Discussion

The role of abstract syntactic knowledge in language acquisition: a reply to Tomasello (2000)

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Abstract

In his paper "Do young children have adult syntactic competence?" Tomasello (Cognition 74 (2000) 209) interprets young children's conservatism in language production as evidence that early language use, and verb use in particular, are based entirely on concrete lexical representations, showing no evidence of abstract syntactic categories such as "verb" or "transitive sentence". In this reply, I argue that Tomasello's interpretation depends on three questionable premises: (a) that anyone with a robust grammatical category of verbs would use new verbs in unattested sentence constructions; (b) that there are no reasons other than lack of syntactic competence for lexical effects in language use; and (c) that children always interpret a new verb presented in the context of an action on an object as a causal action verb, and therefore as one they should use transitively. I review evidence against all of these assumptions. Tomasello's data, among others', show that children indeed learn item-specific facts about verbs and other lexical items – as they must, to become competent speakers of their native language. However, other data suggest that more abstract descriptions of linguistic input also play a role in early language use. To achieve a complete picture of how children learn their native languages, we must explore the interactions of lexical and more abstract syntactic knowledge in language acquisition. © 2002 Elsevier Science B.V. All rights reserved.

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1. Introduction

The paper by Tomasello (2000) "Do young children have adult syntactic competence?" is part of a growing literature that opposes generative theories of language

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acquisition. The main claim of this literature is that children's early multiword speech is based not on abstract syntactic representations but rather on concrete lexical representations. After reviewing the data supporting this claim, both from laboratory elicitation tasks and from analyses of children's spontaneous speech, Tomasello sketches a constructivist theory of language acquisition. The initial long period of conservative lexical learning plays an important role in this theory: Tomasello argues that children gradually abstract language-specific grammatical structures from a host of more concrete representations of the linguistic data, and that this gradual learning process obviates some classic problems of language acquisition. In particular, he argues that his theory, by assuming a different adult end-point of language acquisition, and by assuming more sophisticated learning processes on the part of the child, requires no innately-specified universal grammar (UG), and no step in which linguistic experience is linked with the categories of UG.

There is much in this that the field should recognize and welcome. First, it is clear that learning about the meanings and syntactic privileges of individual lexical items (verbs and other predicate terms in particular) plays a major role in the acquisition of syntax (e.g. Baker, 1979; Bowerman, 1981; Grimshaw, 1981; Maratsos, 1978; Pinker, 1989). The question of how lexical knowledge and more abstract knowledge interact during acquisition and in language processing throughout life is a central concern of psycholinguistics. Second, the prominent role of lexical learning in acquisition also makes clear that abstract grammatical knowledge must involve a process of abstraction from positive examples. The study of the learning mechanisms that permit this abstraction has also been a main preoccupation of the field (e.g. Fisher, Hall, Rakowitz, & Gleitman, 1994; Gleitman, Gleitman, Landau, & Wanner, 1988; Gomez & Gerken, 1999; Kelly & Martin, 1994; Marcus, Brinkmann, Clahsen, Wiese, & Pinker, 1995; Pinker, 1984; Saffran, Aslin, & Newport, 1996). Third, Tomasello's theoretical sketch shares core features with other theories of language acquisition: though various approaches differ in important ways, most share the assumption that an expectation of uniform relationships between semantic and syntactic structures is a fundamental part of the child's endowment for language acquisition (e.g. Bloom, 1970; Grimshaw, 1981; Landau & Gleitman, 1985; Pinker, 1989).

However, there is one main aspect of Tomasello's argument that I would like to take issue with. In particular, I will question the evidence for the very late appearance of abstract knowledge in linguistic development. In the course of making this argument, I will try to draw out three general themes. All three are dichotomies that tend to divide the field of language acquisition and that make different approaches to explanation seem more different than they really are.

2. Do young children innovate in language production? Should they?

Tomasello's paper begins with an empirical argument that early word combinations are based on strictly conservative word-by-word learning. For example, the child will observe that "tickle" can come with two noun phrases, one naming the

tickler and the other the one tickled, and will learn where in the sentence these noun phrases appear. This knowledge, Tomasello argues, has no consequences for the child's expectations about the behavior of other verbs.

2.1. The data

As evidence for this claim, Tomasello reviews laboratory elicitation experiments in which children learn new verbs and analyses of corpora of children's spontaneous speech. Based on both kinds of data, he argues that there is little evidence for grammatical abstractions such as "verb" or "transitive sentence" in the multi-word utterances of children between the ages of 1.5 and 3 years. For the transitive construction in particular, he finds little evidence of generalization across verbs until about 3 years of age.

Instead, children under 3 stick quite close to the sentence formats in which they have heard each verb used. If an experimenter models a new verb for children in an active transitive sentence, 2-year-olds readily produce new transitive uses of the verb when encouraged to do so (e.g. Brooks & Tomasello, 1999; Tomasello & Brooks, 1998). If the experimenter models the verb only in an intransitive structure (Tomasello & Brooks, 1998), as an imperative (with no overt subject; Lewis & Tomasello, in preparation, cited in Tomasello, 2000), as a passive (Brooks & Tomasello, 1999), or as an unadorned gerund ("Tamming!"; Olguin & Tomasello, 1993), children younger than 3 years of age are reliably less likely to use the new verb in an active transitive sentence. Tomasello's Fig. 1 presents the proportion of children who produced some transitive uses of verbs presented in these various formats. In each experiment, only a minority of children under 3 managed to do so (ranging from 6 to 40% of the children across experiments); the productivity rate gradually increased with age.

The same rarity of innovation is found in early spontaneous speech. Tomasello examined a large corpus of his daughter's speech between 15 and 24 months (Tomasello, 1992), and found that each of her verbs had a syntactic life of its own. Rather than readily using similar verbs in an all-purpose set of constructions, she was likely to give each verb a small and sometimes unique set of sentence frames. Each verb developed along its own course, such that "…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" (Tomasello, 2000, p. 213).

This pattern of relatively conservative (i.e. correct) early production of word combinations in both spontaneous and elicited speech, with both familiar and novel verbs, has been noted by many commentators (e.g. Bowerman, 1981; Gordon & Chafetz, 1990; Maratsos, 1978; Pinker, 1989; Pinker, Lebeaux, & Frost, 1987).

2.2. The interpretation

What should we make of these data? Tomasello concludes that they provide no clear evidence for abstractions such as "verb" or "transitive sentence" in young children's language processing systems. But this conclusion depends on several

questionable premises. First, Tomasello's interpretation requires that anyone in possession of a robust verb category should be willing to use any new verb in any sentence construction. Second, this interpretation assumes that there are no reasons other than lack of linguistic competence for children to fail to innovate with verbs in language production. Third, Tomasello's interpretation of the language production data takes it for granted that children always interpret a new verb presented in the context of an action on an object as a causal action verb, and therefore one that should be used transitively. Sections 2.2.1–2.2.3 treat each of these difficulties in turn; Section 3 discusses where we should look for abstraction in children's language processing.

2.2.1. Lexical vs. abstract knowledge

Should children assume that any new verb can be used transitively? In the adult language, clause syntax is governed both by the abstract grammatical category verb and by much narrower subcategories of verbs. Predicting that a verb learned in one syntactic context can be extended to another is a delicate matter, dependent on considerable learning about the lexical choices of a particular language (e.g. Bloom, 1991; Bowerman, 1990; Fillmore, 1977; Gleitman, 1990; Maratsos, 1998; Pinker, 1989).

Verbs are choosy about the sentence structures they accept. The verb in a clause determines what syntactic phrase types can appear in the clause, and how they will be interpreted. *Hit* and *drop* can be used transitively (as in (1a) and (1b)), but *fall* is only intransitive (1c). *Know* can be transitive (2a) or take a whole sentence as its complement (2b). The semantic weight of the verb is clear in these sentences as well: examples (1a), (1b), and (2a) share the same syntactic structure, but describe very different relationships between the subject and object referents.

(1)	a. Alice hit the ball.
	b. Alice dropped the ball.
	c. The ball fell. (*Alice fell the ball.)
(2)	a. Alice knew the answer.
	b. Alice knew the answer was wrong.

Verbs' syntactic privileges are systematically related to their meanings (e.g. Fisher, 2000a; Gleitman, 1990; Grimshaw, 1981; Jackendoff, 1990; Levin & Rappaport Hovav, 1995; Pinker, 1989). A verb that describes causal action on an object is very likely to be transitive, with the actor as subject (e.g. *Bert hit the ball*), and one that encodes motion routinely takes a noun phrase argument that names the moving object (e.g. *The ball rolled*). Syntactic-semantic correspondence patterns like these show striking regularities across languages (e.g. Croft, 1990; Dowty, 1991; Grimshaw, 1981; Jackendoff, 1990), and even in the gestural communication systems invented by linguistically isolated deaf children (Home Sign; e.g. Goldin-Meadow & Mylander, 1998). Therefore, the acquisition of verb

meaning and verb syntax have usually been treated as inextricably linked (e.g. Bloom, 1991; Braine, 1992; Fisher, 2000a; Gentner & Boroditsky, 2001; Gleitman, 1990; Grimshaw, 1981; Landau & Gleitman, 1985; Maratsos, 1990; Pinker, 1989; Schlesinger, 1988).

However, verb syntactic privileges are not entirely (or easily) predictable from verb meanings. This is particularly true for the complicated alternations in argument structure examined in Tomasello's experiments (e.g. Baker, 1979; Bowerman, 1990; Pinker, 1989; Talmy, 1985). Some English verbs of action on an object can be used both transitively and intransitively, with an associated change in meaning, as in (3) (see Levin, 1993, for many more examples). Thus, in English we often use a single root verb both to describe an agent's action on an object (e.g. *spinning* it) and to describe the resulting motion (e.g. it's *spinning*). But other action verbs are only transitive (4) or only intransitive (5). In these cases, different root verbs express the causal action and the resulting motion.

(3)	Bert spun/rolled/slid Ernie.
	Ernie spun/rolled/slid.
(4)	Bert pushed/launched/slapped Ernie.
	*Ernie pushed/launched/slapped.
(5)	*Bert fell/jumped/went/disappeared Ernie.
	Ernie fell/jumped/went/disappeared.

Different groups of verbs also alternate between transitive and intransitive forms in different ways (see Levin, 1993): the verbs in (3) are of the familiar causative/anti-causative type, in which the intransitive version has the moving object as its subject. In contrast, intransitive *eat* drops its object and its subject remains the actor, as in (6).

(6)	Felice ate pizza.
	Felice ate.
	*The pizza ate. [meaning someone ate the pizza]

Languages differ in how readily they permit a single root verb to occur in multiple syntactic structures – and therefore with multiple senses – and which pairs of verb meanings are expressed by the same root verb (e.g. Bowerman, 1981; Fillmore, 1977; Pinker, 1989). Thus, a young child cannot be assumed to know *a priori* whether a particular new verb can be used both transitively and intransitively in the language being learned. Because of the unpredictability and language-specificity of these verb-syntactic patterns, theories that have tried to account for their acquisition, whether calling themselves generative theories or not, have proposed a long learning trajectory in which children gradually pick up their language's taxonomy of verbs from positive examples (e.g. Bowerman, 1981; Goldberg, 1995; Pinker,

1989). Children's gradually increasing willingness to predict an unattested sentence structure for a new verb is just what we should expect for these arcane, language-specific facts.

Examples like (4) and (5) tell us that the inference tested in many of Tomasello's experiments – that any verb may be used transitively – is not warranted. English and other languages have many verbs that are intransitive or transitive only, as well as verbs that alternate in various ways between these two structures. A child who blithely assumes that any verb can be used transitively when communicatively convenient would be right some of the time (as in (3)), but wrong other times (as in (5)).

Because verbs in the adult grammar differ in their syntactic privileges, each verb has a life of its own in adult usage as well. Naigles and Hoff-Ginsberg (1995) found a pattern of verb use in mothers' speech to 2-year-olds that is very similar to Tomasello's detailed observations of his daughter's speech before 2 years: the individual verbs they examined appeared in unique sets of sentence formats. The mothers used each of their verbs in more of its allowable structures than did 2-year-olds; but, as for children, the best predictor of the syntactic behavior of an individual verb on a given day would not be the mothers' use of other verbs on that same day, but rather their use of the same verb on other days.

In summary, Tomasello's interpretation of the developmental data depends on an unwarranted assumption – that children should predict that any verb could be used transitively, for example. Only after learning a great deal about how a particular language organizes its verbs could a child guess that a new verb can be extended into a new syntactic structure. This yields a first reason to predict the pattern of increasing innovation shown in Tomasello's Fig. 1: with age and experience, children become increasingly likely to use verbs in unattested structures, because they are gradually learning the language-specific restrictions on argument structure alternations. These lexical effects are important, but they cannot be taken as evidence against any role for more abstract knowledge in early acquisition.

2.2.2. Language knowledge vs. language processing

What we know about language processing in adults yields yet another reason to expect children's language use to exhibit lexical restrictions. Recent research on sentence comprehension in adults makes clear that detailed probabilistic knowledge about the syntactic behavior of particular verbs pervades the language processing system. As people read or listen to sentences, verb knowledge comes rapidly into play to help determine how to interpret upcoming phrases (e.g. Garnsey, Pearlmutter, Myers, & Lotocky, 1997; Trueswell & Kim, 1998). Adults therefore have more difficulty understanding sentences that have less frequent (even though grammatical) combinations of verbs and sentence structures.

For example, the verbs *warn* and *worry* can both occur with sentence complements or with direct objects, as in (7) (sentences adapted from Garnsey et al., 1997). However, these verbs differ in the frequency with which they occur with each complement type: *warn* is more frequently used with a direct object, and *worry* with a sentence complement. Other things being equal, listeners will tend to analyze

a noun phrase following *warn* as a direct object, as in (7a). This causes comprehension delays if that noun phrase turns out to be the subject of a sentence complement, as in (7b). This "garden path" effect is much reduced or eliminated if the verb more frequently occurs with a sentence complement (e.g. Garnsey et al., 1997; Trueswell & Kim, 1998). When reading or hearing the "worried" sentence in (7d), we are less likely to experience any comprehension difficulty, because we expected this verb to occur with a sentence complement. Native speakers learn not only which verbs can grammatically occur in which sentence structures, but also how often each verb occurs in each structure. Adults retrieve this information as soon as they identify a verb, and use it to bias online sentence interpretation.

(7) a. The referee warned [NPthe spectators] about throwing things onto the field.
   b. The referee warned [Sthe spectators might throw things onto the field].
   c. The bus driver worried [NPthe passengers] by driving too fast.
   d. The bus driver worried [sthe passengers would become unruly].

Tantalizingly similar lexical effects have been found in children. For example, Gordon and Chafetz (1990) reported that 3–4-year-olds were consistently more accurate in interpreting passive sentences with some verbs than with others and that these preferences mapped onto probabilities in the exposure language. Trueswell, Sekerina, Hill, and Logrip (1999) tracked adults' and children's eyes as they responded to instructions to manipulate objects, as in (8). Five-year-olds interpreted a prepositional phrase following the verb *put* as a destination, regardless of whether the physical context made a noun phrase modifier interpretation for the prepositional phrase pragmatically plausible (e.g. whether two frogs were present, one on a napkin and one not on a napkin). When the same task was repeated with the verb "wiggle", as in (9), children showed a reduction in this garden path effect.

(8)   Put the frog on the napkin in the box.
(9)   Wiggle the frog on the napkin into the box.

This difference suggests that on-line parsing decisions in children as young as 5 are influenced by knowledge about the syntactic behavior of each verb. *Put* almost always occurs with a destination phrase, typically a prepositional phrase. After hearing *put*, the children found a destination interpretation of an "on" phrase impossible to resist. *Wiggle*, on the other hand, does not have this strong tendency to occur with a destination phrase, and so it permitted the modifier interpretation to be considered.

Adult language processing is characterized by a seamless mixture of abstract and more lexically-specific influences. Compelling evidence for the role of abstract syntax in language production comes from the phenomenon of syntactic priming.

Bock and her colleagues (e.g. Bock, Loebell, & Morey, 1992) have found that speakers' spontaneous choice of syntactic structures to describe pictures is influenced by the structure of sentences they have recently uttered. This effect appears even when the prime sentence is unrelated to the target, and when no open-class words are shared between prime and target sentences. Similar effects can be found when the speaker hears but does not say the prime sentence (e.g. Branigan, Pickering, & Cleland, 2000), suggesting that the primed representations are abstract enough to encompass both comprehension and production. Alongside these quite abstract effects, there is evidence of lexical effects on syntactic priming. Pickering and Branigan (1998) found stronger priming when the verb stayed the same from prime to target sentence than when the verb changed.

The psycholinguistic evidence briefly reviewed here testifies to the ubiquity of lexical as well as more abstract effects in adults' language use, and it makes clear that language processing systems are exquisitely sensitive to the history of linguistic experience. Unfortunately, such considerations are rarely applied to children's language production and comprehension data. Part of the reason may be that the phrase "processing problems" has historically meant different things to child language researchers than to other psycholinguists. In studies of adult language use, language processing systems have been the focus of study. Researchers have asked how adults accomplish the dazzling feats of perceptual identification, categorization, and memory retrieval required for ordinary language comprehension and production. To child language researchers, however, the speedy accretion of *knowledge* about the native language has been the central mystery. In this enterprise, the processing systems that enable language comprehension and production may seem mere uninteresting obstacles to understanding the growth of linguistic competence.

Perhaps for this reason, Tomasello assumes that his data directly and simply reveal children's knowledge, and defends himself only against hypotheses that overall performance limits could cause the difficulty with novel verbs in his elicitation experiments. For example, he argues that his data on early productivity with nouns serve as a control for the possibility that young children would simply not be willing or able to use a new word in new ways. But nouns and verbs play quite different roles in grammars and in the language processing systems that embody them. In the course of planning an utterance, the speaker coordinates the choice of verb and sentence structure to produce interpretable output. In the course of comprehending a sentence, the hearer predicts the likelihood of various possible sentence completions based on past experience with the syntactic behavior of each verb. For nouns, the main issue is how the word should be extended to new referential contexts, not what syntactic frames it will appear in. Verbs bear a very different relation to the rest of the grammar and the language processor than nouns do; thus, noun use is not in any real sense a control for "processing difficulties" in verb use.

2.2.3. The problem of verb meaning: formal vs. semantic learning

Thus far I have argued that Tomasello's interpretation of the developmental data

on verb use depends on two unwarranted assumptions – that children should readily place a new verb in an unattested sentence frame, and that only the lack of abstract linguistic categories could prevent them from doing so. On the contrary, as I have pointed out, verbs are not uniformly distributed in sentence contexts in the adult grammar, and the adult language processing system is full of lexical as well as more abstract influences.

Why does it seem so plausible to us, nevertheless, that children who see an experimenter (for example) use a pendulum to knock a toy Ernie off his perch while saying "Look, dacking!" should be willing to say, "You're dacking Ernie"? I think the primary reason for this is that we share with the experimenter an English-based knowledge of how verbs work: English has many caused motion verbs that can be both transitive and intransitive. Moreover, we are able to infer what is wanted when the experimenter asks "What am I doing to Ernie?" when eliciting uses of the new verb. Given all these shared presuppositions, older children and adults readily produce the requested innovative use of the new verb.

But would it be so surprising if the experimenter meant to say, as Ernie plummeted to the floor, something more like "falling" than "pushing"? If this were what the experimenter meant, then an innovative transitive use would be an error. Tomasello's interpretation of the developmental data relies on the assumption that any child hearing a new verb in the presence of a causal action will interpret the verb as a causal action verb, and therefore one that should be used transitively.

To learn the meaning of a new verb, a listener must determine what relation among participants in a scene is encoded by the sentence. Theories of language acquisition, including Tomasello's and the generative theories he criticizes, have routinely treated independent knowledge of the speaker's meaning as a privileged starting point in syntax acquisition. Tomasello (2000) puts his version of this claim strongly: "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" (p. 239). Once children understand the semantic/pragmatic function of each element in a phrase, Tomasello suggests that they can assign a syntactic constituent structure to that phrase. For example, he argues that a child who understands the communicative function of each element in the phrase "your papers" will conclude that "your" modifies "papers", and therefore create an asymmetrical constituent structure in which "papers" is the head, and "your" is not.[1]

The contention that young children can interpret the speaker's intent is based in part on many studies showing that children at about 18–20 months are quite good at using eye gaze and gesture to figure out what object an adult intends to label when producing a novel noun (e.g. Baldwin, 1993; Tomasello & Farrar, 1986). Even 16-

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[1] This is, in essence, a detailed structural analogy from semantic to syntactic structure, based on the assumption that semantically dependent elements will be syntactically dependent as well. This view thus proposes to achieve the structural effects of a theory like semantic bootstrapping (Grimshaw, 1981; Pinker, 1984), while invoking less in the way of language-specific built-in primitives. See Braine (1992) for a similar proposal.

month-olds fail to learn a new noun when an experimenter names one object while the child is looking at another, but successfully pick up the new word if the experimenter looks at and names the object the child is attending to (Baldwin & Markman, 1989). These abilities are impressive. Young children monitor a speaker's gaze or gestures, and avoid mapping a new name onto whatever they happen to be looking at.

But what about understanding a whole sentence, including its verb? Here the data are far less encouraging. Children are good at interpreting adults' goals in acting on objects. For example, several experiments have shown that 16–18-month-olds are more likely to imitate adults' intentional than accidental actions, whether intention is marked linguistically ("Oops!") or not (e.g. Carpenter, Akhtar, & Tomasello, 1998; Meltzoff, 1995). The leap to knowing a speaker's communicative intent in commenting on such actions, however, is a different matter. Verb and other predicate meanings pose problems for interpretation from unaided observation of events. Verbs are abstract; they take a perspective on events that cannot be predicted from observing those events and understanding human intentions. For example, observers cannot know whether a speaker will refer to an exchange event as an instance of giving or getting. Every event has parts, and different verbs encode or focus on different subsets of those parts.

Evidence for the relative obscurity of verb meaning comes from recent studies examining English-speaking adults' ability to guess the words a mother said while talking to her toddler (Gillette, Gleitman, Gleitman, & Lederer, 1999). Adults watched brief silent video clips of mothers and children playing with toys, and heard a beep when the mother uttered a particular word. The target words were the 24 nouns (e.g. *ball*, *hand*, *hat*) and 24 verbs (e.g. *push*, *come*, *look*) most frequently produced by the mothers. For each word, the subjects watched six occasions of use in a row; thus, they had some opportunity for cross-situational observation. Adults correctly guessed an average of 45% of the nouns under these circumstances, but they were able to figure out the verbs only about 15% of the time. Eight of the 24 verbs were never guessed correctly by any subject. Evidently we should not assume that a group of young children who witness an event, as in one of Tomasello's verb learning experiments, all converge on the same interpretation of the new verb.

Moreover, given the principled relationships between a verb's meaning and its syntactic privileges, a new verb's syntactic context should affect its interpretation. Gillette et al. (1999) argued that since verb choice is unpredictable based on extralinguistic context alone, linguistic evidence might fill the informational gap. Gillette et al. again asked adult subjects to guess verbs, adding different combinations of linguistic hints about the mother's intent. For example, one group of subjects saw the same video clips, and for each "beep" were presented with the set of nouns the mother used in the sentence. This provides some information relevant to the verb's selectional restrictions, and relevant to the number of noun phrase arguments each verb accepts. Adults were significantly better able to guess the verbs given this small linguistic hint. Providing a syntactic structure for the verb, with nonsense words replacing content words, was more helpful still. Finally, when adults were given full

syntactic information plus content words (e.g. "Can you GORP Markie on the phone?") along with the video clips, their guesses exceeded 90% accuracy. Adults were able to use varying degrees of linguistic information to guide their guesses about what the mother was saying.

Many studies tell us that children between the ages of 2 and 3 can use syntactic cues in verb interpretation as well (e.g. Naigles, 1990; Naigles & Kako, 1993). For example, 2.5-year-olds and older children interpret new verbs in accord with the number of their noun phrase arguments (Fisher, 1996, in press). Children heard new transitive or intransitive verbs (e.g. *She*'s *pilking her over there* vs. *She*'s *pilking over there*) describing the same caused motion events, and were asked to indicate which of the two participants in the event was doing the action described by the verb (e.g. "Which one is pilking (the other one) over there?"). Children who heard transitive sentences were more likely to choose the causal agent than were children who heard intransitive sentences.

In summary, we should not expect children who hear a verb as they observe a novel causal event all to arrive at the same interpretation of the verb. Instead, children's interpretations of novel verbs will differ depending on the sentence context in which the new verbs are presented. This provides yet another reason for children in different sentence conditions to behave differently in elicitation tasks like those used in Tomasello's experiments: if children have different interpretations of the new verbs, this should affect their future use of those verbs in sentences.

2.2.4. Summary

Tomasello interprets children's conservatism as evidence that early language use is based entirely on concrete lexical representations, showing no evidence of abstract categories. This interpretation depends on three questionable premises: (a) that anyone with a robust grammatical category of verbs would readily use a new verb in unattested sentence constructions; (b) that there are no reasons other than lack of syntactic competence for children to show lexical effects in language production or comprehension; and (c) that children always interpret a new verb presented in the context of an action on an object as a causal action verb, and therefore one that should be used transitively.

I reviewed evidence against all three of these assumptions. (a) The choice of sentence structures in the adult language is governed not only by the category verb, but also by smaller subcategories of verbs. The prediction of unattested sentence structures for verbs depends on language-specific learning. (b) Language processing systems in adults are intricately affected by the history of hearing and saying particular verbs in particular sentence structures. Robust lexical effects in children's language production and comprehension suggest that developing language processing systems have the same tendencies. (c) Even adults are not good at guessing what verb was intended from observation of the communicative context alone. Instead, information about sentence structure influences verb interpretation both in adults and in children well under the age of 3.

3. Where should we look for abstract knowledge?

All of the evidence reviewed in the previous section provides good reasons for the lack of innovation with novel verbs found in Tomasello's experiments, and therefore suggests that these experiments are looking for abstract syntactic knowledge in the wrong places. Where should we look for evidence of abstraction? In this section I make some suggestions in line with the above discussions.

3.1. Production data: variations across conditions

Based on his data, Tomasello concluded 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" (Tomasello, 2000, p. 290). Systematic differences across conditions in some of these elicitation experiments, however, suggest more abstract knowledge than meets the eye.

First, striking evidence for abstract knowledge of both active and passive transitive structures comes from data reported by Brooks and Tomasello (1999). They taught new verbs to children just under 3 (mean age 2;11 in Study 1 and 2;10 in Study 2) in active transitive or passive sentences, and elicited uses of those verbs using theme-focused questions (e.g. "What happened to the truck?") or agent-focused questions ("What did Ernie do?"). As found elsewhere (e.g. Braine, Brody, Fisch, Weisberger, & Blum, 1990), the question had an effect: agent-focused queries encouraged agent–subject transitive uses, and theme-focused queries encouraged theme–subject intransitive uses (in this case, passives). Sentence training also had the expected effect: children produced many more active uses for verbs they had heard in active sentences, and passives for verbs they had heard in passive sentences (as found even for older children by Pinker et al., 1987). Brooks' and Tomasello's two experiments differed in one respect that turned out to be important, however. In Study 1, children learned two verbs in the same structure (two actives or two passives); in Study 2, children learned one verb in each structure (one active and one passive). When the training structure varied within subjects, more than twice as many children produced passive sentences for active-trained verbs (40% of children in Study 2 vs. 12% in Study 1). Similarly, children were more likely to produce innovative active transitive sentences in the within-subjects design (35 vs. 20% in Study 1). As Brooks and Tomasello concluded, this difference looks like syntactic priming. Apparently these children, just under 3 years of age, had a notion of both active transitive and passive sentence constructions that was already abstract enough to be primed across different newly-learned verbs.

Second, Tomasello (2000) showcased recent findings from an elicited production study in which children were taught verbs with English SVO order (*Ernie meeking the tree*), or with odd word orders (SOV: *Ernie the tree meeking*; VSO: *Meeking Ernie the tree*; Akhtar, 1999). Only 4-year-olds routinely corrected the experimenter's odd word orders; younger children were more likely than older children to

mimic the order modeled by the experimenter. However, Akhtar's data show that even the youngest children (mean age 2;8) were perfect in reproducing the SVO order in their own uses of the new verbs (100% accuracy), but only half as accurate in reproducing the experimenter's ungrammatical word orders (approximately 50% accuracy). As Akhtar remarks, these data show evidence of early general knowledge of the English transitive structure.

In both of these cases, Tomasello focuses on the low absolute level of performance: if children have a verb-general notion of active transitive and passive sentences, why don't they produce them on demand with new verbs? If children younger than 4 know the word order of English is SVO, why don't they correct the ungrammatical sentences? A focus on systematic variation across conditions, in contrast, leads to quite different conclusions: the priming of passive and active transitive sentence structures across different new verbs suggests robust and abstract representations of these structures. More successful learning with SVO word orders than with non-English orders suggests that children's language processing systems are already set up to assume the SVO order.

3.2. Comprehension of novel verbs

Another way to assess abstract knowledge is through comprehension tasks. By presenting children with a new verb-structure combination, one can test, not whether they will *predict* that a verb can be extended into a new structure, but whether their system for *interpreting attested utterances* reflects abstract syntactic knowledge.

Many studies have done this, and have uncovered evidence of syntactic influences on sentence interpretation as early as the second birthday, as discussed briefly above. For example, Naigles (1990) showed 25-month-olds a videotape showing two simultaneous events (e.g. a duck bends a bunny over, while both duck and bunny make arm circles). This combination was paired with a nonsense verb in either a transitive (e.g. "The duck is kradding the bunny") or intransitive sentence ("The duck and the bunny are kradding"). The two events were then shown separately on two video screens, and the child was told to "Find kradding!". Children who had heard transitive sentences tended to look longer at the causal action (e.g. bending), while those who heard intransitive sentences looked longer at the noncausal actions (e.g. arm waving). Children at the same age can also use a transitive sentence to direct their attention toward an action that involves only contact (e.g. a bunny touching a duck's head), not causal action (Naigles & Kako, 1993). In both of these studies, young 2-year-olds used sentence cues to infer which event in a scene was relevant to the meaning of a new verb. In a similar preferential looking task, children aged 26 and 21 months showed appropriate biases in the interpretation of word order in English sentences with novel transitive verbs: they looked longer at a screen on which the subject of their test sentence was the agent of a causal action (Fisher, 2000b).

All of these data are consistent with the hypothesis that young children's sentence comprehension shows more abstract knowledge of syntactic structure than is apparent in their language production. This conclusion makes sense, given the principled

difference between predicting unattested combinations and understanding combinations that are present in the input. Since the extension of the same root verb to multiple sentence formats depends on language-particular knowledge about the organization of the lexicon, we should not predict the ready invention of new forms by very young children. Instead, we can look for the influence of relatively abstract knowledge by exploring the initial interpretation of new attested combinations.

4. The beginnings of syntactic knowledge

Do young children have adult syntactic competence? Certainly not from the start. Since acquiring a language involves learning about that language's lexical and syntactic choices, there must in principle be a period during which children have begun to learn the language but have not yet learned everything they need to know. The learner cannot know *a priori*, for example, whether the subject will precede or follow the verb, or whether word order (as opposed to case marking morphology) is used to signal grammatical roles in sentences. However, incomplete syntactic knowledge need not mean that abstract knowledge of sentence structure can play no useful role in early language use and acquisition.

Elsewhere my colleagues and I have proposed an account of early sentence comprehension and verb learning, in which a relatively uninformed analysis of sentence structure constrains interpretation (e.g. Fisher, 1996, 2000a; Fisher et al., 1994; Gillette et al., 1999). This procedure becomes available as soon as children can identify some nouns and represent them as parts of a larger utterance. The general approach depends on the fundamentally relational or structured nature of sentences, conceptual representations, and sentence meanings.

First, in common with most recent work in verb semantics, based on research by Jackendoff (1990), we assume that semantic structures of verbs are essentially of the same kind as the non-linguistic conceptual representations by means of which we represent events. Both semantic and conceptual representations demand a distinction between predicates and arguments, and thus between relations and the entities they relate (see Bierwisch & Schreuder, 1992; Fisher & Gleitman, in press; Fodor, 1975; Gentner, 1982). This assumption is shared by virtually every account of language acquisition (e.g. Bloom, 1970; Braine, 1992; Pinker, 1989; Tomasello, 2000).

Second, we assume that at an early point in language development, children become able to identify some familiar nouns in fluent speech, and represent these as parts of a larger utterance. These assumptions are again widespread: children's early productive vocabularies are dominated by nouns (see Gentner & Boroditsky, 2001, for a review), and infant comprehension of object names appears earlier than comprehension of relational terms (compare Hirsh-Pasek & Golinkoff, 1996; Waxman & Markow, 1995). The grouping of words into utterances is also uniformly assumed as a prerequisite to syntax acquisition (compare Morgan, Meier, & Newport, 1987; Pinker, 1984; Tomasello, 2000).

These assumptions about the early representation of sentences and of scenes have consequences for early sentence interpretation. When children interpret a sentence they attempt to map one structured representation onto another. To the extent that these very different representations (sentence and conceptual) are structurally similar, a sentence could provide a structural analogy for its interpretation in conceptual terms. Assuming that conceptual and semantic structures are of like kind (the first assumption given above), the result of the alignment of these two structures will be a rough semantic structure for the sentence, with semantic content derived from the specifics of the observed situation.

To see how this might work, note that even before the child can use language-specific devices such as word order or case morphology to identify the subject or the object of a sentence, sentences already contain some *number of noun phrases*. This simple structural fact could be informative, permitting children to assign different meanings to transitive and intransitive verbs by mapping an utterance containing two known nouns onto a salient conceptual relation between their referents, and an utterance containing one noun phrase onto the most salient conceptual predicate involving the referent of that noun.

Information about the set of nouns in a sentence, even without more detailed syntactic information, can yield clues to sentence interpretation because it provides a probabilistic estimate of the number of syntactic arguments of the sentence's verb (see also Gillette et al., 1999). But this estimate *is* rough, and therefore predicts some interesting errors of interpretation. Nouns in the sentence and arguments of a verb are not the same thing: the sentences in (10) both contain intransitive verbs but two nouns, by conjunction in subject position in (10a) and by the addition of an adjunct prepositional phrase in (10b). Before children acquire much of the syntax and function morphology of a particular language, they should systematically misinterpret sentences like these, which have more nouns than they have verb argument positions.

(10)	a. Margaret and Henriette are running.
	b. Margaret ran with Henriette.

Previous research has explored some of the relevant sentence types, and the overall pattern of results provides some evidence for the predicted errors. By 25 months children can correctly interpret intransitive sentences with two nouns conjoined in subject position (e.g. "The bunny and the duck are blicking!"; Naigles, 1990). In a slightly more complex sentence, however, even 28-month-olds can be fooled by a mismatch between number of argument positions and number of nouns in the sentence (e.g. Hirsh-Pasek & Golinkoff, 1996). The children tended to interpret sentences like "Find Big Bird and Cookie Monster gorping!" as if they were transitive sentences. This test sentence differed from the main clause structure used in the Naigles study in two ways: it embedded the new verb in a small clause complement to the verb *find*, and omitted the plural copula *are*. Either or both of

these features could have made the sentence harder to understand. The embedded sentence structure is both more complex and less frequent, and the plural verb *are* is one of the possible cues to the sentence's plural interpretation. The children's error suggests that the number of nouns in the sentence is a strong early cue for structure-guided interpretation of sentences.

Much further research will be needed to discover how very young children represent the structures of sentences they hear, and how those representations affect sentence interpretation. For now, however, the point is that sentences can be seen as possessing structure even before the learner knows enough about the native language to build a detailed syntactic structure. If we endow the learner with some simple structure-matching biases, then this primitive structure will influence interpretation as soon as the child can identify some nouns and represent them as parts of a larger utterance. On this incremental view of sentence interpretation (e.g. Fisher, 1996; Gillette et al., 1999), learning some nouns puts the child in a position to link minimally structured sentence representations with potential interpretations. This initial structure-mapping, in turn, will permit access to new regularities in the native language.

In this reply I have focused on the basic predicate–argument structure of the clause, because this is the topic of much of Tomasello's research as well as my own. But of course a complete theory of language acquisition must go beyond the production and comprehension of the simplest clauses. Children learn to cope with questions, negations, quantifiers, the complexities of tense and aspect, and the combinations of structures that give language its unlimited expressive power. The acquisition of each linguistic subsystem, like the acquisition of verb argument structures, involves a combination of conceptual, lexical, and structural factors: children must identify the lexical items that are used to question (*who*, *what*, *where*…), to negate (*no*, *not*), to quantify (*a*, *every*, *all*, *two*…), and to express tense and aspect (*did*, *was*, *is*, *had*, *-ed*, *-ing*…), and work out their privileges of occurrence, their meanings, and their scope in sentences. Just as for the composition of the verb phrase, theories of this development therefore begin with relatively conservative lexical learning (e.g. deVilliers, 1985; Kuczaj & Brannick, 1979; Marcus et al., 1995; Pinker, 1984). However, our view of what children gain from their analysis of the exposure language must also 'scale up' to account for children's ability to creatively combine these devices, in ways that honor fundamental principles of linguistic hierarchical structure (e.g. Lidz & Musolino, 2001).

Some of the most dramatic evidence for the role of abstract analyses of linguistic data in the early acquisition of language comes from findings that children are better learners of syntax and morphology than adults are. Late learners of American Sign Language (ASL) show less than native competence in producing and comprehending the ASL equivalents of function morphemes (Newport, 1990; see also Mayberry & Eichen, 1991). The same pattern emerges in the invention of Nicaraguan Sign Language (NSL) by its first generations of speakers (Senghas & Coppola, 2001). Apparently, younger but not older learners succeed at factoring the linguistic input into its component parts, so that the parts can be abstracted to new contexts.

Tomasello's data, as well as others', clearly show that children learn item-wise facts about verbs and other lexical items – as they must, to become competent speakers of their native language. The other data reviewed here suggest that more abstract descriptions of linguistic input also play a role in early language use. These two claims are not at all contradictory. To achieve a complete picture of how children learn their native languages, we must explore the interactions of lexical and more abstract syntactic knowledge in language acquisition.

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