The item-based nature of children’s early syntactic development

Michael Tomasello

Recent research using both naturalistic and experimental methods has found that the vast majority of young children’s early language is organized around concrete, item-based linguistic schemas. From this beginning, children then construct more abstract and adult-like linguistic constructions, but only gradually and in piecemeal fashion. These new data present significant problems for nativist accounts of children’s language development that use adult-like linguistic categories, structures and formal grammars as analytical tools. Instead, the best account of these data is provided by a usage-based model in which children imitatively learn concrete linguistic expressions from the language they hear around them, and then – using their general cognitive and social-cognitive skills – categorize, schematize and creatively combine these individually learned expressions and structures.

By all accounts, a major characteristic distinguishing human beings from their nearest primate relatives is the use of language. A central question in this regard is how human beings maintain the conventions of a particular language across generations in a specific community, that is to say, how children acquire a language. Of special interest to many developmental psychologists is the question of how children acquire the syntactic structure of a language, because they do not hear an adult speaking in abstract syntactic categories and schemas but only in concrete and particular words and expressions.

The best known answer to this question – first proposed by Chomsky and more recently popularized by Pinker and others – is that children do not have to learn or construct abstract syntactic structures at all, but rather they already possess them as a part of their innate language faculty. This so-called continuity assumption (innate syntactic competence is fundamentally the same at all points in ontogeny) justifies the use of adult-like formal grammars to describe children’s early language. In this view, the ‘5001 or more natural languages of the world each derive from this same innate universal grammar, differing from one another only in the composition of their lexicon and in a few parametric variations of syntax that are prefigured in the human genome.

Recently, however, a number of empirical findings that challenge this majority view have emerged. Most important is the discovery that virtually all of children’s early linguistic competence is item-based. That is to say, children’s early utterances are organized around concrete and particular words and phrases, not around any system-wide syntactic categories or schemas. Abstract and adult-like syntactic categories and schemas are observed to emerge only gradually and in piecemeal fashion during the preschool years. These new data are most naturally accounted for by a usage-based model in which children imitatively learn concrete linguistic expressions from the language they hear around them, and then – using their general cognitive and social-cognitive skills – categorize, schematize and creatively combine these individually learned expressions and structures.

Some recent findings in language acquisition

Most of children’s early language is grammatical from the adult point of view, and this fact has been taken by some theorists as support for the hypothesis of an innate universal grammar. But children can also produce ‘grammatical’ language by simply reproducing the specific linguistic items and expressions (e.g. specific words and phrases) of adults, which are, by definition, grammatical. To differentiate between these two hypotheses, deeper analyses of children’s linguistic competence are needed.

Observational studies

Many researchers believe that young children operate from the beginning with abstract linguistic categories and schemas because they not only follow adult grammatical conventions fairly well, but they also on occasion produce some creative yet canonical utterances that they could not have heard from adults – which means that they must be generating them via abstract linguistic categories or schemas. The most famous example is ‘algorithmic speech’, as reported by Brainard, and indeed such creativity is convincing evidence that the child has some kind of abstract linguistic knowledge. However, recent
Box 1. Cross-linguistic evidence for item-based patterns

A number of systematic studies of children learning languages other than English have also found many item-based patterns in early language development. For example, Pizzuto and Caselli (Ref. 6b) investigated the grammatical morphology used by three Italian-speaking children on simple, finite, main verbs, between the ages of about 16 months to three years. Although there are six forms possible for each verb root (first-person singular, second-person singular, etc.), the findings were that:

- 47% of all verbs used by these children were used in one form only
- an additional 40% were used with two or three forms
- Use of verbs that appeared in four 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 verbs at once, but rather they initially master only some endings with some verbs—and often different ones with different verbs.

In a similar study of one child learning to speak Basque, Pizutto and Pina (Ref. c) found a comparable pattern of results, including additional evidence that the verb forms this child used most frequently and consistently correspond 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). Similarly, in a study of six Hebrew-speaking children—a language that is typologically quite distinct from European languages—Berman and Armon-Lotem (Ref. d; also Ref. e) found that Hebrew children’s first 20 verb forms were almost all “loss-karmed” or morphologically unanalysed (Ref. d, p. 57). Other similar results have been reported for Hungarian (Ref. f), Catalan, German and Danish (Ref. g), Inuktitut (Ref. h), Spanish (Ref. i) and Russian (Ref. j).

References


Trends in Cognitive Sciences – Vol. 4, No. 4, April 2000

Evidence suggests that, in this example, the only abstract knowledge this child possesses is what kinds of things can be agents— not, for example, what kinds of things may be the subjects or objects of verbs. The general methodological problem is that we can never tell from a single utterance in isolation what is the child’s underlying structural knowledge. To determine underlying structural knowledge we must look at all of a child’s uses—and mostly especially non-uses—a whole set of linguistic items or structures.

Using this more systematic method, Tomasello found that although most of his daughter’s early language during her second year of life was “grammatical”, it was also very limited, uneven, and item-based. The item-based nature of this child’s early language was most clearly evident in her use of verbs. Thus, during exactly the same developmental period some semantically similar verbs were used in only one type of sentence frame and that frame was quite simple (e.g. Cat...), whereas other verbs were used in more complex frames of several different types (e.g. Draw... , Draw... en..., Draw... for... , draw en...). In addition, morphological marking (e.g. for past tense) was also very uneven across verbs. Within a given verb’s development, however, there was great continuity, with new uses almost always replicating previous uses with only one small addition or modification (e.g. the adding of tense or the adding of a new participant role). Overall, by far the best predictor of this child’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, there appeared to be no transfer of structure across verbs. The hypothesis was thus that children have an early period in which each of their verbs forms its own island of organization in an otherwise unorganized language system (the Verb Island hypothesis), thereby serving to define lexically specific syntactic categories such as ‘drawer’, ‘thing drawn’, and ‘thing drawn with’ (as opposed to subject, object, and instrument).

Using a combination of periodic sampling and maternal diaries, Loven et al. found some very similar results in a sample of 12 English-speaking children from 2–3 years of age. In particular, they found that children used virtually all of their verbs and productive terms in one and only one sentence frame early in language development—suggesting that their syntax was built around various particular items and expressions. In fact, 92% of these children’s earliest multi-word utterances emerged from one of their first 25 lexically based patterns, which were different for different children. Following along these same lines, ‘Pine and Levine’ found that when these same children began to use the determiner a and the between 2 and 3 years of age, they did so with almost completely different sets of nouns (i.e. there was almost no overlap in the sets of nouns used with the two determiners). This suggested that the children at this age did not have any kind of abstract category of determiner that included both of these lexical items. This general finding of the item-based learning and use of language has now been replicated in a number of different languages of many different types (see Box 1).
Of special note in children’s spontaneous speech are so-called overgeneralization errors because the child has presumably not heard such errors from adults. The overgeneralizations of most interest in the context of a focus on syntax are those involving basic sentence frames, for example, ‘She failed me don’t’ or ‘Don’t giggle me’, in which the child uses intransitive verbs transitively (i.e. a verb normally used with a subject only is used with both a subject and an object).

Bowerman12 documented a number of such overgeneralizations in the speech of her two English-speaking children, and Pinker12 compiled examples from other sources as well. The main result of interest was that these children produced very few of these types of overgeneralizations before about 3 years of age. This developmental pattern again provides support for the hypothesis that the construction of abstract linguistic categories and schemas is a gradual process that takes place over many months, and even years, of ontology.

**Experimental studies**

The other main method for studying the nature of children’s linguistic knowledge involves teaching them novel linguistic items and seeing what they do with them. The idea is that if the child uses the novel item in creative yet canonical ways, we may infer that she has assimilated it to some kind of abstract category or schema. If she does not use it in any creative ways (despite repeated opportunities), but only in ways she has heard from adults, the inference is that there is no abstract system to take up the new element, and the child is simply imitatively learning a specific linguistic item or structure (assuming that there are no performance limitations, involving limited memory or the like, that prevent the child from demonstrating her syntactic competence in the experiment).

Experiments using novel verbs have demonstrated that by 3–4 years of age most children can readily assimilate novel verbs to abstract syntactic categories and schemas that they bring to the experiment, for example, taking a verb they have heard only in a passive sentence frame and using it in an active sentence frame13,14. However, the same is not true for younger children. For example, Tomasello and Brooks15 exposed 2–3 year old children to a novel verb used to refer to a highly transitive and novel action in which an agent was doing something to a patient. In the key condition the novel verb was used in an intransitive sentence frame such as ‘The sock is tamming’ (to refer to a situation in which, for example, a bear was doing something that caused a sock to ‘tam’ – similar to the verb roll or spin). Then, with novel characters performing the target action, the adult asked children the question, ‘What is the doggie doing?’ (when the dog was causing some new character to tam). Agent questions of this type encourage a transitive reply such as ‘He’s tamming the cat’, which would be creative as the child has previously heard this verb only in an intransitive sentence frame. The outcome was that very few children at either age produced a transitive utterance with the novel verb. As a control, children also heard another novel verb introduced in a transitive sentence frame, and in this case virtually all of them produced a transitive utterance. This demonstrates that children can use novel verbs in the transitive construction when they have heard them used in that way (see Fig. 1).

The generality of this finding is demonstrated by a number of similar studies using different modelled constructions and measurement procedures. These studies have used children of many different ages and have tested for a variety of different constructions (see Box 2). Most of the findings concern children’s ability to produce a simple transitive utterance (subject–verb–object: SVO), given that they have heard a novel verb only in some other sentence frame (e.g. intransitive, passive, imperative, etc.). When all of these findings are compiled and quantitatively compared, we see a continuous developmental progression in which children gradually become more productive with novel verbs during their third and fourth years of life and beyond (see Fig. 2 and Table 1).

![Fig. 1. Imitative production of novel verbs. The number of utterances children produced with the novel verb in one condition of the Tomasello and Brooks study15. Conservative utterances (light gray) were those in which children heard an intransitive use of the novel verb and then reproduced a similar intransitive utterance, even when they were encouraged to produce a transitive utterance. Productive utterances (dark gray) were those in which children used the novel verb heard in an intransitive utterance in a transitive utterance. (Adapted from Ref. 12.)](./image.png)
Box 2. Other experimental studies of children’s early productivity

A number of studies have used the same basic design as Tomasello and Brooks (Ref. 4) but with different age children and with the novel verbs presented in different sentence frames. With specific reference to children’s ability to generate a novel transitive (subject–verb–object, SVO) utterance:

1. Children were presented with a novel verb in a possession construction such as ‘This is called gapging’, and encouraged via questions to produce a transitive utterance (Ref. B.4).

2. Children were presented with a novel verb in an imperative construction such as ‘This is called gapging’, and encouraged via questions to produce a transitive utterance (Lewis and Tomasello, unpublished data).

3. Children were presented with a novel verb in a passive construction such as ‘Ernie’s getting mucked by the dog’, and encouraged via questions to produce a transitive utterance (Ref. 4).

In all of these studies the overall finding was that children below 3 years of age were very poor at using their newly learned verbs in the transitive construction, with the vast majority of children below this age never producing a single transitive utterance. In most cases we also had control conditions in which those very same children did produce a transitive utterance (using different object names as subject and object) when they had heard a novel verb modelled for them in this way.

It is also noteworthy that the few novel verb studies on languages other than English (although using slightly different syntactic constructions) have found very similar results – a general lack of productivity with novel verbs before 3 years of age (Ref. 4; Heber, Children and Tomasello, unpublished data, Chilean Spanish).

One other study of special importance because it did not only show children failing to be creative; it actually succeeded in inducing children to produce non-grammatical English utterances (which should not be possible if certain innate parameters, such as head direction, were already set). Alkhatir modelled novel verbs for novel transitive events for young children 2.8, 3.6, and 4.4 years of age (Ref. 4). One verb was modelled in canonical English SVO order, as in ‘Ernie moving the cat’, whereas two others were in non-canonical orders, either SOV (‘Ernie the one moving’) or VSO (‘Gapging Ernie the one’).

Children were then encouraged to use the novel verbs with neutral questions such as ‘What’s happening?’ Almost all of the children at all these 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. In general, the older children used their verb-general knowledge of English transitivity to ‘correct’ the non-canonical use of the novel verb to canonical SVO form. The younger children, in contrast, much more often matched the ordering pattern they had heard with the novel verb, so that the novel pattern sounded to adult ears. Interestingly, many of the younger children vacillated between imitation of the old sentence pattern and ‘correction’ of those patterns to canonical SVO order. This indicated 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 with the novel verb.

References


Opinions

Fig. 2. Productive transitive utterances in different studies. Percentage of children (or responses in some cases – see Table 1) that produced transitive utterances of a novel verb that was heard in some other sentence frame. The data points correspond to the studies listed in Table 1.
findings have important implications for current theories of child language acquisition.

Linguistic nativism
Classically, as opposed by Chomsky for example, linguistic nativism has emphasized that child language acquisition: (1) takes place quickly and effortlessly because children have full linguistic competence at birth and need only to learn to express this competence overtly in performance; (2) relies only indirectly on the language children hear (i.e. “input” only serves to “trigger” innate syntactic structures or to “set parameters”); and (3) is creative from early in ontogeny because it is generated by an abstract grammar. The data just reviewed are clearly at variance with each of these claims, and in addition, the data call into question altogether the use of adult-like grammars to describe children’s early language.

The classic response of linguistic nativism to children’s syntactic limitations is to invoke hypothesized (but never measured) performance limitations that inhibit the full expression of children’s innate linguistic competence (e.g. limited working memory)47. Many of the control conditions in the above experiments, however, put performance demands on children very similar to those of the experimental conditions, but children experienced no learning difficulties — for example, in using a newly learned noun in novel ways and in using a newly learned verb in a transitive utterance when they had heard it modelled in that way. It is also noteworthy that children’s performance was also conservative and item-based in two different comprehension experiments, which place many fewer performance demands on young children. Recently, some linguistic nativists have also proposed the idea that children are not born with fully adult-like syntactic competence. On this view, children’s early language development might be item-based and piecemeal, but the genesis for many adult-like syntactic structures begin to ‘turn on’ sometime between 2 and 3 years of age50. The problem in this case is that, in the experimental data reviewed, the gradual and piecemeal developmental process was all within the same syntactic structure, namely, the English transitive construction. Children who can use the simple transitive construction for familiar verbs presumably already have the required genetic bases in place, and so it becomes a mystery why they cannot use these same genetic bases to use novel verbs in transitive utterances in experimental contexts.

Table 1. Research using novel verbs

<table>
<thead>
<tr>
<th>Reference</th>
<th>Data point in Fig. 2</th>
<th>Age (yrs; mths)</th>
<th>Productivity</th>
<th>Linguistic model</th>
<th>Eliciting question</th>
<th>Scoring</th>
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<tr>
<td>Ref. 14</td>
<td>1</td>
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<td>0.07</td>
<td>Presentational</td>
<td>Neutral</td>
<td>% children</td>
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<td>0.19</td>
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<td>Neutral</td>
<td>% children</td>
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<tr>
<td></td>
<td>4</td>
<td>2.0</td>
<td>0.06</td>
<td>Passive</td>
<td>% children</td>
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<tr>
<td></td>
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<td>0.13</td>
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<tr>
<td></td>
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*Studies investigating children’s ability to produce transitive (SVO) utterances as a function of age, given a nonce (made-up) verb modelled in some other sentence frame. Each data point in the table corresponds to one data point in Figure 2 (keyed by numbers or letters).
Box 3. A more complex example of structure combining

As a more complex example of structure combining, Diesen and Tomasello (Ref. 1) looked at the complex sentence with sentential complements of six children. They found that virtually all early complement sentences are composed of a simple sentence schema that the child has already mastered, combined with one of a handful of matrix verbs (see also Ref. 6).

These matrix verbs are of two types. First are epistemic verbs such as think and know. In almost all cases children used I think to indicate their own uncertainty about something, and they basically 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 never with a complement (no examples of ‘I think that…’). Thus, that appears to I think is a relatively fixed phrase meaning something like maybe. The child pieces together this fixed phrase with a full sentence, but this putting together does not amount to ‘sentence embedding’ as it is typically portrayed in more formal analyses – it is more like simple concatenation because the main verb (think) is not really acting as a verb. Second, children also use a variation-getting verbs such as look and see in conjunction with full sentences. In this case, they use them almost exclusively in imperative form (again no negations, no non-present tense, no complements).

Therefore, these early complex sentences do not appear to be aberrant sentence embeddings, but rather concatenations of a formulaic expression and a full sentence.

Examples from Sarah:
I think she’s gone
I think it’s in here
I think my daddy took it
I think I saw one
It’s a crazy bone. I think
I think he is or he is not

Examples from Ninea
She’s monkey-crying
Beca sleeping
But go
My hands are washed
She bit me
He bit down

Reference

First in importance is cultural learning or, more specifically, imitative learning in the specific sense used by Tomasello et al.22. On this view, imitative learning is not simply repeating or mimicking the surface form of adult utterances. Rather, it is the attempt by children to reproduce the language adults produce and for the same communicative function – the reproduction of both the linguistic form and its conventional communicative function. At one level of analysis, this absolutely must be true because all children learn the language to which they are exposed, and for all non-canonical aspects of language structure – all idioms, lexical items, quirky constructions and the like – nobody has ever proposed any mechanism other than some form of imitative learning. (For example, only by observing and reproducing particular linguistic symbols can one learn that, in English, ‘That isn’t done well with him’ means that he won’t like that.) The current proposal is simply that, initially, imitative learning is all that children do for all linguistic constructions, canonical and quirky alike. This approach thus highlights the role of the language that children hear around them, and it also takes seriously the possibility of individual differences based both on children’s potentially different perceptual and cognitive skills and on their potentially different language learning environments23,24.

Secondly, children go beyond these early item-based constructions in due course. The only way they can do this is to find patterns in the language they are hearing, and thereby to form some kinds of abstract categories and schemas. Children do this in the case of the category of concrete noun quite early. But in addition they abstract across more complex relational structures as well, for example, whole constructions such as the simple transitive construction. Although there are no good data on how they do this, the work of Gentner on analogy and ‘structure mapping’ provides some interesting hypotheses25.

The idea is that children must see both the structural and the functional simulation in utterances such as ‘I drew true’, ‘She kissed me’, ‘I hit Jeffrey’, ‘You hug Mummy’, ‘Jamie kicking ball’, in terms of their relational structure, independent of the specific words involved. A reasonable an-
Box 4. Grammaticalization

Each of the 5000 or more languages of the world has its own inventory of linguistic conventions, including syntactic conventions, which allow us to share experience with one another symbolically. This inventory of symbolic conventions is grounded in universal structures of human cognition, human communication, and the mechanics of the vocal–auditory apparatus. The pan-reality of particular languages comes from differences in the kinds of things that different speech communities think it important to talk about and the ways they think it useful to talk about them—along with various historical accidents. All of the conventions and constructions of a given language are not in- vited at one time, of course, and once invented they often do not stay the same for very long, but other verbs, adverbs, and auxiliaries are continually being added to a human stock of linguistic devices that one can pass along from one generation to another. This sort of process is called grammaticalization, and it involves such well-attested phenomena as free-standing words evolving into grammatical markers, and nouns and adverbially organized discourse elements congealing into right and left syllabically organized syntactic constructions (see Robins for some recent research). Some examples are as follows:

(1) The future tense marker in many languages is grammaticalized from free-standing words for such things as volition or movement to a goal. So in English the original verb was will, as in ‘I will be happy’, and this became grammaticalized into ‘I will happen’ (with the valutational component ‘bleached’ out).

Similarly, the original use of get was for movement (I’m going in the one’s car) and this was grammaticalized into ‘I’m going in the one’s day’ (with the movement ‘bleached’ out).

(2) The English past perfective, using have, is very likely derived from sentences such as ‘I have a broken finger’ or ‘I have the present boost’ (in which have is a verb of possession) into something like ‘I have broken a finger’ (in which the possessive meaning of have is ‘bleached’ out and in turn now indicates perfective aspect).

(3) English phrases such as ‘in the top of’ and ‘in the side of’ evolved into ‘on top of’ and ‘inside of’ and eventually into ‘up’ and ‘inside’. In some lan- guages relative words such as those spatial prepositions have also become attached to nouns as case markers—in this instance as possible locative marker.

(4) Loose discourse sequences such as ‘He pulled the door open and searched’ may become syntacticized into ‘He pulled the door open (a transitive construction).

(5) Loose discourse sequences such as ‘My boyfriend…be playing…be playing in a band’ may become ‘My boyfriend…be playing…be playing in a band’. Or, similarly, ‘My boyfriend…be riding horses…be riding horses’ may become ‘My boyfriend…be riding horses…be riding horses’.

(6) Similarly, if someone expresses the belief that Mary will see John, another person might respond with an assert ‘I believe that…’, followed by a repetition of the expressed belief that ‘Mary will see John’—which became syntacticized into the single utterance ‘I believe that Mary will see John’.

(7) Complex sentences may also derive from discourse sequences of ini- tially separate utterances, as in ‘I want it… I buy it… I evolving into ‘I want to buy it’.

Outstanding questions

• When children imitate learn some complex linguistic expression, how do they come to understand the communicative functions of the different constituents involved?
• On what basis do children make analogies or form schemas as they abstract across their verb island and other relational linguistic schemes?
• What principles govern the ways in which children combine established linguistic constructions with one another creatively?
• How do children select what they need from all the language they hear around them?
• What is the nature of the cross-linguistic and individual differences that can be observed in children acquiring natural languages?
dependency (see Box 4). These transformations of linguistic structure occur as a result of social-instructive processes in which (1) speakers try to abbreviate linguistic expression as much as they can, and (2) 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 at work in the origin and early evolution of language, turning loosely organized sequences of single symbols into grammaticalized linguistic constructions.

Even so, grammaticalization by itself is not enough because it does not account for the abstruseness of linguistic structures. Abstruseness, as Chomsky recognized in even his earliest writings, must be contributed by the minds of individual children as they acquire the use of particular pieces of language. It is possible—albeit very difficult—to imagine that children make this contribution by simply linking an innate universal grammar with the particular structures of the particular language they are learning. However, it is also possible, and more in accord with recent data, to imagine that children make this contribution in more extended developmental processes in which they apply their general cognitive, social-cognitive, and vocal-auditory processing skills to the historical products of grammaticalization. Overall, then, we may hypothesize that human language originated ultimately from a species-unique biological adaptation for symbolic communication, but the actual grammatical structures of modern languages were humankind created through processes of grammaticalization during particular cultural histories, and through processes of cultural learning, schema formation, and structure combining during particular individual ontogenies.

Acknowledgements

The author would like to thank Elena Lieven, Helle Bovensies, Holger Dissing, Nazneen Akhtar, and Patty Brooks for helping to develop the early evolution of language turning loosely organized sequences of single symbols into grammaticalized linguistic constructions.

Overall, then, we may hypothesize that human language originated ultimately from a species-unique biological adaptation for symbolic communication, but the actual grammatical structures of modern languages were humankind created through processes of grammaticalization during particular cultural histories, and through processes of cultural learning, schema formation, and structure combining during particular individual ontogenies.

References

Tomasello – Early language development