiments using novel verbs as tracer elements have demonstrated that by 3.5 or 4 years of age most children can readily assimilate novel verbs to abstract syntactic categories and schemas that they bring to the experiment. For example, with special reference to the simple transitive construction, Maratsos, Gudeman, Gerard-Ngo and DeHart (1987) taught children from 4.5 to 5.5 years of age the novel verb *fud* for a novel transitive action (human operating a machine that transformed the shape of playdough). Children were introduced to the novel verb in a series of intransitive sentence frames such as ''The dough finally fudded'', ''It won't fud'', and ''The dough's fudding in the machine''. Children were then prompted with either neutral questions, such as ''What's happening?'' or more biasing questions such as ''What are you doing?'' which encourages a transitive response such as ''I'm fudding the dough'' (see also Ingham, 1993). Pinker, Lebeaux and Frost (1987) used a similar experimental design except that they introduced children to the novel verb in a passive construction, ''The fork is being floosed by the pencil'', and then asked them the question ''What is the pencil doing?'' to pull for an active, transitive response such as ''It's floosing the fork''. In both of these studies, the general finding was that the vast majority of children from 3.5 to 8 years of age (2/3 or more of the sample in most cases) could produce a canonical transitive utterance with the novel verb, even though they had never heard it used in that construction. These results suggest that children of this age come to the experiment with some kind of abstract, verb-general, SVO transitive construction to which they readily assimilate the newly learned verb simply on the basis of observing the real world situation to which it refers (and, in some cases, hints from the way adults ask them questions about this situation).

Over the past few years my collaborators and I have pursued a fairly systematic

investigation of English-speaking children's ability to produce simple transitive SVO sentences with verbs they have not heard used in this construction, but focusing mainly on children below the ages represented in these previous studies. The focus on younger children is important because most theories of the acquisition of syntactic competence single out the age range from 2 to 3.5 years as especially important, and indeed by virtually all theoretical accounts children of 3.5 years and older should possess much syntactic competence. Reviewing these studies with children beginning at 2;0 years thus provides an opportunity to look for some kind of developmental trajectory in children's earliest syntactic competence with novel verbs. Indeed, to anticipate the outcome of the review, there does seem to be a gradual increase in children's ability to perform in more adult-like ways in novel-verb experiments during this early age range. However, care must be taken in reviewing these experiments to discriminate between the possibility that children are acquiring their abstract syntactic knowledge only gradually, and the alternative possibility that they have such knowledge all along but must still learn how to display that knowledge in the context of different kinds of performance demands in both experimental and naturalistic contexts. We must therefore pay serious attention to the control procedures used in these studies.

First and most simple was a study by Tomasello, Akhtar, Dodson and Rekau (1997). We were interested in what children just learning to combine words would do with novel verbs and also, as a kind of control procedure, with nouns. Fifteen children from 1;6 to 1;11 (identified as word combiners) were exposed to multiple adult models of two novel nouns and two novel verbs in minimal syntactic contexts: for the noun ''Look! The wug!'' and for the verb ''Look! Meeking'' or else ''Look what Ernie's doing to Big Bird! It's called meeking!'' (this second type of verb model was an attempt to ensure that the children saw the event as transitive and also that they had heard adults name the participants involved). Children were exposed to these words multiple times each day over a ten-day period, with opportunities to produce the words available continuously on each day. Virtually all children produced each word at least once as a single word utterance, mostly multiple times, with an average of over 20 times per word per child - and virtually all children responded appropriately on tests of comprehension to all words as well. There was thus no difference in children's learning of the nouns and verbs as lexical items. However, there was a very large difference in the way the children combined their newly learned nouns and verbs with other words. They combined the nouns quite freely, averaging 14.5 word combinations per child, with a number of fully transitive utterances such as ''I see wug'', ''I want my wug'', ''I pushing wug'', and ''Wug did it''. On the other hand, the children hardly combined their newly learned verbs with other words at all, averaging only about 0.5 word combinations per child, and there was only one token from one child of a transitive utterance: ''I meeking it''. In a pair of similar studies with slightly older children (1;11 to 2;3), Olguin and Tomasello (1993); Tomasello and Olguin (1993) found very similar results, with children producing over 6 novel combinations per child with nouns but only one child produced a novel transitive utterance with his newly learned verb (7 tokens of ''I/me gorp

it'').[1] Working with older children still, Dodson and Tomasello (1998) used the same basic methodology with children from 2;5 to 3;1 and found that only 3 of 18 children between 2;5 and 3;0 produced a novel transitive utterance with their newly learned verb. Three of 6 children over 3;0 did so, however, suggesting the possibility that 3 years of age is an important milestone for many children.

Akhtar and Tomasello (1997) wanted to explore specifically whether children's conservative use of newly learned verbs was due to some kind of performance factors. Perhaps the children used verbs conservatively because that is what they thought was expected of them in the experiment (although it is unclear why they did not also think this for nouns), and perhaps they would show more skills in tests of comprehension. In the first study we simply replicated Olguin and Tomasello (1993) but with older children from 2;9 to 3;8. Consistent with that study, only 2 of the 10 children produced a novel transitive utterance with an appropriately marked agent and patient (i.e. using canonical English word order). In a second study we then tried to eliminate the possibility that the children might not understand what was expected of them in this experimental context. Children at 2;9 and 3;8 heard us say *This is called pushing* as we enacted a pushing event. They were then asked *What's happening?* and were encouraged through various kinds of modeling and feedback to respond with SVO utterances of the type *Ernie's pushing Bert*. We then trained them in exactly the same manner with a novel verb and action (*This is called gopping)* and then asked them *What's happening?* In response to this training all of the 20 children independently produced at least one canonical SVO utterance such as *Ernie's gopping Bert*, most children producing several. The logic of this study was thus that children were trained in what would be expected of them in the test, and they did not proceed to the test phase unless they first demonstrated an understanding of the task and an ability to master its performance demands. For the test, children were then introduced to another novel verb paired with a novel action - *This is called meeking* - followed by the question *What's happening?* In this final test sequence the 3;8 children were quite good, with 8 of 10 children producing at least one productive transitive utterance of the form *She's meeking the car*. However, only 1 of the 10 younger 2;9 children produced a novel transitive utterance with the test verb.

In a third study Akhtar and Tomasello (1997) also ran two different comprehension tests - which would seem to have fewer performance demands than tests of language production. In the first, the children who had just heard *This is called dacking* for many models were then asked to *Make Cookie Monster dack Big Bird*. All 10 of the children 3;8 were excellent in this task (9 or 10 correct out of

[1] Dodson and Tomasello (1998) reviewed all of the published data on children under 2;5, including the unpublished raw data of Braine, Brody, Fisch, Weisberger and Blum (1990), and found that virtually every token of a productive word combination by children in this age range had the pronoun *I* or *me* as subject and the pronoun *it* as object - suggesting that some children may have early island-type constructions structured not around the individual verbs involved but around the individual lexical items *I/me* and *it* (Lieven et al., 1997; Pine et al., 1998).

10 trials), whereas only 3 of the 10 children at 2;9 were above chance in this task - even though most did well on a control task using familiar verbs. Because using the verb as single word utterance is a somewhat odd way for children to be introduced to a verb (a theme to which I return shortly), a second comprehension test was also conducted with children at 2;9. The children first learned to act out a novel action on a novel apparatus with two toy characters, and only then (their first introduction to the novel verb) did the adult hand them two new characters and request *Can you make X meek Y* (while placing the apparatus in front of them)? In this case children's only exposure to the novel verb was in a very natural transitive sentence frame used for an action they already knew how to perform. Since every child knew the names of the novel characters and on every trial attempted to make one of them act on the other in the appropriate way, the only question was which character should play which role. These under-3-year-old children were, as a group, at chance in this task, with only 3 of the 12 children performing above chance as individuals. (See Fischer, 1996, for some positive results, using a slightly different methodology, for children averaging 3;6 years of age).

As alluded to above, one concern about these experiments is that when children hear things like *Dacking* or *This is called dacking* they do not really understand that the novel word is a verb. My collaborators and I chose this so-called ''presentational construction'' because we felt that the full sentences used by Maratsos et al. (1987); Pinker et al. (1987) posed a different problem for children; that is, when children hear a verb used in an intransitive construction such as *The top is spinning* (unaccusative) and then are encouraged to produce *Bill is spinning the top*, the child has to change the syntactic role being played by the top from actor (subject) to patient (object) - and with passives the two roles must be interchanged. Nevertheless, the naturalness of these language models is an important advantage as they demonstrate for the child one way the novel verb may behave as a verb. My collaborators and I therefore conducted three additional novel verb experiments with young children using these more natural models: one with a passive model (as in Pinker et al., 1987), one with an intransitive model (as in Maratsos et al., 1987), and one with an imperative model.[2] We also followed the procedure of these previous studies in putting children under ''discourse pressure'' by asking them leading questions that encouraged particular types of responses.

Another issue involving performance demands is as follows. Although in the earlier studies we compared children's use of novel verbs to novel nouns (and used other control procedures), perhaps a more appropriate control is to teach children two novel verbs - one in a transitive construction and one in some other construction - then put them under discourse pressure to produce a transitive utterance with each of their

[2] It should be noted that in each of these cases the ''transformation'' the child has to effect to change the adult's utterance into a transitive utterance is different: to get from a passive to an active she has to rearrange the positioning of the arguments; to get from an (unaccusative) intransitive to a transitive she has to add an argument (and ''move'' the other); and to get from an imperative transitive to an indicative transitive she simply has to add an argument.

newly learned verbs. A transitive utterance would thus **not** be productive for the children who learned the new verb in a transitive construction, but it would be productive for the children who learned the new verb in some other construction. The three studies we have performed with passive, intransitive, and imperative models all had this kind of control condition.

- Brooks and Tomasello (1999) exposed 20 children (average age = 2;10) to one novel verb in the context of a passive model such as *Ernie is getting meeked by the dog* and another novel verb in the context of an active transitive model such as *The cat is gorping Bert* - each for a highly transitive and novel action in which an agent did something to a patient. We then asked them agent questions of the type *What is the AGENT doing?* This agent question pulls for an active transitive utterance such as *He's meeking Ernie* or *He's gorping Bert* - which would be novel for *meek* since it was heard only as a passive, but **not** novel for *gorp* since it was heard only as an active transitive. Overall in two studies, fully 93% of the children in the control condition, who heard exclusively transitive models with the novel verb, were able to use that verb in a transitive utterance. On the other hand, only 28% of the children at 2;10 who heard exclusively passive models with the novel verb were able to use that verb in an active transitive utterance.
- Tomasello and Brooks (1998) exposed 16 children at 2;0 and 16 children at 2;6 to one novel verb in the context of an intransitive model such as *The ball is dacking* and another novel verb in the context of a transitive model such as *Jim is tamming the car* - each for a highly transitive and novel action in which an agent did something to a patient. We then asked them agent questions of the type *What's the AGENT doing?* Again this question pulls for a transitive utterance such as *He's dacking the ball* or *He's tamming the car* - which would be novel for *dack* since it was heard only as an intransitive, but **not** novel for *tam* since it was heard only as a transitive. With the transitively introduced verb in the control condition, 11 of the 16 younger children and all 16 of the older children produced a novel transitive utterance. However, with the intransitively introduced verb, only one of 16 children at 2;0 and only 3 of 16 children at 2;6 produced a novel transitive utterance.
- Lewis and Tomasello (in preparation) exposed 18 children at 2;0, 2;6, and 3;0 to one novel verb in the context of both transitive and intransitive imperative models such as *Dop the lion!* and *Dop, Lion!* and another novel verb in the context of both transitive and intransitive indicative models such as *Jim is pilking the lion* and *The lion is pilking* - each for a highly transitive and novel action in which an agent is doing something to a patient. We then asked them neutral questions of the type *What's happening?* With the indicatively introduced verb in the control condition, 11 children at 2;0, 11 children at 2;6, and 16 children at 3;0, produced either a transitive or intransitive utterance, with subject, as modeled. However, with the imperatively introduced verb (never heard with a subject), only 1 of 18 children at 2;0, 2 of 18 children

at 2;6, and 6 of 18 children at 3;0 produced a transitive utterance with a subject.[3]

To my knowledge there are only two studies of children learning languages other than English that employ the novel verb experimental paradigm. First, Berman (1993) investigated young Hebrew-speaking children's ability to use an intransitively introduced novel verb in a canonical transitive construction - requiring them to creatively construct a special verb form (a type of causative marker on the formerly intransitive verb) as well as a special arrangement of the other lexical items involved. Berman showed children of 2;9, 3;9, and 8;0 one-participant pictures (e.g. a ball rolling) and described it with a novel verb in canonical intransitive form, and then showed them a picture in which one participant acted on another (e.g. a boy rolling the ball). She then used a sentence completion task (she started the sentence for them, as in ''The boy.....'') in the hopes of eliciting novel transitive utterances. The findings were, as in the English reported above, a steady increase in novel transitive utterances over age, in this case from 9% at 2;9 to 38% at 3;9 to 69% at 8;0 - a bit lower level of performance than English-speaking children of the same ages (perhaps because the Hebrew children had to both change the verb morphologically and rearrange the order of some sentence elements). Second, Childers and Tomasello (1999) conducted a study in Chilean Spanish, which designates subjects by means of special endings on verbs in the typical Romance paradigm (with lexical subjects optional). Children heard a number of utterances with one and only one form of a nonce Spanish verb - either third person singular (e.g. *Mega*) or third person plural (e.g. *Megan*) - and were then encouraged to produce the other form. Results were that 4 of the 16 children at 2;6 and 6 of 16 children at 3;0 were able to produce the form they had not heard. Despite the very different linguistic structures involved in this case - all that was needed was a simple change of verb morphology, with nothing to be added and no reordering of elements needed - the Spanish-speaking children still had much trouble creatively producing the means for designating who-did-what-to-whom with the novel verb.

All of these studies involve children producing or failing to produce canonical utterances that go beyond what they have heard from adults. Their general failure to do so at early ages suggests that they do not possess the abstract structures that would enable this generativity. However, there is one recent study that may be of special importance because it succeeded in inducing children to follow adult models that were non-canonical English - and so the children produced utterances that

[3] The study of Naigles (1990) is sometimes taken to be discrepant with these findings. Her study employed a preferential looking paradigm in which children simply had to look at the video scene that matched the adult language (i.e. longer than at a mismatching picture). However, the two sentences that were compared in that study were *The duck is glorping the bunny* and *The bunny and the duck are glorping* - with one picture depicting the duck doing something to the bunny and the other depicting the two participants engaged in the same parallel action. The problem is that children might very well have been using the word *and* as an indicator of the parallel action picture (Olguin & Tomasello, 1993; Pinker, 1994). The similar study by Naigles et al. (1993), using an act-out task, has a number of methodological problems (see Akhtar & Tomasello, 1997, p. 964).

involved a different configuration of SVO than was typical in almost all of the speech they had previously heard or produced. Akhtar (1999) modeled novel verbs for novel events with young children at 2;8, 3;6, and 4;4 years old. One verb was modeled in canonical English SVO order, as in *Ernie meeking the car*, whereas two others were in non-canonical orders, either SOV (*Ernie the cow tamming*) or VSO (*Gopping Ernie the tree*). Children were then encouraged to use the novel verbs with neutral questions such as *What's happening?* Almost all of the children at all three ages produced exclusively SVO utterances with the novel verb when that is what they heard. However, when they heard one of the non-canonical SOV or VSO forms, children behaved differently at different ages. Only 1 of the 12 children at 2;8 and 4 of the 12 children at 3;6 consistently 'corrected' the non-canonical adult word order patterns to a canonical English SVO pattern, whereas 8 of 12 children at 4;4 did so. Interestingly, many of the younger children vacillated between imitation of the odd forms and 'correction' of the odd forms to canonical SVO order - indicating perhaps that they knew enough about English word order patterns to discern that these were strange utterances, but not enough to overcome completely their tendency to imitatively learn and reproduce the basic structure of what the adult was saying. A reasonable expectation is that if younger children were run in this experiment (at 2;0 to 2;6, for example), they would follow the adult models almost exclusively with little vacillation - because they know even less about English SVO ordering than Ahktar's youngest children.

2.3. The developmental trajectory

From these naturalistic and experimental studies, it is clear that young children are productive with their early language in only limited ways. Although there are data on a variety of structures in a variety of languages, the results are strongest for the most-studied structure, the English transitive construction. Before 3 years of age only a few English-speaking children manage to produce canonical transitive utterances with verbs they have not heard used in this way. We see this pattern when we look at their naturalistic utterances carefully and systematically - including the various ways in which particular verbs are and are not used - and we also see this same pattern when we look at their performance in a fairly diverse set of experimental paradigms in which they must (a) ''get to'' the transitive utterance from a variety of different constructions (presentational, intransitive, passive, imperative, non-canonical), and (b) they must do this in a variety of different tasks in a variety of types of discourse interactions with adults. Explanations in terms of child production deficits and other syntactically extraneous factors are not a likely explanation for these experimental findings because of all of the control procedures used (more extensive discussion below). The general finding for the large majority of children under 3 years of age is thus always the same no matter the method: they use some of their verbs in the transitive construction - namely, the ones they have heard used in that construction - but they do not use other of their verbs in the transitive construction - namely, the ones they have not heard in that construction.

Many children 3 years of age and older, however, do show evidence that they

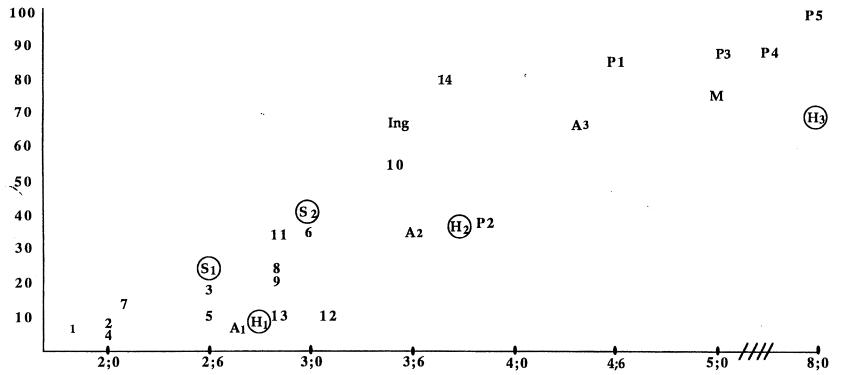

Fig. 1. Percentage of children (or in some cases responses - see Table 1) that produce productive transitive utterances using novel verbs in different studies (see Table 1 to identify studies and some of their charateristics).

posses an abstract transitive construction to which they can freely assimilate newly learned verbs - and indeed a few children show such evidence at even younger ages. Thus, when all of the findings just reviewed are compiled and quantitatively compared, we see a very gradual and continuous developmental progression (see Fig. 1 (see Table 1 for key). Fig. 1 was constructed by computing a single number for the productivity of children at each age group in each of the experimental studies reported above (see key to Fig. 1). In the vast majority of cases (including all of the studies by Tomasello and colleagues) this number was simply the proportion of children who produced at least one novel and canonical transitive utterance - despite the number of imitative utterances they produced, which in some cases was quite high. For a few studies this proportion could not be determined from published reports, and so the overall proportion of children's utterances that were productive was used instead (mostly this was for older children and involved very high proportions - in which case the two different ways of estimating productivity should correlate highly). Even though each study has some unique qualities of experimental design and procedure - many of which were detailed above - nevertheless virtually all of the studies fall on a curve that slopes steadily upward from age 2 to 4, at which point the slope flattens a bit but still reaches 100% by 8 years of age.

But this developmental picture of the ever-growing abstractness of the transitive construction is obviously not the whole picture. Children cannot just generalize all syntactic constructions to all verbs at will; at some point they must constrain the generalization process so as to conform with adult usage. I cannot give this difficult and important question all of the attention it deserves here, but a brief look at some recent findings will perhaps be useful in the current context since these findings suggest, once again, that there is a gradual developmental process of constraint in which children are, once again, strongly influenced by the language they hear around them.

Pinker (1989) proposed that there are certain very specific and (mostly) semantic

Table 1
Studies used: How they are designated in figure: Age of children; What percentage of children (or responses) were productive; The type of linguistic model used; The type of elicitation question used; Some notes on how the productivity score was calculated

Study	No. in Fig. 1	Age	Productivity	Linguistic model	Eliciting question	Scoring
Tomas et al. (1997)	1	1:10	0.07	Presentational	Neutral	% children
Tomas and Brooks (1999)	2	2;0	0.06	Intransitive	Agent	% children
	3	2;6	0.19			
Lewis and Tomas (in prep)	4	2;0	0.06	Imperative	Neutral	% children
	5	2;6	0.13			
	6	3;0	0.38			
Olguin and Tomas (1993)	7	2;1	0.13	Presentational	Neutral	% children
Dodson and Tomas (1998)	8	2;10	0.25	Presentational	Neutral	% children
Brooks and Tomas (1999)	9	2;10	0.20	Passive	Agent	% children
(Studies 1 and 2)	10	3;5	0.55			
	11	2;10	0.35			
Akhtar and Tomas (1997)	12	3;1	0.20	Presentational	Neutral	% children
(Studies 1 and 2)	13	2;9	0.10			
	14	3;8	0.80			
Ingham (1993)	Ing	3;5	0.67	Intransitive (low freq. English verbs)	Agent	% responses
	P1	4;6	0.86			
Pinker et al. (1987)	P2	3;10	0.38	Passive	Agent	% responses
Studies 1, 2 and 3	P3	5;1	0.88			(action verbs)
	P4	6;1	0.88			

Table 1 (*continued*)

Study	No. in Fig. 1	Age	Productivity	Linguistic model	Eliciting question	Scoring
	P5	7;11	1.00			
Maratsos et al. (1987)	M	5;0	0.75	Intransitive	Agent	% children (3 of 10 in 0–7% group)
Akhtar (1999)	A1	2;8	0.08	SOV & VSO	Neutral	% children (consistently correct)
	A2	3;6	0.33			
	A3	4;4	0.67			
Berman (1993)	H1	2;9	0.09	Intransitive (HEBREW)	Sentence completion	% responses (fully correct)
	H2	3;9	0.38			
	H3	8;0	0.69			
Childers and Tomas (1999)	S1	2;6	0.25	1st or 3rd Person Verb (SPANISH)	Neutral	% children
	S2	3;0	0.38			

constraints that apply to particular English constructions and to the verbs that may or may not be conventionally used in them. For example, a verb can be used felicitously with the English transitive construction if it denotes 'manner of locomotion' (e.g. *walk* and *drive* as in *I walked the dog at midnight* or *I drove my car to New York*), but not if it denotes a 'motion in a lexically specified direction' (e.g. *come* and *fall* as in **He came her to school* or **She falled him down*). How children learn these verb classes - and they must learn them since they differ across languages - is unknown at this time. Two other factors involved in syntactic constraint have also been widely discussed: entrenchment and preemption (see Bates & MacWhinney, 1989; Braine & Brooks, 1995; Clark, 1987; Goldberg, 1995). First, the more frequently children hear a verb used in a particular construction (the more firmly its usage is entrenched), the less likely they will be to extend that verb to any novel construction with which they have not heard it used. Second, if children hear a verb used in a linguistic construction that serves the same communicative function as some possible generalization, they may infer that the generalization is not conventional - the heard construction preempts the generalization. For example, if a child hears *He made the rabbit disappear*, when she might have expected *He disappeared the rabbit*, she may infer that *disappear* does not occur in a simple transitive construction - since the adult seems to be going to some lengths to avoid using it in this way (the periphrastic causative being a more marked construction). In many cases, of course, both entrenchment and preemption may work together, as a verb that is highly entrenched in one usage is not used in some other linguistic context but an alternative is used instead.

Two recent studies provide evidence that indeed all three of these constraining processes are at work, that is, entrenchment, preemption, and knowledge of semantic subclasses of verbs. First, Brooks, Tomasello, Lewis, and Dodson (in press) modeled the use of a number of fixed-transitivity English verbs for children from 3;5 to 8;0 years - verbs such as *disappear* that are exclusively intransitive and verbs such as *hit* that are exclusively transitive. There were four pairs of verbs, one member of each pair typically learned early by children and typically used often by adults (and so presumably more entrenched) and one member of each pair typically learned later by children and typically used less frequently by adults (less entrenched). The four pairs were: *come-arrive, take-remove, hit-strike, disappear-vanish* (the first member of each pair being more entrenched). The finding was that, in the face of adult questions attempting to induce them to overgeneralize, children of all ages were less likely to overgeneralize the strongly entrenched verbs than the weakly entrenched verbs; that is, they were more likely to produce *I arrived it* than *I comed it.*[4]

Second, Brooks and Tomasello (in press) taught novel verbs to children 2.5, 4.5, and 7.0 years of age. They then attempted to induce children to generalize these

[4] Bowerman (1988, 1997) reports that her two daughters produced many overgeneralizations for some early verbs that should be highly entrenched, such as *go* and *come*. However, precisely because these verbs are so frequent in children's speech, they have many opportunities to overgeneralize them; it is thus difficult to know if these verbs are overgeneralized more often than other verbs on a proportional basis.

novel verbs to new constructions. Some of these verbs conformed to Pinker (1989) semantic criteria, and some did not. Additionally, in some cases experimenters attempted to preempt generalizations by providing children with alternative ways of using the new verb (thus providing them with the possibility of answering *What's the boy doing?* with *He's making the ball tam* - which allows the verb to stay intransitive). In brief, the study found that both of these constraining factors worked, but only from age 4;6. Children from 4;6 showed a tendency to generalize or not generalize a verb in line with its membership in one of the key semantic subclasses, and they were less likely to generalize a verb to a novel construction if the adult provided them with a preempting alternative construction.

The details of these studies are not important for current purposes. What is important is that these constraining influences on syntactic constructions emerge only gradually. Entrenchment works early, from 3;0 or before, as particular verb island constructions become either more or less entrenched depending on usage. Preemption and semantic subclasses begin to work sometime later, perhaps not until 4;6 or later, as children learn more about the conventional uses of verbs and about all of the alternative linguistic constructions at their disposal in different communicative circumstances. Thus, just as verb-argument constructions become more abstract only gradually, so also are they constrained only gradually. Combining these findings on constraints with the findings depicted in Fig. 1, we may create a developmental trajectory that includes both the growing abstractness of children's constructions and also the factors that conspire to constrain the resulting generalization processes - preventing children from using all constructions with all verbs. The process may be illustrated, as in Fig. 2, with three verbs very similar in meaning: *laugh, giggle,* and *chortle* (this example being inspired by Bowerman's child's

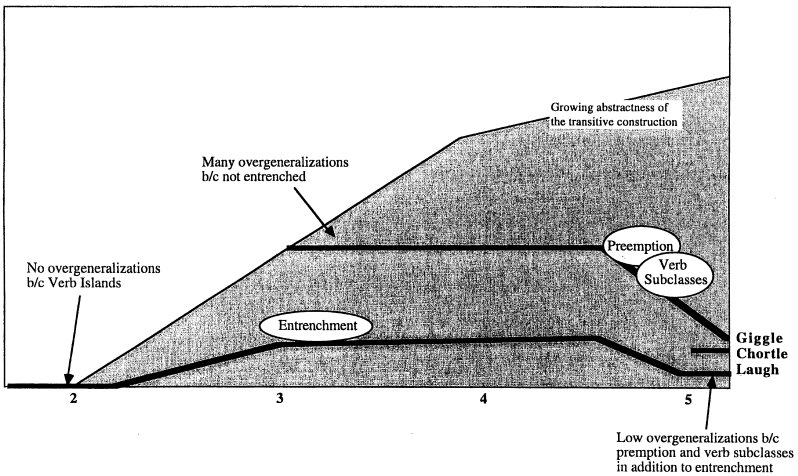

Fig. 2. Shaded area depicts growing abstractness of the transitive construction (as in Fig. 1). Other specifications designate constraints on the tendency to overgeneralize innappropriate verbs to this construction.

famous overgeneralization at 3;0: ''Don't giggle me''). My hypothesis, as illustrated graphically in Fig. 2, is that *laugh* is not likely to be overgeneralized to the transitive construction because it is learned early and entrenched through frequent use as an intransitive verb only. *Chortle* is also not likely to be overgeneralized but for a different reason; even though it is not highly entrenched, it is typically learned only after the child has begun to form verb subclasses (and *chortle* belongs to one that cannot be used in the transitive construction) and only after the child has also learned preempting alternative constructions (such as *That made me chortle with glee*, preserving its intransitive status). *Giggle* is more likely to be overgeneralized because it is not so entrenched as *laugh* and it is learned before the child has formed verb subclasses or learned many alternative constructions that might preempt an overgeneralization; that is, it may be a verb that is learned in a high vulnerability window of developmental time.

Currently, this model of how argument structure constructions and their associated verbs are constrained developmentally is speculative - based on only two experimental studies - but it is at least fairly explicit in the factors posited as causal and the ages at which they operate. And of course, at this point it is confined to the simple transitive construction in English. Nevertheless, although very little research has explored experimentally children's productive use of constructions other than the English transitive construction, there is some evidence from both naturalistic analyses and the experimental studies suggesting that the different verb-argument constructions develop and are constrained in the same general manner as the transitive construction, although each very likely has its own developmental timetable. As just a hint at this variability among constructions, Fig. 3 plots children's productive uses of intransitive utterances (from Tomasello & Brooks, 1998), productive uses of imperative utterances (from Lewis & Tomasello, in preparation), and productive uses of passive utterances (from Brooks & Tomasello, 1999; Pinker et al., 1987).

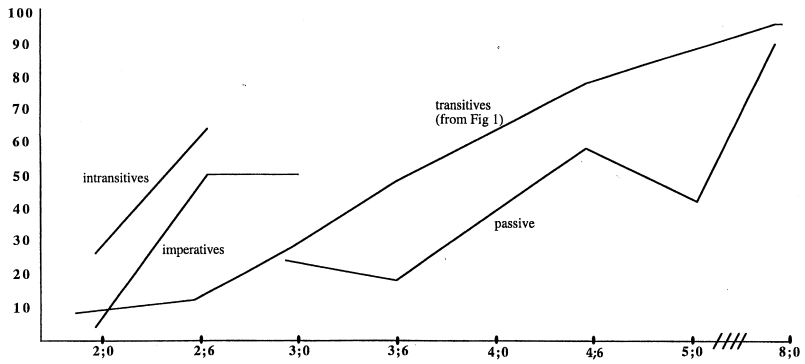

Fig. 3. Percentage of children (or in some cases responses) who produce productive utterances using novel verbs for different syntactic contructions (see text for studies used).

3. Implications for the continuity assumption

The continuity assumption is arguably the core assumption of generative (Chomskian) approaches to language acquisition because only it permits the use of adult-like grammars to describe children's early language. The obvious problem - made especially salient in the above review - is that children's early language looks very little like adult language. To explain this discrepancy between children's hypothesized adult-like competence and their actual child-like performance, additional theoretical machinery is required. There have been various proposals for such machinery over the past few decades, mostly involving ''external'' factors that might conceal the child's true syntactic competence.

But the current data pose some much more serious and specific problems for the continuity assumption. To illustrate the point, I take the three major classes of generative acquisition theories, as described by Clahsen (1996), and show in each case how the current data - especially the experimental data - present insurmountable problems. I then show that all three of these approaches have also been seriously deficient in facing the very difficult problem of how children might ''link'' their pre-existing universal grammars (hypothesized by all generative approaches) to particular pieces of particular natural languages - the only serious attempt at solving this linking problem currently having no empirical support.

3.1. Full competence plus external developments

The first generative theory is a fairly straightforward application of Chomsky's original competence-performance distinction (see Chomsky, 1986, for an especially clear statement). In Clahsen's (1996), p. xix) formulation:

> The first approach claims that young children when they begin to produce sentences already have full grammatical competence of the particular language they are exposed to, and that differences between sentences children produce and adults' sentences should be attributed to external factors, i.e. to developments in domains other than grammatical competence.

The best-known examples of external factors are memory and processing limitations (e.g. Valian, 1991) and pragmatic limitations (Weissenborn, 1992).

The main problem in this case is that there have never been any serious attempts to actually measure and assess children's performance limitations, and so they are simply invoked whenever they are convenient. There have been strenuous objections to this practice from generativists (e.g. Roeper, 1996, p. 417) and non-generativists (e.g. Sampson, 1997) alike. But in addition, from a more empirical point of view, I would argue that in the experiments on the English transitive construction reviewed above, a number of control procedures ruled out, for all practical purposes, performance limitations as a viable explanation for children's lack of productivity with newly learned verbs. Specifically, the same children who failed to use newly learned verbs in transitive utterances:

- were highly productive with novel nouns - which rules out the possibility that

children are simply reluctant to use newly learned words in novel ways in this experimental context;
- performed conservatively when tested for their comprehension of novel transitive utterances - which rules out many production factors since comprehension tasks pose fewer (or at least different) performance demands than production tasks;
- produced transitive utterances both in their spontaneous speech and with novel verbs in the experiment if they had first heard an adult use those novel verbs in transitive utterances - which rules out many other performance factors having to do with the difficulties of using newly learned verbs in transitive utterances.

It is not that children possess fully adult-like performance capabilities. They clearly do not, and any serious theory of language acquisition has to deal with children's growing skills of linguistic performance that develop in tandem with their growing linguistic competence. However, in the experimental studies reviewed above, all of the evidence suggests that the children were working within their performance limitations. And they still showed no signs of possessing the kinds of abstract, adult-like syntactic competence attributed to them by believers in the continuity assumption.

3.2. Full competence plus maturation

The second approach shares much with the first because, despite the name, the maturation occurs not in universal grammar itself but in aspects of linguistic competence considered peripheral to universal grammar. In Clahsen's (1996), p. xix) description:

> The second approach assumes that UG principles and most of the grammatical categories are operative when the child starts to produce sentences. Differences between the sentences of young children and those of adults are explained in terms of maturation. The claim is made that there are UG-external learning constraints which restrict the availability of grammatical categories to the child up to a certain stage and then are successively lost due to maturation. Consider, for example, Wexler (1994) who argued that the feature TENSE matures at around the age of 2;5, and Rizzi (1993) who suggested that the constraint which requires all root clauses to be headed by CP in adult language is not yet operative in young children, but that it matures at the age of approximately 2;5.

The details of this theory are not important for current purposes (not even the issue of what is considered internal and external to universal grammar). The critical points are the same as for the previous theory - even if it is posited that some aspects of universal grammar itself mature (see Chomsky, 1986). First, like performance limitations, maturation is basically an unconstrained 'fudge factor', since any time new acquisition data arise it may be invoked without any consultation of genetic research or any independent assessment of this causal factor at all (Braine, 1994). Second, and more empirically, I would argue that in the experimental data reviewed above, all possible factors that might be subject to maturation (both internal and external to universal grammar) were the same in the experimental and control

conditions - since everything in both conditions was focused on one and only one syntactic construction. That is to say, children who used the simple transitive construction with numerous verbs in their spontaneous speech, and with novel verbs which they had heard in the transitive construction (in the control condition), would be presumed to have in place the required genetic-maturational bases for producing transitive utterances. But then it is a total mystery why they did not use these same genetic bases to produce transitive utterances with novel verbs in the experiment (given that performance limitations have essentially been ruled out - see above).

3.3. Lexicalism

The third generative approach is a bit different and raises a new set of theoretical issues. Again in Clahsen's (1996), xx) words:

> The third approach shares with the two other views the assumption that all UG principles are available to the child from the onset of acquisition. However, the grammar of the particular language the child is acquiring is claimed to develop gradually, through the interaction of available abstract knowledge, e.g. about X-bar principles, and the child's learning of the lexicon. This view does not violate the continuity assumption...

The claim is thus that children must have a certain amount of linguistic experience with their own particular language before they can access certain aspects of their universal grammar (e.g. Clahsen, Eisenbeiss & Penke, 1996; Radford, 1990); that is to say, the process by which a particular language ''triggers'' different aspects of universal grammar is a bit more complicated than originally thought. Because it makes reference to the particularities of particular languages and lexical items, this approach at least holds out the promise of being able to account for the data reported above.[5]

The main problem is that to account for the experimental data reported above, this approach would have to claim that to assimilate a newly learned verb to those aspects of universal grammar involved in the transitive construction (involving head-direction, etc.), children must hear each specific verb used in that specific construction. Generalized, this would mean that to begin to participate in a productive system of generative grammar the child must hear each of her lexical items in each of its appropriate syntactic contexts (see Hyams, 1994, for a proposal very near

[5] It should be noted that the phrase ''lexical specificity'' is currently used in two totally different ways in different theoretical paradigms. In the generative grammar version of lexical specificity, all that is meant is that the formal syntactic categories and schemas are attached to individual lexical entries (''Each item of the lexicon consists of a set of features, typed as phonological, semantic or formal....''; Atkinson, 1996, p. 478). So this simply means that the abstract syntactic (formal) categories are located in the lexicon rather than in rules or constraints (perhaps especially in the new theories based on Minimalism). In contrast, in more usage-based theories (see below), ''lexically specific'' means that utterances are generated with words and phrases that are totally concrete, with no abstract categories anywhere - either in the lexicon, in syntactic operations, or anywhere else.

to this). This theory can explain the data, of course, but, it seems to me, at the cost of the whole point of a generative account - which classically posits that human beings possess and use linguistic abstractions early in ontogeny and independent of specific linguistic experiences other than a minimal triggering event. If children have to hear each verb in each of its ''licensed'' syntactic constructions, then the generativist account will be empirically indistinguishable from many usage-based accounts (see below).

Perhaps even more seriously, none of the proponents of this approach has attempted to work out precisely how the child goes about linking up item-specific linguistic knowledge with universal grammar. Atkinson (1996), pp. 473–74), in particular, criticizes proponents of this view for not explicating how the linking process might take place. But ''linking'' is a problem not just of this specific approach, but rather of the generative paradigm as a whole.

3.4. The problem of linking

Pinker (1984, 1987, 1989) identified and explored the key problem for generative approaches to language acquisition. The problem is how children link their universal grammar - in whatever form that may exist - to the particular language they are learning. For example, let us suppose that children are born with an innate idea of 'subject of a sentence' (or any other abstract linguistic entity). How do they go about identifying this entity in the language they hear, given that across languages sentence subjects seemingly do not share any distinctive perceptual features (ignoring for current purposes the more difficult problem that many languages may not even have sentence subjects; Foley & Van Valin, 1984.) How does a child (or an adult) who hears an utterance in Turkish or Walpiri or Tagalog or English go about identifying a subject when not only are there no phonemes that consistently accompany subjects across languages, there are also no other consistent features such as word order or case marking or co-indexing on the verb that are the same across languages (Dryer, 1997)?

If we look for guidance to other behavioral systems in the biological world that have a strong genetic component, we see the problem even more clearly. Imprinting is one such system. Thus, some baby ducks are born with a built-in system for identifying and staying close to their mothers - for obvious biological reasons. But how does the duckling identify its mother in the first place? Nature has built in a search image of 'mother' constituted by the specific perceptual features that identify a mother in terms of what it is to look like, how it is to move, and what kind of noises it is to make. But 'subject of a sentence' cannot be specified in this way because children growing up in different cultures experience sentence subjects that are perceptually very different, with basically no overlapping perceptual features. So perhaps a better biological analogy is cognitive mapping and spatial cognition, which involves more abstract conceptual entities. Thus, an individual mammal cannot be born knowing where in its local environment water and food and predators may be located, but many mammals are born with the skill to create a cognitive map of their local environment on the basis of experience in that environment. This

would seem to be a more appropriate analogy to language acquisition since it involves an animal being pre-tuned to learn very quickly from local experiences, with the local experiences only 'triggering' the building of the cognitive map - whose structure is not affected in any fundamental way by the specifics of the specific environment. But even in the case of spatial cognition, there are still experiential invariants in the animal's visual world that serve to trigger the building up of the cognitive map in specific ways, and these are the same in all different local environments - such things as the distances, angular relationships, topological relationships, and other Gibsonian-type higher order perceptual invariants of which all local spatial environments consist.

And so the question of whether language acquisition is like building a cognitive map reduces to the question of whether such things as 'subject of a sentence' have some invariant perceptual, or experiential, features across languages.Pinker (1984, 1987, 1989) recognized this fact, and so he proposed the following: (a) a list of key syntactic categories innately given to all human beings, (b) a list of key experiential categories innately given to all human beings, and (c) a set of innate linking rules to connect the two. In the case of 'subject of a sentence', the link was first to 'agent of an action', or, if there was no agent, to such things as 'theme' or 'goal' (the so-called linking hierarchy). Thus, if the child saw a dog bite a man and heard someone say 'The dog bit the man', she would know on the basis of her general causal cognition that the dog is the agent of the action; her innate linking rule would then connect agent to subject.[6]

However, in the specific case of 'sentence subject' it is almost certain that Pinker's proposal is not correct. First of all, on general theoretical grounds it has been known for some time that in ergative languages the notion of 'subject' does not operate like it does in English and other accusative languages, and so a direct connection to agent is not possible. Moreover, even if there were some solution to this problem, there are many languages that are so-called split ergative: some of its constructions are ergative while others are accusative based on such things as person (first and second person are accusatively structured whereas third person is ergatively structured) or tense (present-future is accusatively structured whereas past is ergatively structured) (DeLancey, 1981; Van Valin, 1992). In general terms, Slobin (1997) has made a persuasive case that there is much too much variability across languages - not to mention historical change within languages - for any static and innate look-up table to function in the way it would need to solve the problem of linking (see also Braine, 1992).

A second, more empirical problem with Pinker's proposal is that at least two naturalistic analyses of early child language have failed to find any evidence for innate linking rules. First, Lieven et al. (1997) analyzed the first sentences of 12

[6] Because she notices the linguistic form associated with the subject, the child can also now recognize future exemplars of 'sentence subject' on the basis of this form alone (say a particular word order configuration or a particular case marker), even if they are not agents; thus, the English-speaking child will eventually have to deal with experiential subjects that are not agents (as in *John saw Mary*) and even passive sentences in which subjects are not agents and agents are not subjects.

English-speaking children and found that many early subjects came from such unremarkable utterances such as *I like it, Maria have it, I see it,* and *It has a hole* in which there is no agent of an action at all (see also Pye, Loeb, Redmond & Richardson, 1994). More strongly still, Bowerman (1990, 1997) found that it happens with some regularity in early child language that the subject hierarchy is violated totally, that is, arguments that are further down the linking hierarchy end up as subjects - as in the utterance *Pete hurt by car* (patient = subject, agent = oblique) reported by Tomasello (1992) for a child at 1;8. And so, not only do innate linking rules run into difficulties cross-linguistically, they also make wrong predictions for the order of acquisition of some structures within a language.

To my knowledge, no generative theorist other than Pinker has proposed a systematic theory of how children might solve the linking problem. One might suppose that positing parametric variation in different languages - along with an acquisition mechanism involving parameter setting - might help in solving the linking problem, but it does not. Parameter setting in fact depends on linking. Thus, Mazuka (1995) provided a detailed analysis of how children might set the hypothesized head direction parameter (to either head first, as in the Spanish *la casa grande*, or head last, as in the English *the big house*). What she demonstrated was that parameter setting rests fundamentally on linking processes; that is, to set the head direction parameter in universal grammar, a language learner must first be able to recognize clausal heads in the specific language she is learning. Once this fundamental linking problem is accomplished the parameter setting is trivial, indeed superfluous:

> Setting a Head Direction parameter by analyzing the syntactic structure of the input involves a paradox. The Head Direction parameter is supposed to determine the order in which the head and complement should appear in the language the child is acquiring. But, for a child to set this parameter, she must first find out which units are the heads and the complements in the sentence she hears. If her linguistic skills are sophisticated enough to know which are heads and complements, she will also know which order they came in. If she already knows which order the head and the complements come in a sentence, there is no need to set the parameter. (Mazuka, 1995, pp. 24–25).

The hard part is thus recognizing 'heads' and 'complements' in a particular language, and this difficulty is logically prior to any act of parameter setting.

3.5. Summary

My assessment of the continuity assumption is thus clear. Neither of the two generative approaches invoking hypothesized but unmeasured factors that prevent

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children from displaying their adult-like syntactic competence - either ''external'' performance factors or genetic maturation - can explain the data presented above, particularly the experimental data. Lexicalist approaches may be able to explain the data, but to do so they must invoke essentially the same kinds of local learning processes that generative approaches were designed to replace. And then they are still stuck with the linking problem; there is basically no answer to the question of how the language learning child might link up the linguistic items and structures she is learning locally with the hypothesized innate universal grammar.

4. A usage-based account

The continuity assumption thus has no empirical support and at least one very serious theoretical problem. However, most of the classic arguments in favor of the continuity assumption have actually been ''negative'', that is, they are arguments against the possibility of a learning-based explanation - since, by hypothesis, mature linguistic competence is so abstract and formal that children could not possibly learn or construct it (Gleitman & Wanner, 1982). This argument may be summarized as: ''You can't get there from here''.

But many language acquisition theorists reject this argument (e.g. Bates & Goodman, 1997; Bloom, 1992; Budwig, 1995; Lieven, 1997; MacWhinney, 1999; Slobin, 1985, 1997; Tomasello & Brooks, 1999). The basic issues are two. First, the adult endpoint of linguistic development does not have to be characterized in the abstract terms of a Chomskian universal grammar. There is currently a new class of linguistic theories - falling under the general rubric of Functional and Cognitive Linguistics - that conceptualize adult linguistic competence in some new and more child-accessible ways. Second, there are also some new ways of thinking about how children learn and construct abstract cognitive entities. Generativists typically make their impossibility arguments against outdated learning concepts from the 1950s, such as simple association and blind induction. But there are new ideas about cognitive development in the domain of language that go beyond these simplistic notions, especially with respect to children's very powerful skills of: (i) intention-reading and cultural learning, (ii) analogy making, and (iii) structure combining. My attempt here is to describe - only very briefly and in general outline - both the new way of looking at adult language and the three cognitive skills that help children to attain mature linguistic competence.

4.1. The adult endpoint

Generative grammar accounts of human linguistic competence are aimed at mathematical elegance. Thus, when an advance in the formalism is made - as in the new minimalism (Chomsky, 1993) - it is automatically assumed to characterized universal grammar with no empirical verification deemed necessary. In using such a formalism to describe either adult or child language, the attempt is not to account for all of human linguistic competence, but only to explain ''core grammar'' - the most abstract and systematic aspects of language use - with lexical items, idioms,

and quirky syntactic constructions all being consigned to the periphery (the lexicon, pragmatics, etc.). The distinction between core and periphery forms the basis for several recent theoretical proposals to the effect that acquiring a natural language requires two distinct processes: (a) abstract and *a priori* rules for the linguistic core, and (b) 'normal' processes of learning and memory for the linguistic periphery (e.g. Chomsky, 1980; Clahsen, 1999; Pinker, 1991).

But in recent years a new paradigm in theoretical linguistics has arisen that attempts to determine the nature of human linguistic competence from a more psychological, and less mathematical, point of view. It is called Cognitive-Functional Linguistics (e.g. Bybee, 1985; Croft, 1991; Fillmore, 1985; Givón, 1995; Goldberg, 1995; Lakoff, 1987; Langacker, 1987, 1991; Talmy, 1988; van Valin, 1991; see papers in Tomasello, 1998a). In this view, competence with a natural language consists of nothing more or less than the mastery of its various linguistic symbols and constructional schemas, each of which consists of one or more linguistic forms (signifier) each with a communicative function (signified). Cognitive-functional approaches attempt to explain **all** aspects of human linguistic competence - from the highly canonical (core) to the highly idiosyncratic (periphery) (Kay & Fillmore, 1999). Thus, fluent speakers of English control both abstract morphological and sentence-level constructions (e.g. the regular past tense and the ditransitive sentence schema) as well as very many concrete expressions based on individual words or phrases, including everything from ritualized greetings (*How-ya-doing?*) to idioms (*Nothing ventured, nothing gained*) to metaphors (*She's dressed to the nines*) to non-canonical phrasal collocations (*I wouldn't put it past him; He's getting to me these days; Hang in there; That won't go down well with the boss; She put me up to it;* etc.; see Benson, Benson and Ilson, 1997, for a dictionary of many of the tens of thousands of idiosyncratic English collocations; see also Pawley and Syder, 1983; Jackendoff, 1996). In this view, competence with linguistic symbols and constructional schemas are very general cognitive abilities that manifest themselves in many domains of human activity, although they may take on some special characteristics in the domain of linguistic communication. Because there is no mathematically elegant universal grammar guiding the process of acquisition, there is no linking problem.

It is theoretically significant that the abstractness of a construction - as evidenced by its productivity - does not automatically mean that it is in the ''core'' from a generative grammar point of view. Thus, consider the incredulity construction:

- *Him be a doctor!*
- *My mother ride a motorcycle!*
- *Them come to the party!*

This construction is highly abstract in the sense that it is not dependent on any particular word or phrase, and it is highly productive in the sense that any fluent speaker of English can generate innumerable further exemplars. But at the same time, it is very odd from the point of view of the majority of English sentence-level constructions because the subject is in the accusative case (*Him, Them*) and the verb is non-finite (*My mother ride....,* without the agreement marker). Another example of

an abstract and productive yet idiosyncratic construction is the nominal extraposition construction (Michaelis & Lambrecht, 1996), as in:

- *It's amazing the people you see here.*
- *It's staggering the number of books that can pile up.*
- *It's ridiculous how long it takes.*

Constructions like these are important because they represent, in essence, existence proofs that human beings can master highly abstract and productive constructions that do not behave like any (or many) other constructions in the language. In all linguistic theories, including generative theories, constructions such as these must be learned on their own.

Interestingly, natural languages also contain some ''mixed'' constructions, that is, constructions that are in some ways abstract but that revolve around particular lexical items. For example:

- *I wouldn't live in Boston, let alone in New York.*
- *She won't ride the stationary bike, let alone lift weights.*
- *She won't talk to, let alone go out on a date with, that swine.*

This particular construction - which has a very distinct communicative function involving some interesting pragmatic implicatures about the speaker's attitude towards the entities involved - is defined by a particular lexical item (*let alone*) even though it is otherwise fairly open to the entities that may be compared (Fillmore, Kaye & O'Connor, 1988). This construction is thus distinctly reminiscent of the verb island constructions of two-year-old children.

There are, of course, highly canonical aspects of mature linguistic competence in the sense that many linguistic constructions are organized into inheritance hierarchies. For example, the English intransitive, ditransitive, and causative constructions are all instances of an even more abstract Subject-Predicate construction in English, and so all three share its main characteristics (Goldberg, 1995). But the linguistic ''core'' is not a discrete entity - indeed it is notoriously difficult to decide whether certain constructions (e.g. mixed constructions) are a part of core competence - and constructions may differ from the core in many and diverse ways. A plausible way to think of mature linguistic competence, then, is as a structured inventory of constructions, some of which are similar to many others and so reside in a more core-like center, and others of which connect to very few other constructions (and in different ways) and so reside more towards the periphery. The proposal would thus be that the child initially learns individual, item-based linguistic constructions (e.g. verb island constructions), and if there are patterns to be discerned among these different item-based constructions in adult usage, she could then make abstractions and create inheritance hierarchies of constructions. In this view of language and its acquisition, therefore, there is continuity **not** of structures - adults control a more diverse and abstract set of constructions than do children - but there is continuity of process in the sense that the processes of learning and abstraction are the same wherever and whenever they are applicable (see below). This general approach is **usage-based** in the sense that all linguistic knowledge - however abstract it may ultimately become -

derives in the first instance from the comprehension and production of specific utterances on specific occasions of use.

With this re-definition of the endpoint of language acquisition in terms of linguistic constructions of varying degrees of complexity, abstraction, and systematicity, it is now much easier to see how children might get from 'here' to 'there' - especially if we also take into account some recent proposals about children's surprising skills at (i) learning culturally, (ii) making analogies, and (iii) combining structures, in their acquisition of language.[7]

4.2. Intention reading and cultural learning

There are over 5,000 natural languages in the world - each with its own inventory of symbols and constructions, which change and develop over historical time - and so what human children must be biologically prepared for most urgently is variation; they must be prepared to acquire whichever set of linguistic symbols and constructions they encounter (Levinson, 1999). This means that a large part of the task of language acquisition must be accomplished by means of some form of social or imitative learning.

Classically, imitation has been thought to play only a marginal role in language acquisition. This is because imitation has been conceptualized as the child repeating verbatim something the adult has just said, with little or no understanding. This is a form of social learning that, in another context, I have called mimicking (Tomasello, 1996), and indeed it very likely plays only a minor role in language acquisition. But in a more recent theoretical approach to social learning, I have attempted to identify a subset of social learning processes called cultural learning, one type of which is imitative learning (Tomasello, Kruger & Ratner, 1993). In the current context, the key idea is this. In cultural (imitative) learning, as opposed to simple mimicking, the learner understands the purpose or function of the behavior she is reproducing. Thus, Meltzoff (1995) found that 18-month-old infants attempted to reproduce the intentional action they saw an adult attempting to perform, even if that action was not carried through to completion, and Carpenter, Akhtar and Tomasello (1998a) found that 16-month-old infants attempted to reproduce an adult's intentional, goal-directed actions, but not her accidental actions. With regard to language in particular, the child has to understand a special class of intentions known as communicative intentions. Thus, a child might hear her father exclaim, ''Look! A clown!'' To fully understand his linguistic behavior (with an eye toward reproducing it) she must understand that her father intends that she share attention with him to a particular object; that is to say, understanding a communicative intention means understanding precisely how another person intends to manipulate your attention (Tomasello, 1998c; in press a). It is only by understanding the communicative intention behind these funny noises

[7] It is important to note that many of the phenomena on which generative linguists have focused their attention (and which are claimed to be unexplainable in other frameworks) are currently being described and explained in alternative ways by Cognitive-Functional linguists. As three concrete examples: (1) the binding principles (van Hoek, 1997); (2) the subjacency constraint (van Valin, 1991, 1998); and (3) grammatical relations (Langacker, 1998).

that the child can learn how to use a particular linguistic expression appropriately when she has 'the same' communicative intention (towards someone's attention).

When we move beyond word learning to syntactic constructions the process becomes a bit more complicated, but it is still essentially the same. To comprehend the totality of an adult's utterance, the child must understand his overall communicative intention and also the communicative role being played by the various constituents of the utterance. As a non-linguistic example, a child may see an adult use a stapler and understand that his goal is to staple together two pieces of paper. In some cases, the child may understand also that the goal/function of placing the papers inside the stapler's jaws is to align them with the stapling mechanism inside the stapler, and that the goal/function of pressing down on the stapler is to eject the staple through the two papers - with both of these sub-actions being in the service of the overall goal/function of attaching the two sheets of paper. Of course, even in the most optimistic interpretation the child does not understand many of the details of how this all works, but still she may understand and attempt to imitatively reproduce some basic components. In the case of linguistic constructions, the child might hear an adult say ''I stapled your papers'' and also know the event to which he intends to draw her attention. In addition, she may also understand that in using the word 'stapled' the adult intends to draw her attention to the type of activity he just performed, and that in using 'your papers' he intends to draw her attention to the items he just acted upon - with 'your' being used simply to help specify the papers involved. The basic idea is thus that as the child hears a piece of language she attempts to read the speaker's communicative intentions - both at the level of the entire communicative act and at the level of its constituents. Said another way, in the process of cultural (imitative) learning, the child is attempting to determine the communicative functions of the various linguistic items and structures she hears - their communicative functions being the roles they play in the adult's overall communicative intention. The notion of communicative function is of crucial importance as it enables us to talk about such things as syntactic constituency ('your papers' is a coherent constituent because it serves a single referential function) and dependency ('your' is a dependent element because it functions to identify which 'papers') - in the manner of functional-cognitive linguists (e.g. Croft, 1991; Givón, 1995).

Reconceptualized in this way to include intention reading, my claim is that cultural (imitative) learning is more important in language development, especially in the early stages, than has traditionally been recognized. This is clear in the data reviewed above, which revealed that before their third birthdays children use individual verbs and syntactic constructions in just the way they have heard and understood them being used. Interestingly, this same very strong tendency toward imitative learning is also observed in young children's social learning of tool use, to the point that they sometimes copy adult tool-use behaviors even though this leads to undesirable results (Nagell, Olguin & Tomasello, 1993). This tendency is also apparent in children's early symbolic play with objects, as they almost always choose to do with toys and other objects what adults have demonstrated for them (Tomasello, Striano, & Rochat, in press), and also in their gestural communication as many parents invent, and their children imitatively learn, idiosyncratic gestures

(e.g. a specific mouth movement for 'fish'). Indeed, human children in the ontogenetic period from 1 to 3 years of age are virtual ''imitation machines'', as they attempt to understand and reproduce virtually all of the activities they see in the cultural activities around them (Carpenter, Nagell & Tomasello, 1998b). This early tendency towards imitative learning in both non-linguistic and linguistic activities is perhaps best understood as the initial ontogenetic expression of the human organism's biological adaptation for culture (Tomasello, 1999).

The strong tendency toward linguistic imitation in particular may be illustrated by two phenomena of child language that are often taken to be evidence against imitative learning, but which are actually evidence for it - if we look more precisely at what children do and do not hear. First, many young children say things like *Her open it*, an accusative subject which they supposedly have not heard from adults. But children regularly hear things like *Let her open it* or *Help her open it*, and so they may just imitatively learn the end part of the sentence, *Her open it*. Very telling is the fact that children basically **never** make the complementary error (direct object in nominative case) *Mary hit I* or *Jeff kissed she*. The reason they do not make this error is that they never hear adults say anything like this in any linguistic construction. A similar account can be given for some of the findings going under the general rubric of optional infinitives in which children, among other things, sometimes fail to use subject-verb agreement markers appropriately (Wexler, 1994). Although there may be other factors at work in this case (Leonard, 1998), a major part of the explanation is very likely the large number of non-finite verbs that children hear in various constructions in the language addressed to them, especially in questions such as *Should he open it?* and *Does she eat grapes?* The child might then later say, in partially imitative fashion: *He open it* and *She eat grapes*.[8]

It is important to stress that even in this new view, cultural (imitative) learning by itself can support only limited forms of productivity. Imitative learning is creative and productive only in the sense that it enables the use of particular linguistic symbols and constructions in novel communicative contexts. But it does not enable children to produce novel utterances per se because it cannot create abstract linguistic categories or schemas. This means that imitative learning cannot be the whole story of language development. However, the fact that it is not the whole story does not mean that it is not a very important part of the story. It must be, as all children learn the language to which they are exposed.

4.3. Analogy making and structure-mapping

In the first constructivist formulations in the 1960s, children began constructing linguistic abstractions very early in development. One theory was that they did this on the basis of distributional regularities in the language they heard and produced, leading to a Pivot Grammar based mostly on the positional patternings of words

[8] In both of these illustrations, it is important to note that the child has imitatively learned the end portion of the adult's utterance and its general function for indicating a real world situation, but she has used what she has learned in a slightly different communicative context than the adult utterance - demonstrating her immature understanding of all the constituents' functional roles.

(Braine, 1963). Another theory was that children constructed linguistic abstractions on the basis of the semantic relations inherent in the utterances they heard and produced based on such things as Agent-Action, Possessor-Possessed, and the like (e.g. Brown, 1973). But these kinds of early abstractions are not the kind that adults make, and so if children were to make them they would be headed down a developmental *cul-du-sac* (Gleitman & Wanner, 1982).

The current theory avoids this problem by positing that in the beginning children make virtually no linguistic abstractions at all (beyond something like 'concrete nominal'), only later attempting to zero in on adult-like linguistic categories and schemas. But it is still a constructivist theory, and the generativist objection to constructivist theories of language acquisition - no matter when the construction process begins - is that they founder on the problem of induction. Induction, it is said, cannot create abstractions since to recognize similarities among different exemplars, a child must already have the abstraction *a priori*, that is, innately (Chomsky, 1986). This view of induction goes back to Plato, of course, and very likely cannot be refuted on logical grounds - just as other similar paradoxes cannot be refuted on logical grounds (e.g. a dropped object never reaches the ground because it must first go half way, and then half way again, and so on ad infinitum). However, in the current case we can approach the problem more concretely in the following manner. Undeniably, English speakers create some kind of abstract schema for the nominal extraposition construction (*Its amazing the people you see here!*), and, just as undeniably, this construction does not derive from an innate universal grammar (since it is so idiosyncratic). This very special construction is clearly learned, and it is learned in such a way that it becomes quite productive - presumably indicating abstractness. The contention is simply that however it is done in the case of idiosyncratic yet abstract constructions such as this, this is also how it is done in the case of canonical and abstract constructions such as the ditransitive construction and others.

The research that is most relevant for explicating the process by which children create abstract linguistic constructions is that concerning analogy and structure mapping (see Gentner & Markman, 1997, for a recent review). The basic idea is that human beings are capable of discerning similarities not only among objects on the basis of perceptual or functional features, but also among relational and event situations on the basis of a common relational structure abstracted across the particular objects involved. Gentner (1983) claims that when relations are mapped across situations:

- the specific properties of objects are discarded;
- the relations among objects are preserved; and
- connected systems of relations (such as causality) are more likely to be transferred.

As one instance, Brown and Kane (1988) taught children to use certain kinds of

[8] In both of these illustrations, it is important to note that the child has imitatively learned the end portion of the adult's utterance and its general function for indicating a real world situation, but she has used what she has learned in a slightly different communicative context than the adult utterance - demonstrating her immature understanding of all the constituents' functional roles.

actions with a tool (pull, stack, swing) and then gave them transfer problems in which it was possible for them to use the same actions but with a different tool - which they did reasonably well from 2 years of age. This is of course exactly the kind of cognitive ability needed for children to create a verb island schema across different arrangements of object participants (e.g. they learn 'X pushes Y' and then transfer to 'M pushes N'), especially since so many early linguistic constructions revolve around highly salient intentional, causal, or spatial relations.

More abstract constructions can then be created by a similar relational mapping across different verb island constructions. For example, the several verb island constructions that children have with the verbs *give, tell, show, send*, and so forth, all share a 'transfer' meaning and they all appear in a structure: NP + V + NP + NP. The specific hypothesis is thus that children based their constructional analogies on similarities of **both** form and function: two utterances or constructions are analogous if a ''good'' structure mapping is found both on the level of linguistic form and on the level of communicative function. Precisely how this is done is not known at this time, and indeed a number of computational models are currently being explored for this and similar tasks (Forbus, Gentner & Law, 1995). There are also some proposals that a key element in the process might be some kind of ''critical mass'' of exemplars, to give children sufficient raw material from which to construct their abstractions - although the nature of this critical mass (e.g. verb types versus verb tokens) is not known at this time (Marchman & Bates, 1994). It is also interesting that Gentner has found that higher order relations (relations among relations) begin to be learned during the late preschool period - a very good match with the time period when children might be learning some higher order constructions (e.g. the English Subject-Predicate construction) based on the similarity of structure among many 'first order constructions' such as intransitives, causatives, and ditransitives. Some evidence for this proposal comes from the fact that the syntactic category 'subject' in English, which depends on generalizations across many first order constructions, by all indications does not emerge until school age - by which time children have mastered many types of first order constructions (Braine, Brooks, Cowan, Samuels & Tamis-LeMonda, 1993).

I am thus proposing three stages of analogy making in the creation of abstract linguistic constructions:

- given some stock of utterances using the verb *push*, young children can, by a process of structure mapping, construct a verb island construction around the word *push* (in much the same way they use the same imitatively learned action on different objects);
- given some stock of verb island constructions 'similar' to that used with *push*, children can, by a process of structure mapping, construct something like a simple transitive construction;
- given some stock of first order constructions such as the simple transitive and other 'similar' constructions, older children can, by a process of second order structure mapping, construct some higher order constructions such as the Subject-Predicate construction.

This proposal differs from previous constructivist proposals mainly in: (i) its focus on the importance of sentence-level (argument structure) constructions as the appropriate unit of analysis (most previous proposals have focused on individual grammatical categories, such as 'subject'; e.g. Schlesinger, 1988); (ii) its emphasis on the extended period of child conservativeness, denying the existence of early abstractions that go in non-adult-like directions; (iii) its focus on both form and function as the basis for abstraction; and, (iv) the asymmetry posited for the abstraction of nominal categories versus verb-based constructional schemas. Perhaps the most important aspect of these new features is that they enable us to make the explicit connection with research on analogy, which has a similar focus on whole events and which posits a similar asymmetry between the objects and relations that constitute these events. It is an empirical fact that young children make analogies in both their non-linguistic and linguistic behavior; there is no problem of induction.

It is important to stress that children cannot engage in these processes of analogy making and structure mapping unless they understand something of the functional structure of the utterances they have imitatively learned in terms of the constituency and dependency relations involved. It is only with such an understanding - based ultimately on an understanding of the communicative intentions of others - that children can go on to align appropriately the corresponding constituents in the different constructions with respect to their similar functional roles (what Gentner calls ''structural alignment''). The building of abstract linguistic constructions thus depends on a first step of imitative learning, with some understanding of functional roles, followed by a process of analogy making, initially to get to first order constructions and then again later to get to some higher order constructions (as specified by something like Gentner's theory of structure mapping). Exactly how this is done in the case of specific linguistic constructions - what 'data' are needed from adult language and the child's already mastered constructions, and at what frequency - is not known at this time.

4.4. Structure combining

At any given developmental moment children have at their command a relatively large number of linguistic constructions that vary from one another in both their complexity and their abstractness. This characterization of children's linguistic competence provides the basis for a very different way of thinking about their creative combining of linguistic structures (Tomasello, 1998b). Children are **not** just combining words or isolated linguistic categories, they are combining pre-compiled linguistic constructions of various shapes, sizes, and levels of abstractness.

As just one small example, in Tomasello (1992) I looked closely at all of my daughter's earliest utterances with 3 or more words, which first emerged at around 19–22 months of age. One was *See Daddy's car*, said at around 19 months of age as she spied it coming. Previously she had said things like *See Maria, See Daddy,* and *See this*, on the one hand, and also things like *Daddy's bread, Daddy's ball,* and *Daddy's salad*, on the other. So, my supposition is that she creatively combined something like a *See* __ verb island construction with a *Daddy's* __ possessive

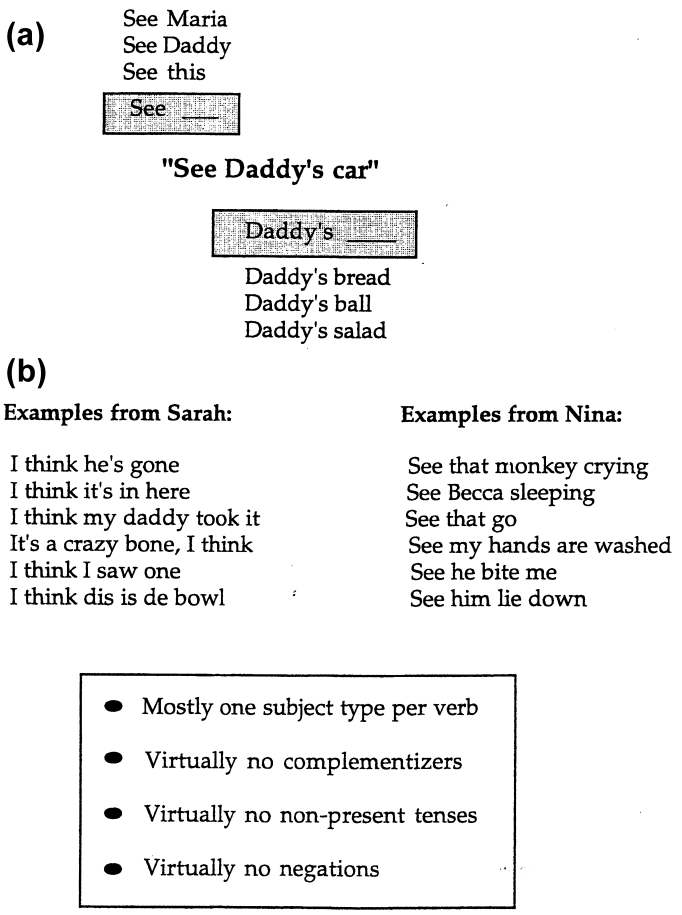

Fig. 4. (a) One structure combining operation for the child of Tomasello (1992). (b) Some examples and general facts about earliest sentential complement sentences from Diessel and Tomasello (in press).

construction (see Fig. 4a). We do not know what this child actually heard or did not hear along the lines of *See Daddy's car* previously in the discourse, and so we do not know the extent to which this was a truly creative combining of constructions versus something suggested to her by an adult utterance. But in any case, even with an adult model, the most natural supposition is that she had already mastered two two-word constructions that she then discovered or perceived how to combine to create a new meaning. It is interesting to note, in this regard, that as independent constructions both *See*___ and *Daddy's*___ had distinctive intonation contours (*See*__ had a fairly neutral intonation, whereas *Daddy's*__ was said with a strong stress on *Daddy's*). The composite construction *See Daddy's car*, however, had the neutral intonation contour of the *See*__ construction - which is noteworthy since the *See*__ construction is syntactically dominant as well. Assuming it was not simply mimicked from adults, the intonation contour of the composite expression might then plausibly

indicate this child's understanding of the syntactic dependency relations among the sub-constructions involved.

As a more complex example of structure combining, Diessel and Tomasello (in press) investigated children's earliest complex sentences (i.e. sentences with two or more verbs). We looked at six children in the CHILDES database, with a special focus on their complex utterances with sentential complements. We found that virtually all early sentential-complement sentences were composed of first, as a main clause, one of a handful of matrix verbs (see also Bloom, 1992), and second, as a complement, a simple sentence schema the child had already mastered. The matrix verbs were of two types (see Fig. 4b). First were epistemic verbs such as *think* and *know*. In almost all cases children used *I think* to indicate their own uncertainty about something, and they virtually never used the verb *think* in anything but this first-person form (i.e. no examples of *He thinks …, She thinks...,* etc.). This form was also virtually never negated (no examples of *I don't think …*), virtually never used in anything other than the present tense (no examples of *I thought …*), and virtually never with a complementizer (no examples of *I think that …*). It thus appears that *I think* is a relatively fixed phrase meaning something like *Maybe*. The child combines this fixed phrase with some full sentence, but this combining does not amount to ''sentence embedding'' as it is typically portrayed in more formal analyses – it is more like simple concatenation since the main verb (*think*) is not really acting as a verb. Second, children also use attention-getting verbs like *Look* and *See* in conjunction with full sentences. In this case, they use them almost exclusively in imperative form (again virtually no negations, no non-present tenses, no complementizers). So again these early complex sentences do not appear to be abstract sentence embeddings, but rather concatenations of a formulaic expression and a full sentence. In all, it seems that these early complex sentences are not abstract sentence embeddings, as they are treated by generative theories, but rather they are pastiches of well-learned linguistic patterns. In particular, they are combinations of a simple verb-argument clause (perhaps item-based, perhaps more abstract) juxtaposed with a specific, item-based epistemic or attention-getting expression such as *I think, You mean, Look,* or *See*.

The key point for current purposes is that structure combining does not mean simply combining words, but rather it means combining whole constructions that the child has previously mastered. Children learn various kinds of constructions from early in development - varying in both complexity and abstractness - and so when they want to express some new meaning, one thing they can do is to juxtapose or integrate those existing structures in some way. The exact way this is done in specific cases - for example, the influence of different kind of source structures in the child's language, the role of frequency of use of source structures, and the role of different kinds of adult models - is not known at this time.

4.5. Summary

This sketch of a possible alternative to generative theories of language acquisition was intended to make only one simple point. The continuity assumption cannot be

justified ''negatively'', that is, by arguing that there must be continuity between child and adult linguistic competence since there is no way a child could get from concrete and item-based linguistic structures to the powerful abstractions that constitute adult linguistic competence. The above account shows that there is a way if (a) we conceive of adult linguistic competence in more psychological, and less mathematical, terms; and (b) we recognize that children's skills of cognition and learning are more powerful than previously suspected, especially with regard to intention reading and cultural learning, analogy making, and structure combining. A usage-based theory of this sort also has the advantage that it does not have a linking problem, since there is no universal grammar with which the child's local learning must ultimately link up. It must also be stressed that in this view of language acquisition there is continuity of process - the basic cognitive and learning mechanisms are the same at all developmental periods - but there is discontinuity of structure. Children's concrete and item-based language early in development rests on lexically specific syntagmatic and paradigmatic categories (''thrower', 'thing thrown', etc.), not on the kinds of abstract and verb-general categories and schemas that characterize much of adult linguistic competence.

5. Conclusion

The modern study of child language acquisition began when developmentalists started to take Linguistics seriously. But taking Linguistics seriously does not mean taking formal grammars written for adults and using them uncritically with children. There is no doubt that formal grammars may be written for children's language; they may be written for just about any natural phenomenon including tonal music (Jackendoff, 1983), the human genome (Collado-Vides, 1991), and dreaming (Foulkes, 1978). But the question is whether these formal grammars are psychologically real entities for young children. Generative theories have simply assumed that they are, and this continuity assumption has been used to justify the practice of taking an individual child utterance and describing it in essentially the same way that that utterance would be described if it were produced by an adult.

But all behavioral and cognitive scientists, whether they study language or some other phenomenon, know that similar behaviors may be produced by different underlying mechanisms. In each case systematic research must be conducted to see whether indeed a child's adult-like, or even partially adult-like, behavior is underlain by adult-like mechanisms. In the current case, when we look at all of a given child's spontaneous language - not only what she does but also what she does **not** do with particular words and phrases - it is clear that children's linguistic competence is much more concrete and item-based than adults'. Moreover, when we give children novel verbs in controlled experimental situations, they are initially conservative and only gradually show an increasing tendency - with perhaps a special spurt at around 3 years of age - to assimilate these novel verbs to abstract syntactic categories and schemas. It is logically possible to argue that those abstract categories and schemas are present throughout early development and that at the younger ages children

simply cannot effect the assimilation due to extraneous performance factors and the like. But a number of control conditions and procedures in the experiments reviewed above effectively rule out that interpretation - suggesting once again that at younger ages children simply do not possess the abstract syntactic competence characteristic of older children and adults.

From a more purely theoretical point of view, the classical ''logical'' arguments of generative grammar against learning-based or usage-based theories simply do not hold when we: (a) replace the mathematical view of language with a more psychologically based view of language, and (b) replace the straw men typically used in these arguments - simple association and blind induction - with the more cognitively sophisticated learning and abstraction processes involved in intention reading, cultural learning, analogy making, and structure combining. And it must be emphasized that all theories of language acquisition of whatever type must posit local learning - so that children can learn the particular structures of the particular languages into which they are born. But in addition, generative theories (and only generative theories) must also find a way for that local learning to link up with an innate universal grammar - which, so far, they have not succeeded in doing.

There is no question that human children are biologically prepared to acquire a natural language in any number of ways involving basic processes of cognition, social interaction, symbolization, and vocal-auditory processing. But this does not mean that they have to possess from the beginning the final adult syntactic structures in all of their complexity and abstractness (Tomasello, 1995). Indeed, modern-day linguistic constructions have taken many hundreds, or perhaps thousands, of years of social evolution to grammaticalize into the complex cognitive entities that exist today. Recent research has demonstrated that when human beings communicate symbolically with one another in extended discourse interactions, the stringing together of symbols begins to become grammaticalized, for example, content words such as nouns and verbs become function words or markers such as prepositions, auxiliaries, tense markers, and case markers, and loosely concatenated symbols acquire syntactic relationships involving constituency and dependency. These transformations of linguistic structure occur as a result of social-interactive processes in which (i) speakers try to abbreviate linguistic expression as much as they can, and (ii) listeners try to make sure that speakers do not go so far in this direction that the message becomes incomprehensible. Grammaticalization processes are well-attested in the written records of numerous languages in their relatively recent pasts, and it is a reasonable assumption that the same processes were also at work in the earlier evolution of language, turning loosely organized sequences of linguistic symbols into grammaticized linguistic constructions - which children then may learn (Bybee, Perkins & Pagliuca, 1994; Givón, 1995; Traugott & Heine, 1991).

It is an interesting hypothesis that the linguistic competence used to acquire these grammaticized constructions is basically the same across all stages of human ontogeny. But it is just that: a hypothesis. Continuity cannot be simply assumed without systematic investigation of the type that is conventional across the behavioral and cognitive sciences. The research results reported here, from both naturalistic obser-

vation and systematic experimentation, suggest that the continuity hypothesis does not provide an accurate description of the early stages of children's emerging syntactic competence.

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