

Acquiring Linguistic Constructions

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Human linguistic communication differs from the communication of other animal species in three main ways. First, and most importantly, human linguistic communication is symbolic. Linguistic symbols are social conventions by means of which one individual attempts to share attention with other individuals by directing their attentional or mental states to something in the outside world. Other animal species do not communicate with one another using linguistic symbols, most likely because they do not understand that conspecifics have attentional or mental states that they could attempt to direct or share (Tomasello, 1998a, 1999). This mental dimension of linguistic symbols gives them unparalleled communicative power, enabling their users to refer to and to predicate all kinds of diverse perspectives on objects, events, and situations in the world.

The second main difference is that human linguistic communication is grammatical. Human beings use their linguistic symbols together in patterned ways, and these patterns, known as linguistic constructions, come to take on meanings themselves - deriving partly from the meanings of the individual symbols but, over time, at least partly from the pattern itself. The process by which this occurs over historical time is called grammaticalization, and grammatical constructions add still another dimension of communicative power to human languages by enabling all kinds of unique symbol combinations.

Grammatical constructions are also uniquely human, of course, because if a species does not use symbols, the question of grammar is moot.

Third, unlike all other animal species, human beings do not have a single system of communication used by all members of the species. Rather, different groups of humans have conventionalized over historical time different, mutually unintelligible systems of communication (there are more than 6,000 natural languages in the world). This means that children, unlike other animal species, must learn the communicative conventions used by those around them - indeed they take several years to acquire the many tens of thousands, perhaps even hundreds of thousands, of linguistic symbols and constructions of their natal group(s). This is much more learning in this domain - by many orders of magnitude - than is characteristic of any other species.

This chapter is about the way children master a language, the way they learn to communicate using the linguistic conventions used by those around them in both their symbolic and grammatical dimensions. We begin in Section 1 with some background history and theory of the field, proceed in Sections 2 and 3 to outline the major ontogenetic steps of language acquisition, and close in Sections 4 and 5 with a focus on the cognitive and social processes involved in becoming a competent user of a natural language.

1. History and Theory

To investigate how children acquire a language, we must first know what a language is. This is not as straightforward as it might seem, since the specialists involved - linguists - do not agree among themselves.

1.1. The Role of Linguistics

Large-scale theories and approaches to child language acquisition are mainly characterized by the theory of linguistics which they assume as their foundation. Thus, using the linguistics of the 1950s (*viz.*, American Structural

Linguistics), the first modern researchers of child language acquisition in the 1960s attempted to identify the items and structures in children's language using exclusively the method of distributional analysis. Making basically no assumptions about possible correspondences between child and adult linguistic competence, the main finding was that many of children's earliest word combinations consisted of one constant word which could be freely combined with one of many variable words. Many of these lexically based patterns also seemed to show some consistencies among one another, however, especially with respect to ordering, and so Braine (1963) formalized these patterns into a 3-rule Pivot Grammar that was supposed to be what children used to generate their language:

1. P¹+O [*More juice, More milk, There Daddy, There Joe*, etc.]
2. O+P² [*Juice gone, Mommy gone, Flowers pretty, Janie pretty*, etc.]
3. O+O [*Ball table, Mommy sock*, etc. - i.e., utterances without a pivot]

The main problem with Pivot Grammar was that, while it did capture something of the spirit of children's early language, in its formalized form it was empirically inadequate since: (i) children did not always use the same pivot in a consistent sequential position, (ii) children sometimes combined two pivots with one another, and (iii) the O+O rule was essentially a wastebasket for noncanonical utterances (Bloom, 1971). It was also unclear in this account how young children could ever get from these purely child-like syntactic categories to the more adult-like syntactic categories that were being described by the linguists of the time.

The natural next attempt, therefore, was to apply the new adult linguistic models of the 1960s and 1970s to the data of child language acquisition. These attempts - which included several versions of Transformational Generative Grammar, Case Grammar, Generative Semantics, and others - were reviewed and evaluated by Brown (1973). Brown's basic conclusion was that, while children's linguistic productions could be forced into any one of the models, none of the models was totally satisfactory in accounting for all the data. But the more

fundamental problem was that there was really no evidence that children employed, or even needed, the adult-like linguistic categories and rules that were being attributed to them in these models. For example, Schlesinger (1971) and Bowerman (1976) surveyed the utterances produced by several children learning several languages and found that - on internal grounds - there was no reason to assume that they were underlain by abstract syntactic categories such as 'subject', 'direct object', and 'verb phrase'. There was also a suspicion among many people who looked broadly at languages across different cultures that no single formal grammar would be adequate to account for the acquisition process in all of the world's many thousands of languages (Slobin, 1973).

Several theorists - including Brown (1973), Slobin (1970), Schlesinger (1971), Bloom (1973), and others - then suggested a semantic-cognitive basis for children's early language: the so-called Semantic Relations approach. The basic observation was that most of the semantic-syntactic relations apparent in children's early language correspond rather closely to some of the categories of sensory-motor cognition as outlined by Piaget (1952). For example, infants know nonlinguistically some things about the causal relations among agents, actions, and objects, and this might form the basis for a linguistic schema of the type: Agent-Action-Object (and similarly for Possessor-Possessed, Object-Location, Object-Attribute, etc.). While again this approach seemed to be capturing something of the spirit of early language - children mostly talk about a fairly delimited set of events, relations, and objects that correspond in some ways to Piagetian sensory-motor categories - it was also empirically inadequate as many child utterances fit into none of the categories while others fit into several (Howe, 1976). Moreover, echoing the theoretical problems of Pivot Grammar, there were basically no serious theoretical proposals about how young children got from these semantically based syntactic categories to the more abstract syntactic categories of adults.

And so, swinging the pendulum back in the adult direction once again, in

the 1980s a new group of theorists began to advocate a return to adult grammars, but in this case using some new formal models such as Government and Binding theory, Lexical Functional Grammar, and the like (e.g., Baker & McCarthy, 1981; Hornstein & Lightfoot, 1981; Pinker, 1984). The general consensus was that proposing a discontinuity from child to adult language – as seemed to be the case in such things as Pivot Grammar and the Semantic Relations approach - created insurmountable ‘logical’ problems, that is to say, problems of learnability. These logical problems were thought by learnability theorists to be sufficient justification to make the ‘continuity assumption’, namely, that children operate with the same basic linguistic categories and rules as adults (Pinker, 1984). This general point of view was strongly associated with linguistic nativism, in which all human beings possess the same basic linguistic competence, in the form of a universal grammar, throughout their lives (Chomsky, 1968, 1980). The inadequacies of this approach soon became apparent as well, most fundamentally its inability to deal with the problems of cross-linguistic variation and developmental change – how children could “link” an abstract and unchanging universal grammar to the structures of a particular language, and why, if this was the process, children’s language looked so different from adults’. And again, there was no evidence that children actually use abstract adult-like categories - continuity was only an assumption.

1.2. Two Theories

It is easy to see in this historical sketch two distinct strands. One derives from researchers who take a formal approach to language and its acquisition - a more adult-centered approach emanating from Chomsky's theory of generative grammar - and the other derives from researchers who take a more functional, usage-based approach to language and its acquisition - a potentially more child-centered approach with room for serious developmental change. And it is indeed these two basic orientations that still structure the current theoretical debate in

the study of child language acquisition.

Chomskian generative grammar is a 'formal' theory, meaning that it is based on the supposition that natural languages are like formal languages (e.g., algebra, predicate logic). Natural languages are thus characterized in terms of: (i) a unified set of abstract algebraic rules that are both meaningless themselves and also insensitive to the meanings of the elements they algorithmically combine, and (ii) a lexicon containing meaningful linguistic elements that serve as variables in the rules. Principles governing the way the underlying algebra works constitute a universal grammar, the "core" of linguistic competence. The linguistic "periphery", involves such things as the lexicon, the conceptual system, irregular constructions and idioms, and pragmatics.

With regard to language acquisition, Chomskian generative grammar begins with the assumption that children possess innately a universal grammar abstract enough to structure any language of the world. Acquisition then consists of two processes: (1) acquiring all the words, idioms, and quirky constructions of the particular language being learned (by 'normal' processes of learning); and (2) linking the particular language being learned, that is, its core structures, to the abstract universal grammar. This is the so-called dual process approach - also sometimes called the words and rules approach (Pinker, 1999) - since the "periphery" of linguistic competence is learned but the "core" is innately given in universal grammar. Because it is innate, universal grammar does not develop ontogenetically but is the same throughout the lifespan - this is the so-called continuity assumption (Pinker, 1984). This assumption allows generativists to use adult-like formal grammars to describe children's language and so to assume that the first time a child utters, for example, "I wanna play" that she has an adult-like understanding of infinitival complement sentences and so can generate 'similar' infinitival complement sentences *ad infinitum*.

In sharp contrast is the group of theories most often called Cognitive-Functional Linguistics, but which are sometimes also called Usage-Based

Linguistics to emphasize their central processing tenet that language structure emerges from language use (e.g., Langacker, 1987a, 1991; Croft, 1991, 2001; Givón, 1995; Bybee, 1985, 1995; Goldberg, 1995; see Tomasello, 1998b, 2003, for other similar approaches). Usage-based theories hold that the essence of language is its symbolic dimension, with grammar being derivative. The ability to communicate with conspecifics symbolically (conventionally, intersubjectively) is a species-specific biological adaptation. The grammatical dimension of language derives from historical processes of grammaticalization, which create various kinds of grammatical constructions (e.g., the English passive construction, noun phrase construction, or *-ed* past tense construction). As opposed to linguistic rules conceived of as algebraic procedures for combining words and morphemes but that do not themselves contribute to meaning, linguistic constructions are themselves meaningful linguistic symbols – since they are nothing other than the patterns in which meaningful linguistic symbols are used in communication (e.g., the passive construction is used to communicate about an entity to which something happens). In this approach, mature linguistic competence is conceived as a structured inventory of meaningful linguistic constructions – including both the more regular and the more idiomatic structures in a given language (and all structures in between).

According to the usage-based theory, there is no such thing as universal grammar and so the theoretical problem of how a child links it to a particular language does not exist. It is thus a single process theory of language acquisition, in the sense that children are thought to acquire the more regular and rule-based constructions of a language in the same way they acquire the more arbitrary and idiosyncratic constructions: they learn them. And, as in the learning of all complex cognitive activities, they then construct abstract categories and schemas out of the concrete things they have learned. Thus, in this view, children's earliest acquisitions are concrete pieces of language – words (e.g., *cat*), complex expressions (e.g., *I-wanna-do-it*), or mixed constructions (e.g., *Where's-the ____*,

which is partially concrete and partially abstract) - because early in development they do not possess the fully abstract categories and schemas of adult grammar. Children construct these abstractions only gradually and in piecemeal fashion, with some categories and constructions appearing much before others that are of a similar type from an adult perspective - due quite often to differences in the language that individual children hear ("input"). Children construct their language using general cognitive processes falling into two broad categories: (1) intention-reading (joint attention, understanding communicative intentions, cultural learning), by which they attempt to understand the communicative significance of an utterance; and (2) pattern-finding (categorization, schema formation, statistical learning, analogy), by which they create the more abstract dimensions of linguistic competence.

1.3. Constructions

In the current chapter, we adopt a usage-based theoretical perspective on the process of language acquisition. We thus assume that what children are learning initially is concrete pieces of language, of many different shapes and sizes, across which they then generalize to construct more abstract linguistic constructions - which underlie their ability to generate creative new utterances. The central theoretical construct is therefore the construction.

A linguistic construction is prototypically a unit of language that comprises multiple linguistic elements used together for a relatively coherent communicative function, with sub-functions being performed by the elements as well. Consequently, constructions may vary in their complexity depending on the number of elements involved and their interrelations. For example, the English regular plural construction (N+s) is relatively simple, whereas the passive construction (*X was VERBed by Y*) is relatively complex. Independent of complexity, however, constructions may also vary in their abstractness. For example, the relatively simple English regular plural construction and the more

complex English passive construction are both highly (though not totally) abstract. To repeat, even these most abstract constructions are still symbolic, as they possess a coherent, if abstract, meaning in relative independence of the lexical items involved (Goldberg, 1995). Thus, in the utterance *Mary sneezed John the football*, our construal of the action is influenced more by the transfer of possession meaning of the ditransitive construction than it is by the verb *sneeze* (since sneezing is not normally construed as transferring possession). Similarly, we know that the nonce noun *gazzers* very likely indicates a plurality without even knowing what a gazzer is.

Importantly, however, some complex linguistic structures are not based on abstract categories, but rather on particular linguistic items (Fillmore, 1988, 1989; Fillmore, Kay, & O'Conner, 1988). The limiting case is totally fixed expressions such as the idiom *How do you do?*, which is a structure of English with an idiosyncratic meaning that dissolves if any of the particular words is changed (one does not normally, with the same intended meaning, ask *How does she do?*). Other clear examples are such well-known idioms as *kick the bucket* and *spill the beans*, which have a little more flexibility and abstractness as different people may kick the bucket and they may do so in past, present, or future tense – but we cannot, with the same meaning, kick the pail or spill the peas. It turns out that, upon inspection, a major part of human linguistic competence – much more than previously believed – involves the mastery of all kinds of routine formulas, fixed and semi-fixed expressions, idioms, and frozen collocations. Indeed one of the distinguishing characteristics of native speakers of a language is their control of these semi-fixed expressions as fluent units with somewhat unpredictable meanings (e.g., *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.; Pawley & Syder, 1983).*

The theoretical problem for algebraic approaches such as generative grammar is what to do with these fixed and semi-fixed complex structures. They are complex and somewhat regular, and so they would seem to be a part of the

core grammar to be generated by rules. But as fixed expressions they would seem to be a part of the periphery to be memorized like words. For example, consider the "-er" construction.

The bigger they are, the nicer they are.

The more you try, the worse it gets.

The faster I run, the behinder I get.

This construction is clearly non-canonical, as both of the two clauses are difficult to classify using classical grammatical techniques. But there are obvious canonical elements as well. Also, consider such things as:

This hairdryer needs fixing

My house needs painting

Note in this case that although *hairdryer* and *house* are the subjects of the sentences they are the logical objects of the predicates *fixing* and *painting* (they are the objects to be acted upon), which are expressed as participles. It turns out that virtually no other verbs besides *need* work in this construction of the English language (some people will accept the semantically similar verbs *require* and *want*). It would thus seem that this construction, while basically canonical, is at the same time best described in lexically specific terms.

The impossibility of making a clear distinction between the core and the periphery of linguistic structure suggests that language structure emerges from language use, and that a community of speakers may conventionalize from their language use all kinds of linguistic structures – from the more concrete to the more abstract, from the more regular to the more idiomatic, with all kinds of mixed constructions as well. If we take these points seriously, an important question for acquisition researchers becomes: if many, perhaps most, of the structures of a language (as embodied in various kinds of semi-fixed expressions, irregular formations, schematic idioms, and the like) may be acquired through ‘normal’ processes of learning and abstraction – as they are in all theoretical accounts – then why cannot the more regular and canonical aspects of a language

be acquired in this same straightforward way? Indeed, in the current approach we will assume that all linguistic structures are acquired in the same basic way.

2. Early Ontogeny

It is quite widely believed that young children begin their linguistic careers by learning words, which they then combine together by means of rules. But this is not exactly accurate. Children hear and attempt to learn whole adult utterances, instantiating various types of constructions used for various communicative purposes. Sometimes children only learn parts of these complex wholes, and so their first productions may correspond to adult words. But these are always packaged in conventional intonational patterns indicating such things as requests, comments, or questions - which correspond to the general communicative functions for which adults use more complex constructions. And so from the beginning children are attempting to learn not isolated words, but rather communicatively effective speech act forms corresponding to whole adult constructions. Learning words - which will not be a topic of the current chapter (see Waxman, this volume) - is essentially a process of extracting elements (including their function) from these larger wholes.

In this section, our account of the early ontogeny of language focuses, first, on the language children hear; then on their early holophrases (single words or phrases that have a larger, holistic meaning); then on their early word combinations, pivot schemas, and item-based constructions; and finally on the linguistic devices they use early in development for marking basic syntactic roles such as agent and patient.

2.1. The Language Children Hear

To understand how children acquire a language we must know something about the language they hear - both in terms of specific utterances and in terms of the constructions these instantiate. Surprisingly, very few studies have attempted

to document the full range of linguistic expressions and constructions that children hear in their daily lives. The majority of studies of child-directed-speech (CDS) have focused on specific aspects (for classic studies see the papers in Snow & Ferguson, 1977; Galloway & Richards, 1994).

Cameron-Faulkner, Lieven, and Tomasello (2003) examined all of the CDS of 12 English-speaking mothers during samples of their linguistic interactions with their 2- to 3-year-old children. They first categorized each of the mothers' utterances in terms of very general constructional categories, resulting in the percentages displayed in Table 1 (which also includes a comparable analysis of the data of Wells, 1983, whose children were sampled in a wider variety of activities). The overall findings were that:

- children heard an estimated 5000 to 7000 utterances per day;
- between one-quarter and one-third of these were questions;
- more than 20% of these were not full adult sentences, but rather were some kind of fragment (most often a noun phrase or prepositional phrase);
- about one-quarter of these were imperatives and utterances structured by the copula; and
- only about 15% of these had the canonical English SVO form (i.e., transitive utterances of various kinds) supposedly characteristic of the English language; and over 80% of the SVOs had a pronoun subject.

 Table 1 About Here

In a second analysis, these investigators looked at the specific words and phrases with which mothers initiated utterances in each of these general construction types, including such item-based frames as *Are you ...*, *I'll ...*, *It's ...*, *Can you ...*, *Here's ...*, *Let's ...*, *Look at ...*, *What did ...*, etc. It was found that more than half of all maternal utterances began with one of 52 highly frequent item-based frames (i.e., frames used more than an estimated 40 times per day for more

than half the children), mostly consisting of 2 words or morphemes. Further, using the same kind of analysis, more than 65% of all of the mothers' utterances began with one of just 156 item-based frames. And perhaps most surprising, approximately 45% of all maternal utterances began with one of just 17 lexemes: *What* (8.6%), *That* (5.3%), *It* (4.2%), *You* (3.1%), *Are/Aren't* (3.0%), *Do/Does/Did/Don't* (2.9%), *I* (2.9%), *Is* (2.3%), *Shall* (2.1%), *A* (1.7%), *Can/Can't* (1.7%), *Where* (1.6%), *There* (1.5%), *Who* (1.4%), *Come* (1.0%), *Look* (1.0%), and *Let's* (1.0%). Interestingly, the children used many of these same item-based frames in their speech, in some cases at a rate that correlated highly with their own mother's frequency of use.

The language learning child is thus faced with a prodigious task: acquiring simultaneously many dozens and dozens (perhaps hundreds) of constructions based on input in which all of the many different construction types are semi-randomly strewn. On the other hand, the task is made a bit easier by the fact that many of, indeed the majority of, the utterances children hear are grounded in highly repetitive item-based frames that they experience dozens, in some cases hundreds, of times every day. Indeed, many of the more complex utterances children hear have as a major constituent some well-practiced item-based frame. This means that the more linguistically creative utterances that children hear every day constitute only a small minority of their linguistic experience, and even these quite often rest on the foundation of many highly frequent and relatively simple item-based utterance frames.

2.2. *Earliest Language*

Most Western, middle-class children begin producing conventional linguistic symbols in utterances in the months following their first birthdays. By the time they begin doing this, they typically have been communicating with other people gesturally and vocally for some months. Children's first linguistic expressions are learned and used in the context of these prior forms of

nonlinguistic communication and for the same basic motives - declarative (statements) and imperative (requests) - and children soon learn to ask things interrogatively (questions) as well. There is typically a distinctive intonational pattern for each of these three speech act types. Children's first declarative utterances are sometimes about shared, topical referents and sometimes aimed at focusing the listener's attention on something new (typically assessed only from their own egocentric point of view; Greenfield & Smith, 1976).

At this early age the communicative functions of children's early single-word utterances are an integral aspect of their reality for the child, and initially these functions (e.g., imperative or interrogative) may not be well-differentiated from the more referential aspects of the utterance (Ninio, 1992, 1993). That is to say, children's early one-word utterances may be thought of as "holophrases" that convey a wholistic, undifferentiated communicative intention, most often the same communicative intention as that of the adult expression from which it was learned (Barrett, 1982; Ninio 1992). Many of children's early holophrases are relatively idiosyncratic and their uses can change and evolve over time in a somewhat unstable manner. Some holophrases, however, are a bit more conventional and stable. Children speaking all the languages of the world use their holophrases to do such things as:

- request or indicate the existence of objects (e.g., by naming them with a requestive or neutral intonation);
- request or describe the recurrence of objects or events (e.g., *More, Again, Another*);
- request or describe dynamic events involving objects (e.g., as described by *Up, Down, On, Off, In, Out, Open, Close*);
- request or describe the actions of people (e.g., *Eat, Kick, Ride, Draw*);
- comment on the location of objects and people (e.g., *Here, Outside*);
- ask some basic questions (e.g., *Whats-that?* or *Where-go?*);
- attribute a property to an object (e.g., *Pretty* or *Wet*); and

- use performatives to mark specific social events and situations (e.g., *Hi*, *Bye*, *Thank You*, and *No*).

An important issue for later language development is what parts of adult expressions children choose for their initial holophrases. The answer lies in the specific language they are learning and the kinds of discourse in which they participate with adults, including the perceptual salience of particular words and phrases in adults' speech (Slobin, 1985). Thus, in English, most beginning language learners acquire a number of so-called relational words such as *more*, *gone*, *up*, *down*, *on*, and *off*, presumably because adults use these words in salient ways to talk about salient events (Bloom, Tinker, & Margolis, 1993; McCune, 1992). Many of these words are verb particles in adult English, and so the child at some point must learn to talk about the same events with phrasal verbs such as *pick up*, *get down*, *put on*, *take off*, and so forth. In Korean and Mandarin Chinese, on the other hand, children learn fully adult verbs from the onset of language development because this is what is most salient in adult speech to them (Gopnik & Choi, 1995; Tardiff, 1996). When they begin with an adult verb as a holophrase, children must then at some point learn, at least for some discourse purposes, to fill in linguistically the nominal participants involved in the scene (e.g., "Take-off shirt!"). Children in all languages also learn object labels for some events, for example, "Bike!" as a request to ride a bicycle or "Birdie" as a comment on a passing flight, which means that they still need to learn to linguistically express the activity involved (e.g., "Ride bike!" or "See birdie").

In addition, most children begin language acquisition by learning some unparsed adult expressions as holophrases - such things as "I-wanna-do-it", "Lemme-see", and "Where-the-bottle". The prevalence of this pattern in the early combinatorial speech of English-speaking children has been documented by Pine and Lieven (1993), who found that almost all children have at least some of these so-called "frozen phrases" in their early speech. This is especially true of some children (especially laterborn children who observe siblings; Barton & Tomasello,

1994; Bates, Bretherton, & Snyder, 1988). In these cases there is different syntactic work to do if the child is to extract productive linguistic elements that can be used appropriately in other utterances, in other linguistic contexts, in the future. For this the child must engage in a process of segmentation, with regard not only to the speech stream but also to the communicative intentions involved – so as to determine which components of the speech stream go with which components of the underlying communicative intention. Functionally speaking, then, children's early one-unit utterances are entire semantic-pragmatic packages - holophrastic expressions - that express a single relatively coherent, yet undifferentiated, communicative intention. Why children begin with only one-unit expressions - either individual words or holistic expressions - is not known at this time. But it is presumably the case that in many instances they initially only attend to limited parts of adult utterances, or can only process one linguistic unit at a time.

2.3. Item-based Constructions

Children produce their earliest multi-word utterances to talk about many of the same kinds of things they talked about previously with their holophrases – since indeed many, though not all, early multi-word constructions may be traced back to earlier holophrases. From the point of view of linguistic form, the utterance-level constructions underlying these multi-word utterances come in three types: word combinations, pivot schemas, and item-based constructions.

Word Combinations. Beginning at around 18 months of age, many children combine two words or holophrases in situations in which they both are relevant - with both words having roughly equivalent status. For example, a child has learned to name a ball and a table and then spies a ball on a table and says, "Ball table". Utterances of this type include both "successive single-word utterances" (with a pause between them; Bloom, 1973) and "word combinations" or "expressions" (under a single intonational contour). The defining feature of word combinations or expressions is that they partition the experiential scene into

multiple symbolizable units – in a way that holophrases obviously (by definition) do not – and they are totally concrete in the sense that they are comprised only of concrete pieces of language, not categories.

Pivot Schemas. Beginning at around this same age, however, many of children's multi-word productions show a more systematic pattern. Often there is one word or phrase that seems to structure the utterance in the sense that it determines the speech act function of the utterance as a whole (often with help from an intonational contour), with the other linguistic item(s) simply filling in variable slot(s) – the first type of linguistic abstraction. Thus, in many of these early utterances one event-word is used with a wide variety of object labels (e.g., "More milk", "More grapes", "More juice") or, more rarely, something like a pronoun or other general expression is the constant element (e.g., *I ___ or ___ it* or even *It's ___ or Where's ___*). Following Braine (1963), we may call these pivot schemas.

Braine (1976) established that this is a widespread and productive strategy for children acquiring many of the world's languages. And Tomasello, Akhtar, Dodson, and Rekau (1997) found that 22-month-old children who were taught a novel name for an object knew immediately how to combine this novel name with other pivot-type words already in their vocabulary. That is, when taught a novel object label as a single word utterance (e.g., "Look! A wug!"), children were able to use that new object label in combination with their existing pivot-type words in utterances such as "Wug gone" or "More wug". This productivity suggests that young children can create linguistic categories at this young age, specifically categories corresponding to the types of linguistic items that can play particular roles in specific pivot schemas (e.g., 'things that are gone', 'things I want more of'). However, these same children do not make generalizations across the various pivot schemas themselves. Thus, Tomasello et al. (1997) also found that when taught a novel verb as a single-word utterance for a novel scene (e.g., "Look! Meeking!", or "Look what she's doing to it. That's called meeking."), these same

22-month-old children were not then able to say creative things like "Ernie meeking!" - because they had never heard how *meeking* structured a pivot schema with an actor. Each pivot schema is thus at this point a constructional island, and so at this stage of development children do not have an overarching grammar of their language.

Item-Based Constructions. Not only are pivot schemas organized only locally, but even within themselves they do not have syntax; that is, "Gone juice" does not mean something different from "Juice gone" (and there is no other marking to indicate syntactic role for elements in pivot schemas). The consistent ordering patterns in many pivot schemas are very likely direct reproductions of the ordering patterns children have heard most often in adult speech, with no communicative significance. This means that although young children are using their early pivot schemas to partition scenes conceptually with different words, they are not using syntactic symbols - such as word order or case marking - to indicate the different roles being played by different participants in that scene.

On the other hand, item-based constructions go beyond pivot schemas in having syntactic marking as an integral part of the construction. The evidence that children have, from fairly early in development, such syntactically marked item-based constructions is solid. Most important are a number of comprehension experiments in which children barely two years of age respond appropriately to requests that they "Make the bunny push the horse" (reversible transitives) that depend crucially and exclusively on a knowledge of canonical English word order (e.g., DeVilliers & DeVilliers, 1973; Roberts, 1983; Bates et al., 1984). Successful comprehension of word order with familiar verbs is found at even younger ages if preferential looking techniques are used (Hirsh-Pasek & Golinkoff, 1991; 1996). In production as well many children around their second birthdays are able to produce transitive utterances with familiar verbs that respect canonical English word order marking (Tomasello, 2000).

However, there is abundant evidence from many studies of both

comprehension and production that the syntactic marking in these item-based constructions is still verb specific, depending on how a child has heard a particular verb being used. For example, Tomasello (1992) found that almost all of his daughter's early multi-word utterances during her second year of life revolved around the specific verbs or predicative terms involved. The lexically specific pattern of this phase of combinatorial speech was evident in the patterns of participant roles with which individual verbs were used. Thus, during exactly the same developmental period some verbs were used in only one type of construction and that construction was quite simple (e.g., *Cut ___*), whereas other verbs were used in more complex frames of several different types (e.g., *Draw ___*, *Draw ___ on ___*, *Draw ___ for ___*, *___ draw on ___*). Interestingly and importantly, 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). In general, 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. (See Lieven, Pine, & Baldwin, 1997, Pine & Lieven, 1993; Pine, Lieven, & Rowland, 1998, for some very similar results in a sample of 12 English-speaking children from 1 to 3 years of age. For additional findings of this same type in other languages, see Pizutto & Caselli, 1992, for Italian; Rubino & Pine, 1998, for Portuguese; Serrat, 1997, for Catalan; Behrens, 1998, for Dutch; Allen, 1996, for Inuktitut; Gathercole, Sebastián, & Soto, 1999, for Spanish; Stoll, 1998, for Russian; and Berman, 1982, for Hebrew.)

Similarly, in experimental studies, when children who are themselves producing many transitive utterances are taught a new verb in any one of many different constructions, they mostly cannot transfer their knowledge of word order from their existing item-based constructions to this new item until after their third birthdays - and this finding holds in comprehension as well (Tomasello, 2000). These findings would seem to indicate that young children's

early syntactic marking - at least with English word order - is only local, learned for different verbs on a one by one basis (see next section for a review of these studies). What little experimental evidence we have from nonce verb studies of case-marking languages (e.g., Berman, 1993; Wittek & Tomasello, submitted) is in general accord with this developmental pattern.

The main point is that unlike in pivot schemas, in item-based constructions children use syntactic symbols such as morphology, adpositions, and word order to syntactically mark the roles participants are playing in these events, including generalized 'slots' that include whole categories of entities as participants. But all of this is done on an item-specific basis; that is, the child does not generalize across scenes to syntactically mark similar participant roles in similar ways without having heard those participants used and marked in adult discourse for each verb specifically. This limited generality is presumably due to the difficulty of categorizing or schematizing entire utterances, including reference to both the event and the participant roles involved, into more abstract constructions - especially given the many different kinds of utterances children hear and must sort through. Early syntactic competence is therefore best characterized as a semi-structured inventory of relatively independent verb island constructions that pair a scene of experience and an item-based construction, with very few structural relationships among these constructional islands.

Processes of Schematization. From a usage-based perspective, word combinations, pivot schemas, and item-based constructions are things that children construct out of the language they hear around them using general cognitive and social-cognitive skills. It is thus important to establish that, at the necessary points in development, children have the skills they need to comprehend, learn, and produce each of these three types of early constructions.

First, to produce a word combination under a single intonation contour, children must be able to create a multiple-step procedure toward a single goal, assembled conceptually ahead of time (what Piaget, 1952, called "mental

combinations"). They are able to do this in nonlinguistic behavior quite readily, from about 14 to 18 months of age in their own problem-solving, and, moreover, they are also able to copy such sequences from the behavior of other persons at around this same age. Thus, Bauer (1996) found that 14-month-old infants were quite skillful at imitatively learning both 2- and 3-step action sequences from adults - mostly involving the constructing of complex toy objects (e.g., a toy bell) that they saw adults assembling. Children were sensitive to the order of the steps involved as well. These would seem to be the right skills at the right time for constructing word combinations.

Second, the process by which pivot schemas are formed - as abstractions across individual word combinations - is presumably very similar to the way one-year-olds form other kinds of sensory-motor schemas, including those learned through observation of others' behavior: what may be called schematization. Thus, Piaget (1952) reports that when infants repeatedly enact the same action on different objects they form a sensory-motor schema consisting of (i) what is general in all of the various actions, and (ii) a kind of slot for the variable component. As one example, Brown and Kane (1988) taught 2-year-old children to use a certain kind of action with a particular object (e.g., pull a stick) and then gave them transfer problems in which it was possible for them to use the same action but with a different object creatively (e.g., they learned to pull stick, pull rope, pull towel). Their skill at doing this demonstrates exactly the kind of cognitive ability needed to create a pivot schema across different utterances so as to yield something like *Pull X*. Ultimately, if the child forms a generalized action or event schema with a variable slot for some class of items (e.g., *Throw X*), that slot and class of items are defined by their role in the schema - which is why Nelson (1985) calls them slot-filler categories. This means that in the case of pivot schemas such as *Throw X*, *X gone*, and *Want X*, the slot could be thought of as something like 'throwable things', 'things that are gone', 'things I want more of', and so forth. This primacy of the schema in defining the slot leads to the kinds of

coercion evidenced in creative uses of language in which an item is used in a schema that requires us to interpret it in an unusual way. For example, under communicative pressure a child might say "I'm juicing it", as she pours juice onto something, or "Where's-the swimming?", as she looks for a picture of a swimming activity in a book. This process of "functional coercion" is perhaps the major source of syntactic creativity in the language of one and two-year-old children.

Third and finally, it is not clear how young children learn about syntactically marking their utterance-level constructions, so creating item-based constructions. Essentially what they need to learn is that whereas some linguistic symbols are used for referring and predicating things about the world, others (including word order) are used for more grammatical functions. These functions are many and various but they all share the property that they are parasitic on the symbols that actually carry the load of referring and predicating. Thus, with special reference to utterance-level constructions, an accusative case marker (or an immediate postverbal position) can only function symbolically if there is some referential expression to indicate the entity that is the object of some action; we may thus call syntactic markers second-order symbols (Tomasello, 1992). Although children do engage in nonlinguistic activities that have clear and generalized roles, there is really nothing in nonlinguistic activities that corresponds to such second-order symbols. (The closest might be the designation of participant roles in some forms of pretend play - but that is typically a much later developmental achievement.) Children presumably learn to deal with such symbols when they hear such things as, in English, *X is pushing Y* and then on another occasion *Y is pushing X*, each paired with its own real world counterpart. From this, they begin to see that the verb island construction involving *push* is structured so that the 'pusher' is in the preverbal position and 'pushee' is in the postverbal position - regardless of the specific identity of that participant.

2.4. Marking Syntactic Roles

From a psycholinguistic point of view linguistic constructions are comprised of four and only four types of symbolic elements: words, morphological markers on words, word order, and intonation/prosody (Bates & MacWhinney, 1982). Of special importance for utterance-level constructions are the syntactic devices used for marking the participant roles (typically expressed as noun phrases, NPs) to indicate the basic 'who-did-what-to-whom' of the utterance, what are sometimes called agent-patient relations. The two major devices that languages use for this purpose are (1) word order (mainly of NPs) and (2) morphological marking (casemarking on NPs and agreement marking between NPs and verb).

Word Order. 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 (Braine, 1971; Brown, 1973; Bloom, 1992). And as reported above, 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 and exclusively on a knowledge of canonical English word order (e.g., DeVilliers & DeVilliers, 1973). But to really discover the nature of children's underlying linguistic representations, we need to examine utterances we know children are producing creatively; this means overgeneralization errors (which they could not have heard from adults) and the use of novel words introduced in experiments.

First, children's overgeneralization errors - indicating a more abstract understanding of word order and constructional patterns - include such things as *She falled me down* or *Don't giggle me* in which the child uses intransitive verbs in the SVO transitive frame productively. Pinker (1989) compiled examples from many sources and found that children produce a number of such overgeneralizations, but few before about 3 years of age.

Second, production experiments focused on the marking of agent-patient

relations by word order in English typically introduce young children to a novel verb in a syntactic construction such as an intransitive or passive and then see if they can later use that verb in the canonical SVO transitive construction. Cues to syntactic roles other than word order (e.g., animacy of the S and O participants, use of case marked pronouns) are carefully controlled and/or monitored.

Experiments of this type have clearly demonstrated that by 3.5 or 4 years of age most English-speaking children can readily assimilate novel verbs to an abstract SVO schema that they bring to the experiment. For example, Maratsos et al. (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 questions such as "What are you doing?" (which encourages a transitive response such as "I'm fudding the dough"). The general finding was that the vast majority of children from 4.5 to 5.5 years of age could produce a canonical transitive SVO utterance with the novel verb, even though they had never heard it used in that construction.

But the same is not true for younger children. Over a dozen studies similar to that of Maratsos et al. (1987) have been done with 2 and 3 year olds and they are generally not productive (see Tomasello 2000, for a review). When findings across all ages are compiled and quantitatively compared, we see a continuous developmental progression in which children gradually become more productive with novel verbs in the transitive SVO construction during their third and fourth years of life and beyond, evidencing a growing understanding of the working of canonical English word order (see Figure 1).

 Figure 1 About Here

Akhtar (1999) used a different novel verb methodology to investigate young children's knowledge of English word order conventions. An adult modeled novel verbs for novel transitive events for young children at 2;8, 3;6, and 4;4 years of age. 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 tammimg*) or VSO (*Gopping Ernie the cow*). 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. In general, the older children used their verb-general knowledge of English transitivity to "correct" the non-canonical uses of the novel verbs to canonical SVO form. The younger children, in contrast, much more often matched the ordering patterns they had heard with the novel verb, no matter how bizarre that pattern sounded to adult ears. Abbott-Smith, Lieven, and Tomasello (2001) have recently extended this methodology to younger ages (children at 2;4, using intransitives) and found that even fewer children (less than half as many as Akhtar's youngest children) corrected the adult's strange word order utterances. The results of these two studies combined are depicted in Figure 2.

 Figure 2 About Here

Perhaps surprisingly, young children also fail to show a verb-general understanding of canonical English word order in comprehension studies using novel verbs in which they must act out (with toys) a scene indicated by an SVO utterance. Thus, Akhtar and Tomasello (1997) exposed young children to many models of *This is called dacking* used to describe a canonical transitive action. They then, using novel characters, asked the children to *Make Cookie Monster dack Big Bird*. All 10 of the children 3;8 were excellent in this task, 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. In a second type of comprehension test, children just under 3 years of age 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 pushing 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. Similar results, using a different comprehension methodology (a token placement task), were found by Bridges (1984). Using a comprehension methodology in which children had to point to the agent of an utterance - the main clue to which was word order, Fisher (1996) found positive results for children averaging 3;6 years of age (and Fisher, 2002, found somewhat weaker evidence for the same effect in children at 2;6).

Another technique used to assess children's comprehension of various linguistic items and structures is so-called preferential looking. In this technique, a child is shown two displays (often on two television screens) and hears a single utterance (through a centrally located loudspeaker) that describes only one of the pictures felicitously. The question is which picture she will look at longer. The relevant studies are those using novel or very low frequency verbs, so we know that children have had no previous experience with them. In almost all of these studies the comparison is between transitives and intransitives. Thus, Naigles (1990) found that when they hear canonical SVO utterances English-speaking children from 2;1 prefer to look at one participant doing something to another (causative meaning) rather than two participants carrying out synchronous

independent activities. This study thus shows that in the preferential looking paradigm young 2-year-old children know enough about the simple transitive construction to know that it goes with asymmetrical activities (one participant acting on another) rather than symmetrical activities (two participants engaging in the same activity simultaneously). What it does **not** show, as is sometimes claimed, is an understanding of word order. That is, it does not show that young children can connect the pre-verbal position with the agent (or subject) and the post-verbal position with the patient (or object) in a transitive utterance – which would be required for a full-blown representation of the transitive construction, and which is indeed required of children in both act-out comprehension tasks and novel verb production tasks.¹

The overall conclusion is thus that in both production and comprehension the majority of English-speaking children do not fully understand word order as a verb-general, productive syntactic device for marking agents and patients (subjects and objects) until after three years of age (although some minority of children may understand it before). In some cases, even the presence of animacy cues (agents were animate, patients inanimate) does not help. But, of course, most English-speaking children are hearing SVO utterances with one or more case-marked pronouns (*I-me, he-him, they-them, we-us, etc.*), and so we now turn to an investigation of their understanding of case marking – which is much more important in some other languages than it is in English.

Case and Agreement. In the 1960s and 1970s, a number of investigators speculated that word order should be easier than case and agreement for children to learn as a syntactic device because canonical ordering is so fundamental to so many sensory-motor and cognitive activities (McNeill, 1966; Bruner, 1975; Braine,

¹ The only preferential looking study which attempted to examine this knowledge is by Fisher (2000). However, the sentences she gave children (1;9 and 2;2) had prepositional phrases that provided additional information (e.g. *The duck is gorging the bunny up and down*). Thus, the child merely had to interpret *bunny up and down* in order to ‘prefer’ the picture in which the bunny was indeed moving up and down.

1976; Pinker, 1981). However, cross-linguistic research has since exploded this “word order myth” (Weist, 1983). That is, cross-linguistic research has demonstrated that in their spontaneous speech, children learning many different languages - regardless of whether their language relies mainly on word order, case marking, or some combination of both - generally conform to adult usage and appear to mark agent-patient relations equally early and appropriately. Indeed, on the basis of his review, Slobin (1982) concluded that children learning languages that mark agent-patient relations clearly and simply with morphological (case) markers, such as Turkish, comprehend agent-patient syntax earlier than children learning word order languages such as English. In support of his argument, Slobin cited the fact that some children learning case marking languages overgeneralize case markers in ways indicating productive control while they are still only 2 years old (Slobin, 1982; Slobin, 1985).

In comprehension experiments, it is clearly the case that children learning morphologically rich languages, in which word order plays only a minor role in indicating agent-patient relations, comprehend the syntactic marking of agent-patient relations as early or earlier than children learning word order languages such as English. Representative studies are reported by Slobin and Bever (1982) for Turkish, Hakuta (1982) for Japanese, and Weist (1983) for Polish (see Slobin, 1982, and Bates & MacWhinney, 1989, for reviews). But it should be noted that in neither comprehension nor production do we have the kind of nonce word studies that could provide the most definitive evidence of children's productive knowledge of case marking. The few nonce verb studies we have of case-marking languages (e.g., Berman, 1993; Wittek & Tomasello, submitted) show a very slow and gradual developmental pattern of increasing productivity, just as with word order marking in English and similar languages.

For English, most of the discussion of case marking has centered around pronoun case errors, such as *Me do it* and *Him going*. About 50% of English-speaking children make such errors, most typically in the 2 to 4 year age range,

with much variability across children. The most robust phenomenon is that children most often substitute accusative forms for nominative forms ("Me going") but very seldom do the reverse ("Billy hit I"). Rispoli (1994, 1998) notes that the particular pronouns that English-speaking children overgeneralize proportionally most often are the objective forms *me* and *her* (and not the subjective forms *I* and *she*). Rispoli attributes these facts to the morphophonetic structure of the English personal pronoun paradigm.

I	she	he	they
me	her	him	them
my	her	his	their

It is easily seen that *he-him-his* and *they-them-their* each has a common phonetic core (*h-* and *th-*, respectively) whereas *I-me-my* and *she-her-her* do not. And indeed, the errors that are made most often are ones in which children in these latter two cases use the forms that have a common initial phoneme (*me-my* and *her-her*) to substitute for the odd-man-out (*I* and *she*), with the *her-for-she* error having the overall highest rate (because of the fact, according to Rispoli, that *her* occurs as both the objective and genitive form; the so-called 'double-cell' effect). The overall idea is thus that children are making retrieval errors based on both semantic and phonological factors.

Currently, there is no widely accepted explanation of children's pronoun case errors in English, and indeed it is likely that several different factors play a role. Of most importance to resolve the issue in a theoretically interesting way is cross-linguistic research enabling the examination of pronoun paradigms with different morphophonemic and syntactic properties.

Cue Coalition and Competition. In all languages there are multiple potential cues indicating agent-patient relations. For example, in many languages both word order and case marking are at least potentially available, even though one of them might most typically be used for other functions (e.g., in many morphologically rich languages, word order is used primarily for pragmatic

functions such as topicalization). In addition, in attempting to comprehend adult utterances children might also attend to information that is not directly encoded in the language; for example, they may use animacy to infer that in an utterance containing the lexical items *man*, *ball*, and *kick* that the most likely interpretation is that the man kicked the ball, regardless of how those items are syntactically combined.

In an extensive investigation of language acquisition in a number of different languages, Slobin (reviewed in 1982) identified some of the different comprehension strategies that children use to establish agent-patient relations, depending on the types of problems their particular language presents to them. A central discovery of this research, as noted above, was that children can more easily master grammatical forms expressed in "local cues" such as bound morphology as opposed to more distributed cues such as word order and some forms of agreement. This accounts, for example, for the fact that Turkish-speaking children master the expression of agent-patient relations at a significantly earlier age than do English-speaking children. In addition, however, it turns out that Turkish is especially "child friendly", even among languages that rely heavily on local morphological cues. Slobin (1982) outlines 12 reasons why Turkish agent-patient relations are relatively easy to learn. An adaptation of that list (focusing on nominal morphology) is as follows. Turkish nominal grammatical morphemes are:

- ◆ postposed, syllabic, and stressed, which makes them perceptually more **salient**
- ◆ obligatory and employ almost perfect one-to-one mapping of form to function (no fusional morphemes or homophones), which makes them more **predictable**
- ◆ bound to the noun, rather than freestanding, which makes them more **local**
- ◆ invariably regular across different nominals and pronominals, which makes them readily **generalizable**

All of these factors coalesce to make Turkish agent-patient relations especially easy to learn, and their identification is a major step in discovering the basic processes of language acquisition that are employed by children in general.

A central methodological problem, however, is that in natural languages many of these cues go together naturally, and so it is difficult to evaluate their contributions separately. Therefore, Bates and MacWhinney (summarized in 1989) conducted an extensive set of experimental investigations of the cues children use to comprehend agent-patient relations in a number of different languages. The basic paradigm is to ask children to act out utterances using toy animals, with agent-patient relations indicated in different ways - sometimes in semi-grammatical utterances with conflicting cues. For example, an English-speaking child might be presented with the utterance "The spoon kicked the horse". In this case, the cue of word order is put in competition with the most likely real-world scenario in which animate beings more often kick inanimate things than the reverse. From an early age, young English-speaking children make the spoon 'kick' the horse, which simply shows the power of word order in English. Interestingly, when presented with an equivalent utterance Italian-speaking children ignore word order and make the horse kick the spoon. This is because word order is quite variable in Italian, and so, since there is no case marking (and in this example agreement is no help because both the horse and the spoon are third-person singular), semantic plausibility is the most reliable cue available. German-speaking children gradually learn to ignore both word order and semantic plausibility (animacy) and simply look for nominative and accusative marking on 'the horse' and 'the spoon' (Lindner, 2003).

2.5. Constructing Lexical Categories

Syntactic roles such as agent and patient, or subject and object, represent syntagmatic categories defined by the role of the element in the larger constructional whole. As utterance-level constructions gradually become more

abstract, therefore, these categories become more abstract with them. Another important part of the process of grammatical development is the construction of paradigmatic categories such as noun and verb. Unlike syntactic roles, paradigmatic categories are not explicitly marked in language. That is, whereas such things as agent/subject are symbolically indicated by word order or grammatical morphology in the construction, nouns and verbs have no explicit marking (despite the fact that they often have some morphology serving other functions, e.g., plural markers on nouns, that can be used to identify them). Consequently, the category cannot be organized around any specific linguistic symbol, but can only be based on commonalities in the way the members of the category function (i.e., on distribution). Thus, *pencil* and *pen* occur in many of the same linguistic contexts in utterances – i.e., do many of the same kinds of things in combining with articles to make reference to an object, in indicating subjects and objects as syntactic roles, etc. - and so a language user will come to form a category containing these and similarly behaving words in it.

The prototypical paradigmatic linguistic categories, and the only ones that are even candidates for universal status, are nouns and verbs. The classic notional definitions - nouns indicate person, place, or thing, and verbs indicate actions - clearly do not hold, as many nouns indicate actions or events (e.g., *party*, *discussion*, etc.) and many verbs indicate non-actional state's affairs that are sometime very difficult to distinguish from things indicated by adjectives (e.g., *be noisy*, *feel good*, which in different languages may be indicated by either a verb or an adjective). On the other hand, Maratsos (1982) points out that both nouns and verbs have characteristic small-scale combinatorial properties, for example, nouns occur with determiners and plural markers and verbs occur with tense and aspect markers. Although these can be used to recognize instances of the categories once they are formed, obviously the core notions underlying nouns and verbs are cognitively and communicatively much deeper. Evidence for this is the simple fact, that some of the most prototypical nominals do not have the same small-

scale combinatorial properties as others, that is, pronouns and proper names do not occur with determiners or plural markers.

Langacker (1987b) provides a functionally based account of nouns and verbs that goes much deeper than both simplistic notional definitions and purely formal properties. Langacker stresses that nouns and verbs are used not to refer to specific kinds of things but rather to invite the listener to construe something in a particular way in a particular communicative context. Thus, we may refer to the very same experience as either 'exploding' or 'an explosion', depending on our communicative purposes. In general, nouns are used to construe experiences as 'bounded entities' (like an explosion), whereas verbs are used to construe experiences as processes (like exploding). Hopper and Thompson (1984) contend further that the discourse functions of reference and predication provide the communicative reason for construing something as either a bounded entity, to which one may refer with a noun, or a process which one may predicate with a verb. Importantly, it is these communicative functions that explain why nouns are associated with such things as determiners - whose primary function is to help the listener to locate a referent in actual or conceptual space - and verbs are associated with such things as tense markers - whose primary function is to help the listener to locate a process in actual or conceptual time (Langacker, 1991). After an individual understands the functional basis of nouns and verbs, formal features such as determiners and tense markers may be used to identify further instances.

From a functional point of view, Bates and MacWhinney (1979, 1982) propose that early nouns are anchored in the concept of a concrete object and early verbs are anchored in the concept of concrete action - and these are generalized to other referents only later. The problem is that young children use adult nouns from quite early in development to refer to all kinds of non-object entities such as *breakfast, kitchen, kiss, lunch, light, park, doctor, night, and party*, and they use many of their verbs to predicate non-actional states of affairs (e.g., *like*,

feel, want, stay, be, etc.) (Nelson et al., 1993). Also problematic for accounts such as these, grounded in the reference of terms, is the fact that early in development young children also learn many words that are used as both nouns and verbs, for example, *bite, kiss, drink, brush, walk, hug, help, and call* (Nelson, 1995). It is unclear how any theory that does not consider communicative function primary - in the sense of the communicative role a word plays in whole utterances - can account for the acquisition of these so-called dual category words.

Instead, the developmental data support the view that children initially understand paradigmatic categories very locally and mosaically, in terms of the particular kinds of things particular words can and cannot do communicatively. Thus, with respect to nouns, Tomasello et al. (1997) found that when 22-month-old children were taught a novel name for a novel object in a syntactically neutral context ("Look! A wuggie.") they immediately combined this new word with many predicative terms ("Hug wuggie", "Wuggie gone", etc.), indicating that they saw something in common between wuggies and the kinds of things one can hug or that can be gone (perhaps aided by the article *a*). Children of this same tender age also were able to indicate when they saw two "Wuggies", even though they had never heard this word used as a plural. However, a very interesting fact helping to specify the processes involved is that these two productive achievements, in syntax and morphology, were very poorly correlated. The children who could productively combine *wuggie* with other words syntactically were not the same ones who could create a productive plural with this same word. This suggests that children are forming their paradigmatic categories for very local communicative purposes, in mosaic and piecemeal fashion, not for all of the many more abstract and interrelated functions that underlie these categories in adults. Exactly how these processes might apply to words that fit the adult category of noun less well (non-object common nouns, proper nouns, mass nouns) is not known at this time.

With respect to verbs, Akhtar and Tomasello (1997) did a similar study

with slightly older 2 and 3-year-old children and found that, as in the analogous case with nouns, children became productive with novel verbs syntactically and morphologically in an uncorrelated fashion - again suggesting local, functionally specific, mosaically acquired, paradigmatic categories. Evidence from other languages also suggests that young children's paradigmatic categories develop in a gradual and piecemeal way as they attempt to assimilate to their more locally based categories the wider array of more abstract functions that underlie the adult version of the category (see Rispoli, 1991, for various types of evidence).

Overall, children's early paradigmatic categories are best explained in the same theoretical terms as their other cognitive categories. As noted above in the discussion of slot-filler categories in early pivot schemas, Nelson (1985, 1996) and Mandler (2000) have both argued that the essence of concepts lies in function; human beings group together things that behave in similar ways in events and activities. In the case of linguistic categories such as noun and verb, however, it is important to be clear that these are categories not of entities in the world (i.e., not referents) but of pieces of language (words and phrases). When words and phrases are grouped together according to similarities in what they do communicatively - grounded in such functions as reference and predication - cognitively and linguistically coherent categories are the result.

The main cognitive skill necessary to form such categories is statistical or distribution learning. Importantly, it has recently been discovered that even prelinguistic infants are able to find patterns in sequentially presented auditory stimuli. Thus, Saffran, Aslin, and Newport (1996) exposed 8-month-old infants to two minutes of synthesized speech consisting of four tri-syllabic nonsense "words" such as *bidakupadotigolabubidakutupiropadoti* They were then exposed to two new streams of synthesized speech simultaneously (one presented to the left and one present to the right) to see which they preferred to listen to (as indicated by the direction they turned their head). One of these streams contained "words" from the original (e.g., *tupiro* and *golabu*), whereas the other

contained the same syllables but in a different order (i.e., there were no "words" from the original). Infants preferred to look toward the speech stream containing the "words" they had been originally exposed to.

Subsequent studies have shown that infants can also find patterns even when the syllables from the original speech stream and the test speech stream are not the same. Thus, Marcus et al. (1999) found that 7-month-old infants exposed repeatedly over a three minute period to tri-syllabic nonsense "words" with the pattern ABB (e.g., wididi, delili) preferred in subsequent testing to look toward the speech stream containing other "words" having this same ABB pattern even though the specific syllables involved were totally new (e.g., bapopo). Gomez and Gerken (1999) found a very similar results with 12-month-old infants.

Interestingly, infants can also find patterns of this same type in both nonlinguistic tone sequences and even in visually presented sequences (Saffran et al., 1999; Kirkham, Slemmer, and Johnson, in press). These pattern-finding skills are thus not specific to language learning. Also, when tamarin monkeys are tested in these same procedures, they show these same abilities (Ramus et al., 2000; Newport, Aslin, and Hauser, 2001; Hauser, Weiss, & Marcus, 2002). These pattern-finding skills are thus not uniquely human.

3. Later Ontogeny

During the preschool years, English-speaking children begin to be productive with a variety of abstract utterance-level constructions, including such things as: transitives, intransitives, ditransitives, attributives, passives, imperatives, reflexives, locatives, resultatives, causatives, and various kinds of question constructions. Many of these are so-called argument-structure constructions, and they are used to refer to experiential scenes of the most abstract kind, including such things as: people acting on objects, objects changing state or location, people giving people things, people experiencing psychological states, objects or people being in a state, things being acted upon, and so forth (Goldberg,

1995). It is presumably the case that these abstract constructions represent children's generalizations across many dozen (or more) item-based constructions, especially in some cases verb island constructions.

Children also construct smaller constructions that serve as the major internal constituents of utterance-level constructions. Most especially, they construct nominal constructions (NPs) in order to make reference to things in various ways (*Bill, my father, the man who fell down*) and verbal constructions (VPs) in order to predicate for something about those things (*is nice, sleeps, hit the ball*). Children also create, a bit later in development, larger and more complex constructions containing multiple predicates such as infinitival complements (*I want him to go*), sentential complements (*I think it will fall over*), and relative clauses (*That's the doggy I bought*). These smaller and larger constructions also are important components in children's later linguistic competence.

Theoretically, we are concerned here again with the nature of the cognitive processes that enable young children to generalize from their linguistic experience and so build up these highly abstract constructions. In addition, in this section we will also address the difficult question of why children make just the generalizations they do, and not some others that might be reasonable from an adult point of view.

3.1. Abstract Constructions

The most abstract constructions that English-speaking children use early in development have mostly been studied from an adult perspective - using constructions defined from an adult model. We will follow suit here, but the truth is that many of the constructions listed here probably should be differentiated in a more fine-grained way (as families of sub-constructions) - once the necessary empirical work is done.

Identificationals, Attributives, and Possessives. Among the earliest utterance-level constructions used by many English-speaking children are those

that serve to identify an object or to attribute to it some property, including a possessor or simple location (Lieven, Pine, & Dresner-Barnes, 1992). In adult language these would almost invariably require some form of the copula, *to be*, although children do not always supply it. Quite often these constructions revolve around one or a few specific words. Most common for the identification function are such things as: *It's a/the X; That's a/the X; or This's a/the X*. Most common for the attributive function are such things as: *Here's a/the X; There's a/the X*. Most common for the possessive function are such things as: *(It's) X's ___; That's X's/my ___; This is X's/your ___*. Clancy (2000) reports some very similar constructions for Korean-speaking children, and a perusal of the studies in Slobin's cross-linguistic volumes reveals many other languages in which these are frequently used child constructions for focusing attention on, or attributing a property to, an external entity.

Simple Transitives, Simple Intransitives, and Imperatives. The simple transitive construction in English is used for depicting a variety of scenes that differ greatly from one another. The prototype is a scene in which there are two participants and one somehow acts on the other. English-speaking children typically produce utterances of this type in their spontaneous speech early in language development for various physical and psychological activities that people perform on objects – everything from pushing to having to dropping to knowing. The main verbs young children use in the transitive construction are such things as: *get, have, want, take, find, put, bring, drop, make, open, break, cut, do, eat, play, read, draw, ride, throw, push, help, why see, say, and hurt*.

The simple intransitive construction in English is also used for a wide variety of scenes. In this case the only commonality is that they involve a single participant and activity. The two main types of intransitives are the so-called unergatives, in which an actor does something (e.g., *John smiled*) and the so-called unaccusatives, in which something happens to something (e.g., *The vase broke*). English-speaking children typically produce utterances of both of these types

early in language development, with unergatives such as *sleep* and *swim* predominating (unaccusatives occurring most often with the specific verbs *break* and *hurt*). The main verbs young children use in the intransitive construction – including imperative uses – are such things as: *go, come, stop, break, fall, open, play, jump, sit, sing, sleep, cry, swim, run, laugh, hurt, and see*.

Ditransitives, Datives, and Benefactives. All languages of the world have utterance-level constructions for talking about the transfer of objects (and other things) between people (Newman, 1996). In English, there is a constellation of 3 related constructions for doing this: the *to*-dative, the *for*-dative (or benefactive), and the double-object dative (or ditransitive). Many verbs occur in both the *to*-dative and the double-object dative constructions (e.g., *give, bring, offer*), with the choice of which construction to use jointly affected by the semantic and discourse status of the participants (Erteschik-Shir, 1979). Most clearly, the prepositional form is most appropriate when the recipient is new information and what is being transferred is known (compare the natural "Jody sent it to Julie" with the unnatural "Jody sent Julie it"). However, the selection of a construction is only partially determined by discourse because a great many English verbs occur only in the prepositional form (e.g., *donate*) and a few occur only in the ditransitive (e.g., *cost, deny, fine*). The main verbs young children use in the ditransitive construction are such things as (see Campbell & Tomasello, 2001): *get, give, show, make, read, being, buy, take, tell, find, and send*.

Locatives, Resultatives, and Causatives. Beginning with their first words and pivot schemas, English-speaking children use a variety of locative words to express spatial relationships in utterance-level constructions. These include prepositions such as *X up, X down, X in, X out, on X, off X, over X, and under X*, and verb+particle constructions such as *pick X up, wipe X off, and get X down*. Once children start producing more complex structures designating events with two or more participants, two-argument locative constructions are common. For Tomasello's (1992) daughter these included such utterances as "Draw star on me"

and "Peoples on there boat" which were produced at 20 months of age. By three years of age most children have sufficient flexibility with item-based constructions to talk explicitly about locative events with three participants, most often an agent causing a theme to move to some object-as-location (e.g., "He put the pen on the desk").

The resultative construction (as in "He wiped the table clean") is used, most typically, to indicate both an action and the result of that action. Although no experimental studies of the resultative construction have yet been conducted with novel verbs, the occurrence of novel resultatives in spontaneous speech attests to the productivity of the construction from sometime after the third birthday. In Bowerman's (1982) study of her two daughters, the following developmental progression was observed. At around two years of age the two children learned various combinations of "causing verb + resulting effect" such as *pull+up* and *eat+all gone*. For the next year or so, each child accumulated an assortment of these forms which were used in an apparently adult-like manner. Subsequently each child, at some point after her third birthday, seemed to reorganize her knowledge of the independently learned patterns and extract a more abstract schema. Evidence for this reorganization came from each child's production of a number of novel resultative utterances such as "And the monster would eat you in pieces" and "I'll capture his whole head off".

Causative notions may be expressed in English utterance-level constructions either lexically or phrasally. Lexical causatives are simply verbs with a causative meaning used in the transitive construction (e.g., "He killed the deer"). Phrasal causatives are important because they supply an alternative for causativizing an intransitive verb that cannot be used transitively. Thus, if Bowerman's daughter had been skillful with phrasal causatives, she could have said, instead of "Don't giggle me", "Don't make me giggle"; and instead of "Stay this open" she could have said "Make this stay open". *Make* is thus the direct causation matrix verb in English, but an important related verb - that is in fact the

most frequent such verb for young English learners - is *let*, as in "Let her do it", "Let me help you", and so forth. Another common matrix verb that follows this same pattern is *help*, as in "Help her get in there" or "Help him put on his shoes". It is unknown whether young children see any common pattern among the utterances in which these three different matrix verbs are used.

Passives, Middles, and Reflexives. The English passive construction consists of a family of related constructions that change the perspective from the agent of a transitive action (relative to active voice constructions) to the patient and what happened to it. Thus, "Bill was shot by John" takes the perspective of Bill and what happened to him, rather than focusing on John's act of shooting (with the truncated passive "Bill was shot" serving to strengthen this perspective further). In addition to this general function of the passive, Budwig (1990) has shown that the "get" and "be" forms of the passive are themselves associated with distinct discourse perspectives. Thus, the prototypical "get" passive in "Spot got hit by a car" or "Jim got sick from the water" tends to be used when there is a negative consequence which occurs when an animate patient is adversely affected by an inanimate entity or a non-agent source. In contrast, the "be" passive construction in "The soup was heated on the stove" is used when there is a neutral outcome of an inanimate entity undergoing a change of state where the agent causing the change of state is unknown or irrelevant. In general, actional transitive verbs can be used in passive constructions quite readily, whereas many stative verbs seem to fit less well (e.g., *She was loved by him*). This was demonstrated experimentally by Sudhalter and Braine (1985), who found that preschoolers were much better at comprehending passive utterances containing actional verbs (e.g., *kick, cut, dress*) than they were at comprehending passive utterances containing experiential verbs (e.g., *love, see, forget*).

English-speaking children typically do not produce full passives in their spontaneous speech until 4 or 5 years of age, although they produce truncated passives (often with *get*) and adjectival passives much earlier (e.g., "He got

dunked" or "He got hurt"). Israel, Johnson, and Brooks (2000) analyzed the development of children's use of the passive participle. They found that children tended to begin with stative participles (e.g., *Pumpkin stuck*), then use some participles ambiguously between stative and active readings (e.g., *Do you want yours cut?* – i.e., do you want it to undergo a cutting action or, alternatively, do you want to receive it already in a cut state), then finally use the active participles characteristic of the full passive (e.g., *The spinach was cooked by Mommy*). Although passive utterances are infrequent in English-speaking children's spontaneous speech, a number of researchers have observed that older preschoolers occasionally create truncated passives with verbs that in adult English do not passivize, e.g., "It was bandaided", "He will be died and I won't have a brother anymore", indicating some productivity with the construction (Clark, 1982; Bowerman, 1982, 1988).

It is important to note that children acquiring certain non-Indo-European languages typically produce passive sentences quite early in development. This result has been obtained for children learning Inuktitut (Allen & Crago, 1996), K'iche' Mayan (Pye & Quixtan Poz, 1988), Sesotho (Demuth, 1989, 1990), and Zulu (Suzman, 1985). Allen and Crago (1996) report that a child at age 2;0-2;9 (as well as two slightly older children) produced both truncated and full passives quite regularly. Although a majority of these were with familiar actional verbs, they also observed passives with experiential predicates and several clearly innovative forms with verbs that do not passivize in adult Inuktitut. The reasons for this precocity relative to English-speaking children are hypothesized to include the facts that: (i) Inuktitut passives are very common in child-directed speech; and (ii) passive utterances are actually simpler than active voice constructions in Inuktitut because the passivized verb has to agree only with the subject, whereas the transitive verb has to agree with both subject and object.

There is very little research on English-speaking children's use of so-called middle voice constructions (medio-passives) such as "This bread cuts easily" or

"This piano plays like a dream" (see Kemmer, 1993). The prototype of this construction involves an inanimate entity as subject, which is held responsible for the predicate (that is why the adverb is typically needed; "This bread cuts" or "This piano plays" by themselves are scarcely grammatical). Budwig, Stein and O'Brien (2001) looked at a number of utterances of young children involving inanimate subjects, and found that the most frequent constructions of this type in young English-speaking children's speech were such things as "This doesn't pour good". Reflexives are also not common in English-speaking children's early language (or in adult English), although they do produce a few things such as "I hurt myself". However reflexives are quite common in the speech of young children learning languages in which these constructions are frequent in child-directed speech. For example, most Spanish-speaking youngsters hear and use quite early such things as *Se cayó* (It fell down), *Me siento* (I sit down), *Levántate* (Stand up!), and *Me lavo las manos*. (I wash my hands).

Questions. Questions, of course, are used primarily to seek information from an interlocutor. In many languages this is done quite simply through a characteristic intonation ("He bought a house?") or by the replacement of a content word with a question word ("He bought a what?"). Although both of these are possible in English, two other forms are more common: Wh- questions and yes/no questions. In the classic structural linguistic analysis, English questions are formed by subject-auxiliary inversion (sometimes with do-support) and Wh- movement. These rules assume that the speaker has available a simple declarative linguistic representation, which she then transforms into a question by moving, rearranging, or inserting grammatical items. Thus, "John kicked the ball" becomes either "Did John kick the ball?" or "What did John kick?"

But this rule-based analysis is highly unlikely initially in development for two main reasons. First, some English-speaking children learn some Wh-question constructions before they learn any other word combinations. For instance, Tomasello's (1992) daughter learned to ask where-questions (e.g.,

"Where's-the bottle?") and what-questions (e.g., "What's that?") as her first multi-word constructions. Second, everyone who has studied children's early questions has found that their earliest constructions are tied quite tightly to a small number of formulae. For example, in their classic analysis Klima and Bellugi (1966) suggested that almost all of the wh- questions of Adam, Eve, and Sarah emanated from two formulae: *What NP (doing)?* and *Where NP (going)?* Fletcher's (1985) subject produced almost all of her early questions with one of three formulae: *How do*, *What are*, and *Where is* More recently, Dabrowska (2001) looked in detail at one child's earliest uses of Wh- questions in English and found that 83 percent of her questions during her third year of life came from one of just 20 formulas such as *Where's THING? Where THING go? Can I ACT? Is it PROPERTY?* and so forth.

One phenomenon that bears on this issue is so-called inversion errors. English-speaking children sometimes invert the subject and auxiliary in Wh-questions and sometimes not - leading to errors such as *Why they're not going?* A number of fairly complex and abstract rule-based accounts have been proposed to account for these errors, and, as usual, some researchers have claimed that children know the rules but apply them only optionally or inconsistently (e.g., Ingran & Tyack, 1979). However, in a more detailed analysis Rowland and Pine (2000) discovered the surprising fact that the child they studied from age 2 to 4 consistently inverted or failed to invert particular Wh-word-auxiliary combinations on an item-specific basis. He thus consistently said such incorrect things as *Why I can...? What she will...? What you can...?*, but at the same time he also said such correct things as *How did...? How do...? What do ...?* In all, of the 46 particular Wh-word - auxiliary pairs this child produced, 43 of them were produced either 100% correctly or 100% incorrectly (see also Erreich, 1984, who finds equal number of inversion errors in Wh- and yes/no questions). Again, the picture is that children learn questions as a collection of item-based constructions, moving only gradually to more abstract representations.

Analogy. Children begin to form abstract utterance-level constructions by creating analogies among utterances emanating from different item-based constructions. The process of analogy is very like the process of the schematization for item-based schemas/constructions (as discussed in Section 2.3); it is just that analogies are more abstract. Thus, whereas all instances of a particular item-based schema have at least one linguistic item in common (e.g., the verb in a verb island schema), in totally abstract constructions (such as the English ditransitive construction) the instances need have no items in common. So the question is: On what basis does the learner make the alignments among constituents necessary for an analogy among complex structures?

The answer is that the learner must have some understanding of the functional interrelationship that make up the two structures being aligned. In the most systematic research program on the topic, Gentner and colleagues (Gentner & Markman, 1995; 1997; Gentner & Medina, 1998) stress that the essence of analogy is the focus on relations. When an analogy is made, the objects involved are effaced; the only identity they retain is their role in the relational structure. Gentner and colleagues have much evidence that young children focus on relations quite naturally and so are able to make analogies quite readily. An example is as follows. Children are shown two pictures: one of a car towing a boat (hitched to its rear) and one of a truck towing a car (hitched to its rear), and this car is identical in appearance to the car in the other picture. After some training in making analogies the experimenter then points to the car in the first picture and asks the child to find the one doing the same thing in the second picture. Children have no trouble ignoring the literal match of cars across the two pictures and choosing the truck. In essence, they identify in both pictures the 'tow-er', or the agent, based on the role it is playing in the entire action depicted.

Gentner and colleagues also stress what they call the systematicity principle, that in making analogies structures are aligned as wholes, as "interconnected systems of relations". In the current context this simply means

that learners align whole utterances or constructions, or significant parts thereof, and attempt to align all of the elements and relations in one comparison. In doing this, learners search for "one-to-one correspondence" among the elements involved and "parallel connectivity" in the relations involved. In the current context this means that the learner makes an analogy between utterances (or constructions) by aligning the arguments one to one, and in making this alignment she is guided by the functional roles these elements play in the larger structure. For example, in aligning *The car is towing the boat* and *The truck is towing the car*, the learner does not begin to match elements on the basis of the literal similarity between the two *cars*, but aligns *the car* and *the truck* because they are doing the same job from the perspective of the functional interrelations involved. This analysis implies that an important part of making analogies across linguistic constructions is the meaning of the relational words, especially the verbs, involved - particularly in terms of such things as the spatial, temporal, and causal relations they encode. But there is basically no systematic research relevant to the question of how children might align verb meanings in making linguistic analogies across constructions.

Gentner and colleagues also have some specific proposals relevant to learning. For example, they propose that even though in some sense neutralized, the object elements that children experience in the slots of a structure can facilitate analogical processes. In particular, they propose that in addition to type variability in the slots, also important is consistency of the items in the slots (i.e., a given item occurs only in one slot and not in others). When all kinds of items occur promiscuously in all of the slots in two potentially analogous relational structures, structure mapping is made more difficult (Gentner & Medina, 1998). For example, children find it even easier to make the analogy cited above if in the two pictures a car is towing a boat and a car is towing a trailer, so that the 'tow-er' is identical in the two cases. This principle explains why children begin with item-based constructions. They find it easier to do structural alignments when

more of the elements and relations are not just similar functionally but also similar, or even identical, perceptually - the process of schematization as it works in, for example, verb island constructions. Children then work their way up to the totally abstract analogies gradually. There are also some proposals from the morphological domain, that a certain number of exemplars is needed - a "critical mass" - before totally abstract analogies can be made (Marchman & Bates, 1994). But if this is true, the nature of this critical mass (e.g., verb types versus verb tokens) is not known at this time; there is no research.

It is thus possible that abstract linguistic constructions are created by a structural alignment across different item-based constructions, or the utterances emanating from them. For example, some verb island constructions that children have with the verbs *give*, *tell*, *show*, *send*, and so forth, share a 'transfer' meaning, and they appear in the form: NP1+V+NP2+NP3. In the indicated transfer, NP1 is the 'giver', NP2 is the 'receiver', and NP3 is the 'gift'. So the aligning must be done on the basis 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 (even if these are only categorically indicated) and on the level of communicative function. This consideration is not really applicable in nonlinguistic domains. It may also be that in many cases particular patterns of grammatical morphology in constructions (e.g., X was VERBed) - which typically designate abstract relations of one sort or another - facilitate, or even enable, recognition of an utterance as instantiating a particular abstract construction.

The only experimental study of children's construction of an abstract linguistic construction (as tested by their ability to assimilate a nonce verb to it) was conducted by Childers and Tomasello (2001). In this training study, 2 1/2-year-old English-speaking children heard several hundred transitive utterances, such as *He's kicking it*, involving 16 different verbs across three separate sessions. Half the children learned new English verbs (and so increased their transitive verb vocabularies during training - towards a critical mass) whereas the other

half heard only verbs they already knew. Within these groups, some children heard all of the utterances with full nouns as agent and patient, whereas others heard utterances with both pronouns (i.e., *He's VERB-ing it*) and also full nouns as agent and patient. They were then tested to see if they could creatively produce a transitive utterance with a nonce verb. The main finding was that children were best at generalizing the transitive construction to the nonce verb if they had been trained with pronouns and nouns, regardless of the familiarity of the trained verbs (and few children in a control condition generalized to the novel verb at all). That is, the consistent pronoun frame *He's VERB-ing it* (in combination with type variation in the form of nouns as well) seemed to facilitate children's formation of a verb-general transitive construction to a greater degree than the learning of additional transitive verbs with nouns alone, in the absence of such a stabilizing pronominal frame.

The results of this study are consistent with Gentner's more general analysis of the process of analogy in several ways. First, they show that children can make generalizations, perhaps based on analogy, across different item-based constructions. Second and more specifically, they also show that the material that goes in the slots, in this case NP slots, plays an important role (see also Dodson & Tomasello, 1998). In English, the pronoun *he* only goes in the preverbal position, and, although the pronoun *it* may occur in either position in spontaneous speech, it occurs most frequently in postverbal position in child-directed speech and indeed that is the only position in which the children heard it during training. These correspondences between processes in the creation of nonlinguistic analogies and in the creation of abstract linguistic constructions constitute impressive evidence that the process is basically the same in the two cases.

3.2. Constraining Generalizations

Importantly, there must be some constraints on children's linguistic abstractions, and this is a problem for both of the major theories of child language

acquisition. Classically, a major problem for generative theories is that as the rules and principles are made more elegant and powerful through theoretical analyses, they become so abstract that they generate too large a set of grammatical utterances; and so constraints (e.g., the subadjacency constraint) must be posited to restore empirical accuracy. In usage-based theories children are abstracting as they learn, but they cannot do this indiscriminately; they must make just those generalizations that are conventional in the language they are learning and not others. It is thus clear that any serious theory of syntactic development, whatever its basic assumptions, must address the question of why children make just the generalizations they do and not others.

We may illustrate the basic problem with so-called dative alternation constructions. The situation is this. Some verbs can felicitously appear in both ditransitive and prepositional dative constructions, but others cannot; for example:

He gave/sent/bequeathed/donated his books to the library.

*He gave/sent/bequeathed/*donated the library his books.*

Why should the other three verbs be felicitous in both constructions, but *donate* be felicitous only in the prepositional dative? The three verbs have very similar meanings, and so it would seem likely that they should all behave the same.

Another example is:

She said/told something to her mother.

*She *said/told her mother something.*

Again, the meanings of the verbs are very close, and so the difference of behavior seems unprincipled and unpredictable (Bowerman, 1988; 1996). Other similar alternations are the causative alternation (*I rolled the ball; The ball rolled*) and the locative alternation (*I sprayed paint on the wall; I sprayed the wall with paint*) - both of which also apply only to limited sets of verbs.

One solution is quite simple. Perhaps children only learn verbs for the constructions in which they have heard them. Based on all of the evidence

reviewed above, this is very likely the case at the earliest stages of development. But it is not true later in development, especially in the 3 to 5 year age period. Children at this age overgeneralize with some regularity, as documented most systematically by Bowerman (1982, 1988; see Pinker, 1989, for a summary of evidence). As reported above, her two children produced things like: "Don't giggle me" (at age 3;0) and "I said her no" (at age 3;1). It is thus not the case that children are totally conservative throughout development, and so this cannot be the whole answer.

A second solution is also quite simple. It is possible that when children make overgeneralization errors adults correct them, and so children's overgeneralization tendencies are constrained by the linguistic environment. But this is not true in the sense that adults do not explicitly correct child utterances for their grammatical correctness (Brown & Hanlon, 1970). Adults, at least Western middle-class adults, do respond differently to well-formed and ill-formed child utterances, however. For example, they continue conversing to well-formed utterances but they revise or recast ill-formed utterances (e.g., Farrar, 1992; Bohannon & Stanowicz, 1988). But this kind of indirect feedback is generally not considered by most theorists sufficient to constrain children's overgeneralization tendencies, as it is far from consistent. It is also not clear that this type of feedback is available to all children learning all languages. Nevertheless, it is still possible that linguistic feedback from adults may play some role – although neither a necessary nor a sufficient role – in constraining children's overgeneralization tendencies (see below).

Given the inadequacy of these simple solutions, three factors have been most widely discussed. First, Pinker (1989) proposed that there are certain very specific and (mostly) semantic 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. Second, it has also been proposed that 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 (Clark, 1987; Braine & Brooks, 1995; Goldberg, 1995; Bates & MacWhinney, 1989). And third, 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).

Two experimental studies provide evidence that indeed all three of these constraining processes - entrenchment, preemption, and knowledge of semantic subclasses of verbs - are at work. First, Brooks, Tomasello, Lewis, and Dodson (1999) 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*.

Second, Brooks and Tomasello (1999b) taught novel verbs to children 2.5, 4.5, and 7.0 years of age. They then attempted to induce children to generalize these novel verbs to new constructions. Some of these verbs conformed to Pinker's (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 4.5. Children from 4.5 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. But the younger children showed no such tendency.

Overall, entrenchment seems to work 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 years of age 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.

3.3. Nominal and Verbal Constructions: Learning Morphology

Across the languages of the world utterance-level constructions are constituted by two major types of sub-constructions: nominal and verbal constructions. Actually, in real discourse, nominal and verbal constructions are often used alone as full utterances, which is one strong piece of evidence for their

reality as functionally coherent and independent constructions. Thus, when someone is asked "Who is that over there?" a reasonable utterance in response is the nominal "Bill" or "My father", and when someone is asked further "What is he doing?" a reasonable utterance in response is the verb or verb phrase "Sleeping" or "Playing tennis". Of course many utterances are constituted by some combination of nominals and verbals: "My father is playing tennis".

Nominal Constructions. Nominals are used by people to make reference to 'things'. In many theories, the prototype is concrete objects (people, places, and things). But it is well known that nominals may be used to refer to basically any kind of entity at all, real or imagined. Thus, when the need arises, there are ways of construing actions, properties, and relationships as if they were things, on analogy with concrete objects. For example, we may say such things as "Skiing promotes good health", "That blue looks awful in my painting", "Bigger is better", and so forth. Indeed, there are some languages that do not really have a clear-cut class of concrete nouns specialized for the single function of reference, such as *dog* and *tree*, but rather they have a single class composed of words that can be used as either nouns or verbs depending on whether they are used as nouns or verbs - similar to English words such as *cut* (*I cut the bread, There's a cut on my finger*) or *hammer* (*I'm hammering in this nail with my hammer*). Langacker (1987b) notes that the discourse function of identifying the participants in events and states of affairs requires language users to construe whatever they wish to talk about as a 'thing', so that it can be referred to, no matter its 'true' ontological status.

In making reference to a 'thing', speakers must choose among various nominal constructions - e.g., proper name, noun + article, pronoun - based on the exigencies of the communicative situation at hand. Of most importance for this choice is the speaker's assessment of the knowledge and expectations of the listener at any given moment based on their currently shared perceptual situation and on their previously shared experience, especially in the immediately preceding discourse context. In the terminology of Langacker (1991), speakers

must "ground" their conventional act of reference in the current speech situation involving particular persons in a particular usage event. In the terminology of pragmatic theorists, speakers must assess the cognitive availability (accessibility, topicality, givenness) of the referent for the listener (Givón, 1993; Ariel, 1988; Gundel, Hedberg, & Zacharski, 1993).

Typically, speakers choose to use a pronoun (*he*) or a proper name (*Jennie*) to refer to an entity that is either in the current attentional focus of speaker and listener or else can be recovered from memory quite easily (e.g., because it is shared knowledge who Jennie is). The most studied referential strategy of young children is one used when recoverability is harder, specifically, the use of a full noun phrase containing some kind of common noun and some kind of determiner(s). Such full noun phrases do not assume - at least not to the same degree as pronouns and proper names - shared knowledge between speaker and listener. In addition, they also employ a more analytic technique of reference than proper names and pronouns, typically using multiple words or morphemes to indicate the intended referent. Thus, full noun phrases typically comprise two separately indicated sub-functions: a common noun (*boy, yard, party*) is used to indicate a category of things, and a determiner (*a, the, my*) is used to help the listener to specify an individual member of that category.

Children produce full noun phrases in their very earliest multi-word speech, sometimes as whole utterances (e.g., saying "A clown" when asked "What is that?" or "My blanket" when asked "What do you want?"). The determiners used in these early utterances fall mainly into three categories. The first is demonstratives, as in *this ball* or *that cookie*. These are often used deictically with pointing, but their perspectival aspect (physical or psychological distance from speaker) is not mastered for several years. The second category is possessives, as in *my shoes* or *Maria's bike*. These are also used quite early in language development, and they are of special importance because they seem to be used quite accurately from the beginning (see, e.g., Tomasello, 1998c). This early

mastery of possessive noun phrases means that all of the trouble that children have with other kinds of noun phrase involving such things as definite and indefinite articles, are not due to general difficulties with forming a phrase consisting of a common noun plus a determiner. Their difficulties must come from somewhere else, presumably the additional perspectival and/or pragmatic dimensions that must be mastered for appropriate use of these other types of determiners in noun phrases.

The determiners that have been studied most extensively in English acquisition are the definite and indefinite articles, *the* and *a*. Appropriate usage of these is notoriously difficult for second-language learners of English, especially for those coming from languages that do not have articles at all (e.g., Japanese or Russian). Although textbook accounts quite often present these words as contrasting alternatives, the fact is that each of them has a wide range of uses, some of which are quite unrelated to one another. Indeed, the historical situation is that across many languages the definite determiner derives from a demonstrative - a mainly deictic function - whereas the indefinite determiner derives from the number word for *one* - a very different function. In English, the definite determiner was grammaticized from a demonstrative many generations before the indefinite determiner was grammaticized from the number word for *one* (Trask, 1996).

There are two main difficulties that children have to overcome to use English articles appropriately. The first difficulty is that these words encode two different, but highly correlated, dimensions of the referential situation: specificity and givenness. On the one hand, the definite article *the* serves to pick out a specific entity, as in "I want the cookie" (that's in your hand), whereas the indefinite article *a* serves to pick out a non-specific entity, as in "I want a cookie" (any cookie). On the other hand, the definite article *the* is used when the speaker can assume that the referent is to some degree given (or available) for the listener (e.g., "I have the kite" - i.e., the one we just talked about), whereas the indefinite

article *a* is used to introduce a new referent into the discourse situation even if that entity is definite (e.g., "I have a kite" – you'll find it upstairs). These two aspects – specificity and givenness – most often occur in a totally confounded manner, and indeed it is only in somewhat special uses that they are unconfounded. The second difficulty is that this second dimension of article use – taking into account listener perspective (givenness) – may be especially difficult cognitively for 2- and 3-year-old children. Much research in developmental psychology has demonstrated that the requisite perspective-taking skills are much better developed in 4-year-olds (see Flavell, 1997, for a review).

Brown's (1973) naturalistic observations have documented that by three years of age English-speaking children use the definite and indefinite articles quite flexibly and appropriately with respect to the specificity of the referent intended. However, Brown also notes that this spontaneous usage provides little evidence one way or the other for children's skills with the perspectival component, especially in the most demanding case in which the intended referent is known by the speaker but unknown to the listener (i.e., where givenness is different for speaker and listener). This especially difficult case has been the target of a number of experimental investigations, and not surprisingly the general finding is that when young children have a referent they wish to introduce to someone for whom it is totally new in the discourse context, they tend to overuse the definite article (the egocentric error). For example, with no introductory comments whatsoever they might tell a friend that "Tomorrow we'll buy the toy" (Maratsos, 1976).

Emslie and Stevenson (1981) had children tell a story from a set of pictures to another child sitting on the other side of a partition. They found that 3-year-olds used the articles consistently and appropriately with regard to specificity. With regard to perspective, the key task was one in which children were asked to narrate a story from a series of pictures to another child, and in the middle of the series a picture of a completely new and irrelevant object or person appeared -

definitely requiring an indefinite article for its introduction (e.g., “And then a snake appeared in the grass ...”). They found that only the 4-year-olds (not the 3-year-olds) consistently used the indefinite article to introduce the novel referent for their unsuspecting listener. In the same vein, Garton (1983) found that in a similar experimental task children before their fourth birthdays did not use the definite and indefinite articles differentially for adults either wearing or not wearing a blindfold.

Verbal Constructions. Just as nominals are grounded in space, in the sense that they help the listener to ‘locate’ the intended referent, clauses are grounded in time to help the listener identify which particular event is being indicated (Langacker, 1991). This is typically done in two ways that work together. The internal temporal contour of a clause is designated by some marking of its grammatical aspect (e.g., progressive aspect marks ongoingness, as in *X is/was smiling*), while the external placement of the event along a time line, grounded in the speech moment, is designated by some marker of its tense (e.g., past tense) (Comrie, 1976). These work together in narrative discourse to enable such temporal juggling as *While I was Xing, she Yed*. In addition, and importantly, many clauses also contain some indication of the speaker's attitude towards the event or state of affairs. For example, in English people frequently mark their attitude through the use of modal auxiliaries such as *may, can, can't, won't, should, might, must, could, would*, etc. - and with a number of different kinds of things in other languages (e.g., marking how the speaker came to know what she is saying, so-called evidentiality). All of this works together - with some grammatical morphemes in some languages being plurifunctional in the extreme - in what is called tense-aspect-modality (TAM) marking. TAM marking may be done either with freestanding words or with grammatical morphology, depending on exactly which of these things in a given language has been grammaticized, and to what degree.

To ground their clauses in the current speech event, speakers must locate the

symbolized state or event in time. Weist (1986), building on Smith (1980), proposes four stages in children's ability to linguistically indicate the temporal ordering of events using tense marking in an adult-like manner.

- Age 1;6: talk about events in the here and now only
- Age 1;6 to 3;0: talk about the past and future
- Age 3;0 to 4;6: begin to talk about past and future relative to a reference time other than now (typically indexed with adverbs such as *when*)
- Age 4;6 and older: talk about past and future relative to a reference time other than now using adult-like tensing system (typically verb morphology)

The problem with this neat account is that the linguistic indication of tense interacts in complex ways with the linguistic indication of aspect, and it does this differently in different languages. As one example, the best-known hypothesis about children's early ability to indicate temporal relations in their early language is the Aspect Before Tense hypothesis. Beginning with Antinucci and Miller (1976), it has been noted that children tend to use past tense most often with change of state (telic) verbs and present tense (or present progressive) most often with activity (atelic) verbs. In the strongest version of the Aspect Before Tense hypothesis, Antinucci and Miller (1976) hypothesized that until about 2;6 children use past tense only for changes of state in which at the end state is still perceptually present, and indeed children at this age think that the past tense marker actually indicates that an event is bounded (telic) and completed (perfective), rather than one that occurred in the past (independent of its telicity and perfectiveness). Thus, the first past tense verbs are prototypically things like *dropped*, *spilled*, and *broke* in which all of these things are confounded.

Antinucci and Miller attributed this pattern of use to children's immature conception of time. However, this strictly cognitive explanation is no longer held by anyone. This is because, first of all, even before their second birthdays many children do on some occasions clearly refer to past situations with activity verbs that have no current perceptual manifestations (Gerhardt, 1988). Secondly, in a

number of comprehension experiments in which children must choose the picture that best depicts a present tense, past tense, or future tense utterance regardless of aspect, they perform well from a relatively early age (e.g., see Weist et al., 1984, 1997, for Polish-speaking children, and McShane & Whittaker, 1988, and Wagner, 2001, for English-speaking children). And thirdly, a number of studies on second language acquisition have shown that second language learning children and adults also use tense-aspect marking in the same biased way as young children, and they presumably are not cognitively immature (Li & Shirai, 2000).

Nevertheless, it is a fact that in basically all languages that have been studied children much prefer to use the past tense for events construed as telic and perfective, such as *broke* and *made*, and they much prefer to use present tense (or progressive) for events construed as atelic and imperfective, such as *playing* and *riding*. Thus, it is relatively rare to hear a one-year-old or young two-year-old saying things like *breaking* or *making*, *played* or *rode*. The languages for which this has been documented include English, Italian, French, Polish, Portuguese, German, Japanese, Mandarin Chinese, Hebrew, and Turkish (see Li & Shirai, 2000, for a review). Quantitatively, in a diary study Clark (1996) found that between the ages of 1;7 and 3;0 her son used the progressive *-ing* with activity verbs about 90% of the time, and he used the past tense *-ed* with the accomplishment subclass of change of state verbs about 60% of the time. Tomasello (1992) found that an even higher percentage of *-ed* use occurred with change of state verbs.

It turns out that one major reason children show this pattern is quite straightforward: this is the pattern they hear in the language around them. Shirai and Andersen (1995) call this the Distributional Bias hypothesis, namely, that the distribution of tense and aspect markers with particular classes of verbs in children's speech follows the distribution the children hear in the language around them. And so, once again what we see is an adult pattern in the use of grammatical words and morphemes that most often conflates and/or confounds

distinctions that the child will need to segregate if she is to attain adult-like competence with these grammatical words and morphemes. Presumably to make all the appropriate distinctions in the current case, the child needs to hear and comprehend enough instances of activity verbs construed imperfectively in the past tense, change of state verbs construed in the progressive aspect, and all other possible combinations. Only wide and varied experience with many different such patterns will provide the raw material necessary for the child to segment and sort out which components of a given clausal construction are being used to indicate which components of the temporal profile the speaker intends to indicate. As in the case of a nominal constructions with determiners - in which the child must sort out such things as referent specificity and listener perspective, which are often confounded - it is no surprise that it takes children many years to do this, and that it is easier to do in languages in which historical grammaticalization patterns have led to fewer confluences and confoundings of these types (Slobin, 1985; 1997).

Learning Morphology. The need to ground nominal and verbal constructions in the ongoing speech event is present constantly. Although there are major differences among languages, these constant communicative pressures have led in many cases to the grammaticalization of forms for effecting these functions, and recurrent functions other than grounding may also lead to the creation of grammatical morphology (e.g., plurals and case marking). From the point of view of learning and generalization, grammatical morphology displays a number of interesting properties. Among these is the fact that children sometimes overregularize grammatical morphemes, which has put them in the center of some major theoretical debates about the nature of cognitive representation in general. In addition, because they are often not very salient in the speech stream - and perhaps for other reasons such as their plurifunctionality in many cases - second language learners and children with the specific language impairment often have special problems with grammatical morphemes.

One of the most intriguing phenomena of child language acquisition is U-shaped developmental growth. That is, in some cases children seem to learn the conventional adult way of saying things early in development, but then become worse as they get older, for instance, saying such things as *mans*, *feets*, *comed*, *sticked*, *putted*, and so forth - returning only later to the conventional adult forms. The traditional interpretation of this developmental pattern is that early on children learn, for example, the past tense form *came* by rote as an individual lexical item; later they learn to use the regular past tense morpheme *-ed* and apply it whenever they want to refer to the past (sometimes inappropriately, as in *comed*); and finally, before school-age, they learn that there are exceptions to the general rule and display adult-like competence (Kuczaj, 1977; Bowerman, 1982). U-shaped developmental growth is thus intriguing because it seems to signal changes in underlying linguistic representations and processes.

Perhaps ironically, given that English is a morphologically impoverished language, the grammatical morpheme that has been studied most intensively in this regard is the English past tense *-ed*. The largest and most systematic study of children's acquisition of the English past tense was conducted by Marcus, Pinker, Ullman, Hollander, Rosen, and Xu (1992). They examined written transcripts of 83 English-speaking preschool-aged children and found that overgeneralization errors were relatively rare proportionally (2.5% of irregular tokens produced had, inappropriately, the *-ed*), and they occurred at this same low rate throughout the preschool period. Typically, for a given verb children produced the correct past tense form before they produced the overgeneralized form, and they made the overgeneralization error least often with the irregular verbs they heard most often in parental speech. For a particular child's use of a particular verb, there was sometimes a relatively extended period (weeks to months) in which both the correct form and the overgeneralized form coexisted.

Marcus et al. explain these results with one form of a dual process model. Children acquire the irregular forms by rote learning, but they acquire the regular

forms by establishing a rule. Rote learning is subject to all the parameters of 'normal' learning, such as the effects of frequency and similarity among exemplars; rule learning is impervious to these effects. (The existence of these different processes is supposed to be of great theoretical significance, since they confirm the existence of rule-based cognitive representations that are not subject to the 'normal' laws of learning; Pinker, 1991, 1999). But the specifics of English past tense acquisition clearly do not fit this neat picture; children sometimes misapply the rule (overgeneralize), even in some cases using both correct and incorrect forms during the same developmental period. Marcus et al. explain these anomalies by invoking in addition the principle of pre-emption (what they call the uniqueness principle or blocking) – and some factors that affect its application. The basic idea is that the regular rule applies whenever it is not blocked (i.e., it is a default rule). This means that when children have an irregular form (e.g., *sang*) it blocks application of the regular *-ed* rule, but when they do not have such a form they might reasonably produce *singed*. The problem with this account, of course, is the finding that children often use both the correct and overgeneralized forms at the same time. Marcus et al. deal with this empirical problem by hypothesizing that blocking sometimes does not work as it is supposed to, basically due to "performance errors". Lexical retrieval is probabilistic and frequency dependent; children sometimes have trouble retrieving infrequent irregular forms and so the rule gets applied simply because it is not properly blocked.

Recently, however, some aspects of this account have been called into question. Maratsos (2000) points out that the error rate reported by Marcus et al. (1992) was computed by pooling all verbs together, and thus very high frequency verbs statistically swamped out low frequency verbs. Indeed, verbs that appeared infrequently for a given child (less than 10 times) were excluded from some analyses altogether. Thus, for example, one child produced 285 past tenses for the verb *say*, with a very low error rate of 1%. This same child, however,

produced 40 different verbs less than 10 times each (155 tokens altogether). The overgeneralization error rate for these individual verbs was 58%. But because of their low token frequency, all of these verbs together contributed less to the computation of the overall error rate than the verbs *say* by itself. In addition, Maratsos also points out that many individual verbs used by individual children are used in both correct and overgeneralized forms for a period of many months (in a few cases years), which could only happen in the rule + blocking account if the child experienced persistent and long-lived retrieval problems of a type Marcus et al. do not discuss.

Maratsos' alternative account is based on the notion of competition - a weaker, frequency-based kind of pre-emption (see Section 3.2). In this account children can produce past tense forms either by rote or by rule, and there may be a period in which they produce both for a given verb. The winner of the competition will be determined eventually by the form the child hears most often in the speech around her (and perhaps by other factors); that is, the most frequent form comes gradually to block the less frequent form, regardless of which is 'regular' or 'irregular'. In contrast, in the Marcus et al. account there is an asymmetry between regulars and irregulars - the regular does not even need to be heard a single time to 'win', since it is a default - and the only role for frequency is as a performance factor that interferes with the normal mechanism.

In general, the acquisition of productive systems of grammatical morphology in natural languages is extremely difficult. According to Klein and Perdue (1997) most adult second language learners, especially those learning in a more natural settings outside the classroom, develop what they call the Basic Variety of a language. This consists of lexical items combined in syntactic constructions, but typically with only one morphological form of each word. Similarly, McWhorter (1998) argues and presents evidence that one of the distinguishing characteristics of pidgin and Creole languages (typically relatively new languages created under unusual situations of language contact) is their

relatively impoverished systems of grammatical morphology. It is also well known that one of the major diagnostic features of children with specific language impairment is their relatively poor mastery of the grammatical morphemes in their language (Leonard, 1998; Bishop, 1997). Finally, when perfectly competent adult speakers of a language are put under various kinds of processing pressure as they listen to a story - e.g., the spoken language describing the story is distorted by white noise or subjects must perform a distracting task while listening - what falls apart most readily in subsequent tests of retention is the grammatical morphology (Dick et al., 2001).

The basic reasons that grammatical morphology is an especially weak link in the language learning process are three. First, it is typically expressed in phonologically reduced, unstressed, monosyllabic bits in the interstices of utterances and constructions. Second, in some though by no means all cases, it also carries very little concrete semantic weight, for example, the English third person *-s* agreement marker is in most cases almost totally semantically redundant; and indeed research with children with specific language impairment has shown that greater semantic weight indeed facilitates children's acquisition of a grammatical morpheme (Leonard, 1998; Bishop, 1997). Third, many grammatical morphemes are plurifunctional (e.g., English articles encoding specificity and definiteness) in ways that make acquisition of the full range of uses in appropriate contexts extremely difficult. Perhaps for all of these reasons, Farrar (1990, 1992) found that children's acquisition of some particular grammatical morphemes in English (e.g., past tense *-ed*, plural *-s*, progressive *-ing*, etc.) was facilitated when mothers used these morphemes as immediate recasts of the child's utterances that were missing them. Recasts are well-known to help children identify elements with low salience since they provide the child with an immediate comparison of her own immature utterance and the correspond full adult form with full morphology (Nelson, 1986).

3.4. Complex Constructions

All natural languages have ways for talking about multiple events and states of affairs related to one another in complex ways. In the most straightforward cases, a speaker simply strings together different clauses across time, linking them with various kinds of appropriate connectors (or not). In other cases, however, the different clauses are more tightly interrelated and thus appear as constituents in a single complex construction under a single intonation contour, which in most cases is an historical grammaticalization of discourse sequences in which specific types of clauses have recurred together repeatedly in the speech community. The linking of clauses - whether more loosely or more tightly - serves a variety of discourse functions, from expressing speaker attitudes about things (as in infinitival and sentential complements) to specifying referents in more detail (as in relative clauses) to indicating the spatial-temporal-causal interrelations among events (as in adverbial clauses - not dealt with here).

Infinitival Complement Constructions. Between 2 and 3 years of age, English-speaking children begin to acquire complex constructions indicating speaker attitudes - such things as intention, volition, or compulsion. The most common are: *wanna V*, *hafta V*, *gotta V*, *needta V* (and perhaps *gonna V*), and they typically structure the earliest complex sentences that English-speaking children learn and use - typically emerging at around the second birthday. Gerhardt (1991) analyzes children's use of *wanna* as indicating 'internal volition' or desire, their use of *hafta* (and *gotta*) as indicating 'external compulsion' (often due to a social norm such as a rule), and *needta* as indicating 'internal compulsion' (almost no choice due to an internal state).

Following the classic studies of Limber (1973) and Bloom, Tackeff, and Lahey (1984), Diessel (in press) reported the largest study to date of non-finite complement clauses. He studied a wider range of constructions - including such things as participial and *Wh* infinitive constructions - and he investigated four children up to five years of age in quantitative detail. The first finding is that over

95% of children's utterances with non-finite complement clauses contained to-infinitives, and these were the first to emerge as well. (The other 5% were such things as the participials *Start V-ing* and *Stop V-ing* and a very few Wh infinitives such as "I know what to do".) Like Bloom et al. (1989), Diessel found that the first matrix verbs to appear were *wanna*, *hafta*, and *gotta*, which emerged at about 2;3 and accounted for over 90% of all the to-infinitives over the course of the entire study. Initially children used these in very formulaic ways. That is, almost all of the first to-infinitives produced by these children had as subjects the first-person pronoun *I*, they were in present tense (assuming *gotta* as present tense), and they were not negated; thus the prototype was things like *I wanna play ball*, *I hafta do that*, and *I gotta go*.

From age 2 to 5, these children's growing linguistic sophistication with this class of constructions was manifest in three main ways. First, their use of the semi-modals became less formulaic and more diverse, so that they now included third-person subjects (e.g., "Dolly wanna drink that") and negatives (e.g., "I don't like to do all this work"). Second, they learned a wider range of matrix verbs, including such things as *forget* (e.g., "I forgot to buy some soup") and *say* (e.g., "The doctor said to stay in bed all day"). Third, the children learned more complex constructions with an NP between the two verbs. As in Bloom et al.'s study, these first emerged at around 2;6 to 3;0, and were dominated by 4 matrix verbs which accounted for 88% of all the utterances of this type. These were thus constructions of the type:

<i>See X VERB-ing</i>	<i>Want X to VERB</i>
<i>Watch X VERB-ing</i>	<i>Make X VERB</i>

After three years of age other matrix verbs representing a more diverse set of constructions emerged. And so, in general, Diessel found a developmental progression from constructions in which the matrix verb and main verb were more tightly integrated - utterances with the semi-modals *wanna*, *hafta*, and *gotta* - to those in which the two verbs were more distinct, as in the constructions with an

intervening NP, and two full propositions were expressed.

Sentential Complement Constructions. Whereas many of the most common matrix verbs with infinitival complements are generally similar to deontic modals (*should, must*) in their concern with purpose/intention/compulsion, many of the most common matrix verbs with sentential complements are similar to epistemic modals (*may, might*) in their concern with certainty/perception/knowledge. But again, the matrix verbs in sentential complements - such things as *think, know, believe, see, say* - are not modal auxiliaries but tensed verbs. In addition, and in contrast to infinitival complements, the second clause in sentential complement constructions is also a fully tensed clause with an overt subject (i.e., it is a fully independent clause). The prototype, then, is utterances like "I know she hit him" and "I think I can do it". Once again, the classic studies are by Limber (1973) and Bloom and colleagues (Bloom, Rispoli, Gartner, & Hafitz, 1989), who found that sentential complement constructions emerged later than infinitival complement constructions, typically between 2;6 and 3;0. They also found that the earliest verbs used in these constructions were a very delimited set, mainly *think, know, look, and see*.

Diessel and Tomasello (2001) looked at young English-speaking children's earliest utterances with sentential complements from 2 to 5 years of age. They found that virtually all of them were composed of a simple sentence schema that the child had already mastered combined with one of a delimited set of complement-taking matrix verbs (see also Bloom 1992). These matrix verbs were of two types. First were epistemic verbs such as *think* and *know*. As one example, 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, present tense form; that is, there were virtually no examples of *He thinks ..., She thinks ..., etc.*, virtually no examples of *I don't think ..., I can't think ..., etc.*, and virtually no examples of *I thought..., I didn't think ..., etc.* And there were almost no uses with a complementizer (virtually no examples of *I think that ...*). It

thus appears that for many young children *I think* is a relatively fixed phrase meaning something like *Maybe*. The child then pieces together this fixed phrase [or one of the other similar phrases like *I hope I bet*, etc.) with a full proposition, with its function being as a sort of evidential marker (not as a matrix clause that embeds another as in traditional analyses). The second kind of matrix verbs were attention-getting verbs like *Look* and *See*, used in conjunction with full finite clauses. In this case, children used these 'matrix' verbs almost exclusively in imperative form (again almost no negations, no non-present tenses, no complementizers), suggesting again an item-based approach not involving syntactic embedding. Thus, when examined closely, children's earliest complex sentences look much less like adult sentential complements (which are used most often in written discourse) and much more like various kinds of 'pastiche' of various kinds of established item-based constructions.

Relative Clause Constructions. Relative clauses are not like complement clauses because they do not involve coordination with a main clause at all. Rather, relative clauses serve the very different function of specifying noun phrases in detail. Textbook descriptions focus on so-called restrictive relative clauses - e.g., "The dog that barked all night dies this morning" - in which the relative clause serves to identify a noun by using presupposed information (both speaker and listener already know that there was barking all night - that's why it can be used as identifying information). Because relative clauses are a part of a noun phrase argument, they are classically characterized as embedded clauses, and so they have attracted much research attention in both linguistics and developmental psycholinguistics.

The largest study of children's acquisition of relative clauses is by Diessel and Tomasello (2000), who studied four English-speaking children between ages 1;9 and 5;2 in quantitative detail. In this study, they made a surprising discovery: virtually all of these children's earliest relative clauses were of the same general form, and this form was not the form typically described in textbooks. Examples

would be:

Here's the toy that spins around

That's the sugar that goes in there

What is noteworthy here is: (1) the main clause is a presentational construction (predicate nominal or closely related), basically introducing a new topic using a proform (*Here, That*) and the copula (-'s); and (2) the information in the relative clause is not presupposed, as in textbook (restrictive) relative clauses, but rather is new information about the just-introduced referent. The main point is that even this very complex construction is firmly based in a set of simpler constructions (copular presentationals) that children have mastered as item-based constructions some time before relative clauses are first acquired and produced.

4. Processes of Language Acquisition

From a Cognitive Science point of view, the central issue in the study of language development is the nature of children's underlying linguistic representations and how these change during ontogeny. Summarizing all that has gone before in this article, we now address directly these two issues.

4.1. The Growing Abstractness of Constructions

Based on all of the available evidence, it would appear that children's early linguistic representations are highly concrete, based in concrete and specific pieces of language not in abstract categories (although they have some open slot-filler categories as well). We have cited: (1) analyses of children's spontaneous productions showing very restricted ranges of application of many early linguistic items and structures, asynchronous development of item-based constructions that from an adult point of view should have similar structures, and gradual and continuous development within specific item-based structures; (2) production experiments in which young children use nonce verbs in the way adults have used them, failing to generalize them to other of their existing constructions -

suggesting that these existing constructions are item-based and not verb-general; and (3) comprehension experiments in which young children, who know the activity they are supposed to act out in response to a nonce verb, fail to assign the correct agent-patient roles to the characters involved based on canonical word order cues (in English) - again suggesting that their constructions at this point are item-based and not totally general.

There is one other recent finding that supports this same conclusion further. Savage, Lieven, Theakston, and Tomasello (2004) primed English-speaking children with either active or passive sentences, in some cases with high lexical overlap between the priming sentence and the sentence the child was likely to produce (i.e., the prime used some pronouns and grammatical morphemes that the child could use in her target utterance even though different objects and actions were involved) and in some cases with very low lexical overlap (i.e., the prime used only nouns, which the child could not use in her target utterance since different objects were involved). In some ways, this method could be considered the most direct test yet of children's early syntactic representations, since successful priming in the high lexical overlap condition would suggest that their linguistic knowledge is represented more in terms of specific lexical items, whereas priming in the low lexical overlap condition would suggest that their linguistic knowledge is represented more abstractly. The answer is that the older children, around 6 years of age, could indeed be structurally primed to produce a particular construction such as the passive. The younger children, who had just turned 3 years old, could not be primed structurally; but they were primed by the more lexically specific primes. Four-year-old children fell somewhere in between these two extremes. So once more - in this case using a very different method, widely accepted in the adult psycholinguistic community - we find that children's early linguistic representations are very likely based in specific item-based constructions (with some abstract slots), and it is only in the late preschool period that their utterance-

level constructions take on adult-like abstractness.

But rather than thinking of children's utterance-level constructions as either concrete or abstract, it is probably better to think of them as growing gradually in abstractness over time as more and more relevant exemplars are encountered and assimilated to the construction. One reasonable interpretation of all of the studies directly aimed at children's underlying linguistic representation - as reviewed here - is thus as follows. From about 2 or 2½ years of age children have only very weak verb-general representations of their utterance-level constructions, and so these show up only in preferential looking tasks which require only weak representations. But over the next months and years their linguistic representations grow in strength and abstractness - based on both the type and token frequency with which they hear certain linguistic structures - and so these now begin to show themselves in tasks requiring more active behavioral decision making or even language production - which require stronger representations. This hypothesis is in the general spirit of a number of proposals suggesting that, if cognitive representations retain information about the variety of individual instances, they may be felicitously described as being either weaker or stronger based mainly on their type and token frequency (e.g. Munakata et al., 1997). It is also consonant with the view that 'linguistic knowledge' and 'linguistic processing' are really just different aspects of the same thing. Thus, things like frequency and the probabilistic distribution of lexical items in the input not only play a crucial role in how children build up their linguistic representations, but they also form an integral part of those representations themselves in the end state (see the papers in Barlow & Kemmer, 2000; Elman et al., 1996).

4.2. Psycholinguistic Processes of Development

In accounting for how children learn linguistic constructions and make generalizations across them, we have argued and presented evidence for the

operation of certain general cognitive processes. Tomasello (2003) argues that we may segregate these into the two overall headings of: intention-reading, comprising the species unique social cognitive skills responsible for symbol acquisition and the functional dimensions of language, and pattern-finding, the primate-wide cognitive skills involved in the abstraction process. More specifically, these two kinds of general cognitive abilities interact in specific acquisition tasks to yield the processes we have outlined in various places above. Thus, we have previously made reference to four specific sets of processes:

- Intention-Reading and Cultural Learning, which account for how children learn linguistic symbols in the first place (discussed here very little);
- Schematization and Analogy, which account for how children create abstract syntactic constructions (and syntactic roles such as subject and direct object) out of the concrete pieces of language they have heard;
- Entrenchment and Competition, which account for how children constrain their abstractions to those that are conventional in their linguistic community; and
- Functionally Based Distributional Analysis, which accounts for how children form paradigmatic categories of various kinds of linguistic constituents (e.g., nouns and verbs).

These are the processes by means of which children construct a language, that is, a structured inventory of linguistic constructions. For a full account, we also need to look briefly at the processes by which children actually produce utterances. By way of summary, then, we look at each of these processes in turn.

Intention Reading and Cultural Learning. Because natural languages are conventional, the most fundamental process of language acquisition is the ability to do things the way that other people do them, that is, social learning broadly defined. The acquisition of most cultural skills, including skills of linguistic communication, depend on a special type of social learning involving intention-reading that is most often called cultural learning, one form of which is imitative

learning (Tomasello et al., 1993). This can be seen most clearly in experimentals in which young children reproduce an adult's intended action even when she does not actually perform it (Meltzoff, 1995) and in which they selectively reproduce only an adult's intentional, but not accidental, actions (Carpenter et al., 1998a). To make matters more complicated, the acquisition of language involves the imitative learning of adult behaviors expressing not just simple intentions but communicative intentions (roughly, intentions toward my intentions). Children's ability to read and learn the expression of communicative intentions can be seen most clearly in word learning studies in which young children have to identify the adult's intended referent in a wide variety of situations in which word and referent are not both present simultaneously (Tomasello, 2001).

In human linguistic communication the most fundamental unit of intentional action is the utterance as a relatively complete and coherent expression of a communicative intention, and so the most fundamental unit of language learning is stored exemplars of utterances. This is what children do in learning holophrases and other concrete and relatively fixed linguistic expressions (e.g., *Thank You, Don't mention it*). But as they are attempting to comprehend the communicative intention underlying an utterance, children are also attempting to comprehend the functional roles being played by its various components. This is a kind of "blame assignment" procedure in which the attempt is to determine the functional role of a constituent in the communicative intention as a whole - what we have called segmenting communicative intentions. Identifying the functional roles of the components of utterances is only possible if the child has some (perhaps imperfect) understanding of the adult's overall communicative intention - because understanding the functional role of X means understanding how X contributes to some larger communicative structure. This is the basic process by means of which children learn the communicative functions of particular words, phrases, and other utterance constituents - and, with help from pattern-finding skills, categories of these.

Schematization and Analogy. Young children hear and use - on a numbingly regular basis - the same utterances repeated over and over but with systematic variation, for example, as instantiated in item-based schemas such as *Where's-the X?*, *I wanna X*, *Let's X*, *Can you X?*, *Gimme X*, *I'm Xing it*. Forming schemas of this type means imitatively learning the recurrent concrete pieces of language for concrete functions, as well as forming a relatively abstract slot designating a relatively abstract function. This process is called schematization, and its roots may be observed in various primates who schematize everything from food processing skills (Whiten, 1998) to arbitrary sequences in the laboratory (Conway & Christiansen, 2001).

The variable elements or slots in linguistic schemas correspond to the variable item of experience in the referential event for which that schema is used. Thus, in *Where's-the X* the speaker's seeking is constant across instances but the thing being sought changes across situations; in *I'm Xing it* the acting on an object is constant but the particular action varies. The communicative function of the item in a slot is thus constrained by the overall communicative function of the schema, but it is still somewhat open; it is a slot-filler category in the sense of Nelson (1985). This primacy of the schema leads to the kinds of functional coercion evidenced in creative uses of language in which an item is used in a schema that requires the listener to interpret that item in an unusual way; for example, under communicative pressure a child might say something like "Allgone sticky", as she watches Mom wiping candy off her hands.

One special form of schematization is analogy - or, alternatively, we might say that one special form of analogy is schematization. Both exemplify the process by which children try to categorize, in the general sense of this term, whole utterances and/or significant other linguistic constructions (e.g., nominals). In general, we may say that an analogy can be made only if there is some understanding of the functional interrelations of the component parts of the two entities to be analogized across. In the case of syntactic constructions, analogies

are made not on the basis of surface form but on the basis of the functional interrelations among components in the two constructions being analogized. Thus, the *X is Y-ing the Z* and the *A is B-ing the C* are analogous because the same basic relational situation is being referred to in each case, and X and A play the role of actor, Y and B the activity, and Z and C the undergoer. In this way, different constructions develop their own syntactic roles, first locally in item-based constructions (e.g., 'thrower' and 'thing thrown'), and then more globally in abstract constructions (e.g., transitive-subject, ditransitive-recipient). There may even emerge late in development, in some languages, a super-abstract Subject-Predicate construction containing an abstract syntactic role such as 'subject' more generally, based on abstractions across various abstract constructions. It is possible that perceptual similarity (or even identity) of the objects involved in analogies, while not strictly necessary, does in many cases facilitate human beings in their attempts to make analogies (the study of Childers & Tomasello, 2001, providing support for this hypothesis). If so, this explains why children begin by schematizing across utterances with common linguistic material, thus creating item-based constructions, before they attempt to make totally abstract analogies based on a structure mapping involving little or no common linguistic material across utterances, thus creating abstract constructions.

An important part of item-based and abstract constructions is various kinds of syntactic marking, specifically indicating the syntactic roles that participants are playing in the scene or event as a whole. Special symbols such as case markers and word order are the most common devices that languages use in general to mark the basic 'who's doing what to whom' of an utterance. This kind of marking of roles may be thought of as the use of second-order symbols, since the function of the markers is to indicate how the linguistic items they mark should be construed in the meaning of the utterance as a whole.

Entrenchment and Preemption. There must be constraints to schematization and analogy, and these are provided by entrenchment and

preemption. Entrenchment simply refers to the fact that when an organism does something in the same way successfully enough times, that way of doing it becomes habitual and it is very difficult for another way of doing that same thing to enter into the picture. Preemption, or contrast, is a communicative principle of roughly the form: if someone communicates to me using Form X, rather than Form Y, there was a reason for that choice related to the speaker's specific communicative intention. This motivates the listener to search for that reason and so to distinguish the two forms and their appropriate communicative contexts. Together, entrenchment and preemption may be thought of as a single process of competition in which the different possible forms for effecting different classes of communicative functions compete with one another based on a number of principles, including frequency/entrenchment.

It is nevertheless true that we know very little about the specifics of how all of this works. Thus, we know very little about the nature and frequency of the syntactic overgeneralization errors that children make at different developmental periods. Further, there is only one empirical study evaluating the effectiveness of entrenchment in preventing syntactic overgeneralizations (Brooks et al., 1999), and that study has no direct measures of the exact frequency of the verbs involved. Similarly, there is only one study of preemption and of semantic classes of verbs as constraining factors (Brooks & Tomasello, 1999a), and this study worked with only a narrow range of structures and verbs. And so, until we actually do some of the empirical work necessary, and see how these general principles actually work when applied to specific linguistic items and structures in specific languages, we will still be doing a fair amount of hand waving about how children make exactly the generalizations they do and not others. But of course it must be added that generative approaches engage in a fair amount hand waving themselves in appealing to abstract principles of universal grammar to constrain children's generalizations as well.

Functionally Based Distributional Analysis. Paradigmatic categories such

as noun and verb provide language learners with many creative possibilities, as they enable learners to use newly learned items in the way that other 'similar' items have been used in the past - with no direct experience. These categories are formed through a process of functionally based distributional analysis in which concrete linguistic items (e.g., words or phrases) that serve the same communicative function in utterances and constructions over time are grouped together into a category. Thus, noun is a paradigmatic category based on the functions that different words of this type serve within nominal constructions - with related categories being such things as pronouns, common nouns, etc., based on the related but different functions these perform. Paradigmatic categories are thus defined in functional terms by their distributional-combinatorial properties: nouns are what nouns do in larger linguistic structures. This provides the functional basis by means of which these paradigmatic linguistic categories cohere.

It is important to emphasize that this same process of functionally based distributional analysis also operates on units of language larger than words. For example, what is typically called a noun phrase may be constituted by anything from a proper name to a pronoun to a common noun with a determiner and a relative clause hanging off it. But for many syntactic purposes these may all be treated as the same kind of unit. How can this be - given their very different surface forms? The only reasonable answer is that they are treated as units of the same type because they all do the same job in utterances: they identify a referent playing some role in the scene being depicted. Indeed, given the very different form of the different nominals involved, it is difficult to even think of an alternative to this functionally based account.

Categorization is one of the most heavily researched areas in the cognitive sciences, including developmental psychology. But how children form categories in natural languages - a process of grouping together not items of perceptual or conceptual experience but rather items used in linguistic communication - has

been very little investigated. The arguments made here suggest that future research on children's skills of linguistic categorization should focus on communicative function as an essential, indeed the essential, element - analogous to the focus on function in the work of Nelson and Mandler on event categories and slot-filler categories in nonlinguistic domains. It is only by investigating how children identify and equate the functional roles linguistic items play in the different constructions of which they are a part that we will discover how children build the abstract categories responsible for so much of linguistic creativity.

Production. If children are not putting together creative utterances with meaningful words and meaningless rules, then how exactly do they do it? In the current view, what they are doing is constructing utterances out of various already mastered pieces of language of various shapes, sizes, and degrees of internal structure and abstraction - in ways appropriate to the exigencies of the current usage event. To engage in this process of symbolic integration, in which the child fits together into a coherent whole such things as an item-based construction and a novel item to go in the slot, the child must be focused on both form and function. The growth of working memory is an integral part of this process (Adams & Gathercole, 2000).

Lieven, Behrens, Speares and Tomasello (2003) recorded one 2-year-old child learning English using extremely dense taping intervals - 5 hours per week for 6 weeks. In order to investigate this child's constructional creativity, all of her utterances produced during the last one-hour taping session at the end of the 6 week period were designated as target utterances. Then, for each target utterance, there was a search for 'similar' utterances produced by the child (not the mother) in the previous 6 weeks of taping. The main goal was thus to determine for each utterance recorded on the final day of the study what kinds of syntactic operations were necessary for its production, that is to say, in what ways did the child have to modify things she had previously said (her 'stored linguistic

experience') to produce the thing she was now saying. We may call these operations 'usage-based syntactic operations' since they explicitly indicate that the child does not put together each of her utterances from scratch, morpheme by morpheme, but rather, she puts together her utterances from a motley assortment of different kinds of pre-existing psycholinguistic units.

What was found by this procedure was that (i) about two-thirds of the multi-word utterances produced on the target day were exact verbatim repetitions of utterances the child had said before (only about one-third were novel utterances); (ii) of the novel multi-word utterances, about three-quarters consisted of repetition of some part of a previously used utterance with only one small change, for example, some new word was 'filled in' to a slot or 'added on' to the beginning or end. For example, the child had said many hundreds of times previously *Where's the ___?*, and on the target tape she produced the novel utterance *Where's the butter?* The majority of the item-based, utterance-level constructions that the child used on the last day of the study had been used by the child many times during the previous six weeks; (iii) only about one-quarter of the novel multi-word utterances on the last tape (a total of 5% of all utterances during the hour) differed from things this child had said before in more than one way. These mostly involved the combination of 'filling in' and 'adding on' to an established utterance-level construction, but there were several utterances that seemed to be novel in more complex ways

It is important to note that there was also very high functional consistency across different uses of this child's utterance-level constructions, that is, the child filled a given slot with basically the same kind or kinds of linguistic items or phrases across the entire six week period of the study. Based on these findings, we might say that children have three basic options for producing an utterance on a particular occasion of use (1) they might retrieve a functionally appropriate concrete expression and just say it as they have heard it said; (2) they might retrieve an utterance-level construction and simultaneously "tweak" it to fit the current communicative situation by filling a

new constituent into a slot in the item-based construction, adding a new constituent onto the beginning or end of an utterance-level construction or expression, or inserting a new constituent into the middle of an utterance-level construction or expression; or (3) they might produce an utterance by combining constituent schemas without using an utterance-level construction on the basis of various kinds of pragmatic principles governing the ordering of old and new information.

These processes of utterance production may be called usage-based syntactic operations because the child does not begin with words and morphemes and glue them together with contentless rules; rather, she starts with already constructed pieces of language of various shapes, sizes, and degrees of abstraction (and whose internal complexities she may control to varying degrees), and then “cuts and pastes” these together in a way appropriate to the current communicative situation. It is important to note in this metaphor that to cut and paste effectively a speaker is always making sure that the functions of the various pieces fit together functionally in the intended manner – one does not cut and paste indiscriminately in a word processing document but in ways that “fit”. These processes may also work at the level of utterance constituents and their internal structure.

4.3. Individual Differences

Most of the work on individual differences in language development has focused on vocabulary. Individual differences in grammar, the learning of constructions, is much less well-documented. But there is at least some interesting work on individual differences in both the rate and the style of early grammatical development (see Bates et al., 1988, and Lieven, 1997, for overviews).

Rate. There are several widely used standardized instruments for measuring the rate of children's grammatical development (often in clinical settings), but they are fairly labor intensive and require linguistically sophisticated researchers. Consequently, there is only one that has been used to conduct large-scale norming studies and that is the MacArthur Communicative

Development Inventory (MCDI; Fensen et al., 1994), which is basically a standardized parent interview. The section of the instrument that deals with grammar asks parents to mark on a computerized form which of two alternatives "sounds most like the way your child talks right now". For example, parents are asked to choose between *Baby crying* and *Baby is crying* or between *I like read stories* and *I like to read stories* or between *I want that* and *I want the one you got* or between *I no do it* and *I can't do it*.

Fensen et al. conducted a large-scale norming study with the MCDI with over 1000 English-speaking children from 16 to 30 months of age. Giving a score of 1 and for the more sophisticated alternative of each pair (and 0 for the less sophisticated), they found that at 24 months of age 25% of English-speaking children obtain a score of 2 or less, whereas another 25% obtain a score of 25 or more (out of a total possible 37). At 30 months of age, the lowest 25% of the children scored at 15 or below, whereas the highest 25% were basically at ceiling with a score of 36 or greater. And so, to the extent that this "quick and dirty" assessment is accurate (and the score children obtain correlates well with their grammatical sophistication as scored by more complex methods in the laboratory), we can see that children's grammatical skills are extremely highly variable for the first two and half years of life at the very least.

Explanations for this variability basically fall into two categories. On the one hand, it may be that some children are more efficient learners than others. For example, girls consistently score slightly higher than boys on the MCDI as a whole, and this may be because they are better language learners. There also some very interesting data showing that children with larger working memories seem to learn and process language more efficiently (Adams & Gathercole, 2000). But in general we have very little information on specific child variables that may be responsible for individual differences in typically developing children in the domain of grammar.

On the other hand, we have very large amounts of data demonstrating that the language learning environment in which children grow up is responsible for at least some of the individual differences in rate of development. For example, Nelson (1977) found that providing young children with extra exemplars of some complex syntactic constructions facilitated their acquisition of those constructions. Similarly, the training study of Childer's and Tomasello (2001), described above, also demonstrated that a large number of exemplars of a syntactic construction given to children over a short period of time can facilitate their acquisition of that construction quite dramatically. And Huttenlocher et al. (2003) have recently found that children's mastery of complex constructions (multi-clause sentences) are strongly related not only to the frequency with which their parents use these constructions, but also to the frequency with which their teachers at school use these constructions (thus diminishing the plausibility of shared genetics between parent and child as an explanation for the parent-child correlations).

But it is not only the quantity of language that children hear that affects their language development, it is also in some cases the quality of that language. For example, Farrar (1990, 1992) found that children's acquisition of some particular grammatical morphemes in English (e.g., past tense *-ed*, plural *-s*, progressive *-ing*, etc.) was facilitated when mothers used these morphemes as immediate recasts of the child's utterances that were missing them; for example, the child might say "I kick it" and the mother might reply "Yes, you kicked it". Adult conversational replies that maintain the child's topic and to some extent her meaning, while at the same time recasting it into a more adult-like form, are thought to be especially important in helping children to identify grammatical elements with low salience since they provide them with an immediate comparison of their own immature utterance and the corresponding full adult form with full morphology and grammar (Nelson, 1986).

Style. Nelson (1973) proposed that some children acquire linguistic competence by focusing mostly on words, whereas others acquire their language

by focusing more on larger phrases and fixed expressions such as *Gimme-dat*. She called the first type of learner referential and the second type expressive (Bates et al., 1988, called the first type of learner analytic and the second type holistic). As a dichotomous classification, this typology has not fared well empirically, as most children acquire both words and larger phrases/expressions simultaneously. However, there does seem to be a continuum such that some children seemed to acquire large vocabularies before they produce longer sentences, whereas other children produce seemingly longer expressions (whose internal structure they may or may not understand) from early in development (Lieven, 1997).

The factors responsible for such individual differences in language acquisition style are not known. Noting that there are also individual differences that may be characterized as analytic-holistic in human visual information processing, Bates et al. (1988) speculated that perhaps some children may be more inclined toward analytic or holistic processing strategies naturally. Also interesting is the possibility that some children are naturally greater risk takers than others, and so attempt longer utterances with less well-developed skills than others (Dale and Thornton, 19xx, report that it is more advanced children that tend to make *I-you* reversal errors, perhaps because they are greater risk takers). On the other hand, there is some evidence that laterborn children tend to adopt more holistic strategies, and it is therefore possible that being exposed to more third-party child-directed speech (i.e., as parents talk to the sibling) plays some role (Barton and Tomasello, 1994). It is also possible that experiencing language mostly in imperative utterances also tends to make children more holistic learners (Barton & Tomasello, 1994).

4.4. Atypical Development

Because language is such a complicated phenomenon, it can go wrong in many different ways. The scientific study of atypical language development has for the most part focused on four developmental disorders that have serious consequences for language acquisition: Down syndrome, Williams syndrome, autism, and specific

language impairment. Although there is much clinical literature focused on issues of language diagnosis and assessment for all of these groups, there is actually surprisingly little basic research on the process of grammatical development in any of them.

Down Syndrome. Children with Down syndrome are significantly delayed in their grammatical development. And is not just an overall delay; they produce simpler and shorter sentences than typically developing children and Williams syndrome children who have the same vocabulary size (Singer et al., 1994, as cited in Tager-Flusberg, 1999). Most Down syndrome children never master truly complex syntactic constructions involving sentence embedding and the like (Fowler, 1990), even though significant gains in language development continue to occur in many of these children well into adolescence (Chapman et al., 1992).

Although not enough research has been done to be sure, it would seem that the main problem of children with Down syndrome is a cognitive one. They have a number of cognitive weaknesses - many but not all of which show up on standard IQ tests - that might plausibly be linked to their delayed language development. In particular, although no experiments have been done, there is some suggestive correlational evidence that the specific problem, or at least one specific problem, may be with working memory in the auditory domain (Jarrold, Baddeley, & Phillips, 2002; Laws & Gunn, 2004).

Williams Syndrome. Children with Williams syndrome also have a number of cognitive deficits - some but not all of which show up on standard IQ tests - especially in the domain of spatial perception and cognition (Mervis et al., 1999). Although initial reports suggested that these children might nevertheless have relatively normal language development (e.g., Bellugi et al., 1988), more recent research demonstrates that they do indeed have significantly delayed syntactic development in general, with the majority of Williams children never able to correctly understand complex syntax such as sentence embedding (Karmiloff-Smith et al., 1998; Mervis et al., 1999).

One reason why Williams syndrome children were originally thought to have

such amazing syntactic skills is because in the original studies they were compared to children with Down syndrome, and as noted above these children have syntactic development that is poorer than would be expected from their vocabulary sizes. Williams syndrome children, on the other hand, have syntactic development that is accurately predicted both by their vocabulary size and by their mental age as assessed by IQ tests (see Tager-Flusberg, 1999, for a review). In addition, just as for children with Down syndrome, there is correlational evidence for children with Williams syndrome that one specific cognitive problem contributing to their language delay is auditory working memory (Mervis et al., 1999).

Children with Autism. Autism is a disorder less of general cognition than of social cognition and social relations. It is thus not surprising that about half of all children with autism do not have the social-cognitive and communication skills necessary to acquire any serviceable language at all, and those who do almost invariably have abnormal pragmatics skills. In a study looking at standardized language scores for young adults with autism, who used some language, Howlin et al. (2004) found that 44% had a language age below 6 years; 35% scored within the 6 to 15 year range; and only 16% scored above the 15 year level.

The grammatical development of those children with autism who do speak has been very little studied, but it is clear that it is significantly delayed (Tager-Flusberg et al., 1990). That is, when sentences of equal length are compared between children with autism and typically developing children, the sentences of children with autism are significantly less complex syntactically (Scarborough et al., 1991). The most plausible explanation for this finding is that children with autism are highly echolalic/imitative/repetitive, and so they have quite a bit of formulaic speech - which makes them appear more syntactically competent than they really are (Tager-Flusberg and Calkins, 1990 - although these researchers did not find that sentences which were immediate repetitions of adult utterances were syntactically more complex than spontaneously produced sentences). In general, there are very few studies of grammatical development in children with autism, and no studies of older

children involving complex syntax.

Specific Language Impairment. The diagnosis specific language impairment (SLI) is intended to identify children who have language problems but no other obvious cognitive or social-cognitive deficits (including no problems with hearing). This means that children with this diagnosis actually form a fairly heterogeneous group, whose only commonality is that their language development gets off to a fairly slow start and continues to be an area of weakness. There are no widely accepted subgroupings of children with SLI, but some researchers refer to a minority of these children as having pragmatic language impairment (PLI), which resembles in some ways autism (Bishop, 1997). More commonly, researchers refer to expressive SLI and expressive-receptive SLI, with the most severe problems associated with the latter diagnosis which involves problems of language comprehension.

Although not typically detectable on IQ tests, it turns out that SLI children, or at least some of these children, quite often have relatively subtle perceptual or cognitive deficits of one kind or another (Leonard, 1998, Chapters 5 and 6). Thus, one possible problem for some SLI children is in processing speech, that is, in dealing with the rapid vocal-auditory sequences that make up complex sentences (Tallal, 2000). This can often result in problems specifically with grammatical morphology, which is quite often of low perceptual salience in the speech stream (Leonard et al., 2003). Also, there is very good recent evidence that, like many children with atypical language development, some of SLI children's problems with language may derive from problems with auditory working memory (Gathercole & Baddeley, 1990; Bishop, North, & Donlan, 1996; Conti-Ramsden, 2003).

5. Conclusions

Acquiring a language is one of the most complicated tasks facing developing children. To become competent users of natural language, children must, at the very least, must be able to: comprehend communicative intentions as expressed in utterances; segment communicative intentions and ongoing speech

and so extract individual words from these utterances; create linguistic schemas with slots; mark syntactic roles in item-based constructions; form abstract constructions across these schemas via analogy; perform distributional analyses to form paradigmatic categories; learn to take their current listener's perspective into account in both forming and choosing appropriately among conventional nominal and clausal constructions; learn to comprehend and express different modalities and negation (speaker attitude); acquire competence with complex constructions containing two or more predicates; learn to manage conversations and narratives, keeping track of referents over long stretches of discourse; cut and paste together stored linguistic units to produce particular utterances appropriate to the current communicative context; and on and on.

There are no fully adequate theoretical accounts of how young children do all of this. One problem has been that quite often the study of language acquisition has been cut off from the study of children's other cognitive and social skills - with linguistic theories that barely make reference to these other skills. But in the current view our best hope for unraveling some of the mysteries of language acquisition rests with approaches that incorporate multiple factors, that is, with approaches that incorporate not only some explicit linguistic model, but also the full range of biological, cultural, and psycholinguistic processes involved. Specifically, it has been argued here that children need to be able (i) to read the intentions of others to acquire the productive use of meaningful linguistic symbols and constructions and (ii) to find patterns in the way people use symbols and thereby to construct the grammatical dimensions of language. The outstanding theoretical question in the field is whether, in addition, children's language learning also incorporates an innate universal grammar and, if so, what functions this additional element might serve.

In the meantime there is much to be done empirically. We know very little about how children segment the communicative intentions behind utterances into their sub-components. We know very little about how children form analogies

across complex linguistic constructions. Perhaps the weakest part of all theories of language acquisition is how children come to constrain the generalizations that they make to just those generalizations that are conventional in their linguistic community. And how children use their "mind-reading" skills to take into account listener perspective is only now being seriously studied. The utterance production process is also one that requires much more intensive investigation. In general, the way forward in the study of language acquisition involves both more intensive empirical investigations of particular phenomena, and more breadth in the range of theoretical and methodological tools utilized.

References

- Abbot-Smith, K., Lieven, E., & Tomasello, M. (2001). What children do and do not do with ungrammatical word orders. *Cognitive Development, 16*, 1-14.
- Akhtar, N. (1999). Acquiring basic word order: Evidence for data-driven learning of syntactic structure. *Journal of Child Language, 26*, 339-56.
- Akhtar, N., & Tomasello, M. (1997). Young children's productivity with word order and verb morphology. *Developmental Psychology, 33*, 952-965.
- Allen, S. (1996). *Aspects of argument structure acquisition in Inuktitut*. Amsterdam: John Benjamins.
- Baker, C.L., & McCarthy, J.J. (1981). *The logical problem of language acquisition*. Cambridge, MA: MIT Press.
- Barrett, M. (1982). The holophrastic hypothesis: Conceptual and empirical issues. *Cognition, 11*, 47-76.
- Barton, M., & Tomasello, M. (1994). The rest of the family: The role of fathers and siblings in early language development. In C. Gallaway & B. Richards (Eds.), *Input and Interaction in Language Acquisition*. Cambridge: Cambridge University Press.
- Bates, E., & MacWhinney, B. (1979). The functionalist approach to the acquisition of grammar. In E. Ochs & B. Schieffelin (Eds.), *Developmental pragmatics*. New York: Academic Press.
- Bates, E., & MacWhinney, B. (1982). A functionalist approach to grammatical development. In E. Wanner & L. Gleitman (Eds.), *Language acquisition: The state of the art*. Cambridge: Cambridge University Press.
- Bates, E., & MacWhinney, B. (1989). Functionalism and the competition model. In B. MacWhinney and E. Bates (Eds.), *The cross-linguistic study of sentence processing*. Cambridge: Cambridge University Press.
- Bates, E., MacWhinney, B., Caselli, C., Devoscovi, A., Natale, F., & VENZA, V. (1984). A cross-linguistic study of the development of sentence comprehension strategies. *Child Development, 55*, 341-354.

- Bates, E., Bretherton, I., & Snyder, L. (1988). *From first words to grammar: Individual differences and dissociable mechanisms*. Cambridge: Cambridge University Press.
- Bauer, P. (1996). What do infants recall of their lives?: Memory for specific events by one- to two-year-olds. *American Psychological Association, 51*, 29-41.
- Behrens, H. (1998). Where does the information go? Paper presented at MPI workshop on argument structure. Nijmegen.
- Bellugi, U., Marks, S. Bihrl, A., & Sabo, H. (1988). Dissociations between language and cognitive functions in children with Williams Syndrome. In D. Bishop & K. Mogford (Eds), *Language development in exceptional circumstances* (pp 177-189). London: Churchill Livingstone.
- Berman, R. (1982). Verb-pattern alternation: The interface of morphology, syntax, and semantics in Hebrew child language. *Journal of Child Language, 9*, 169-91.
- Berman, R. (1993). Marking verb transitivity in Hebrew-speaking children. *Journal of Child Language, 20*, 641-670.
- Bishop, D.V.M. (1997). *Uncommon understanding: Development and disorders of language comprehension in children*. East Sussex, UK: Psychology Press.
- Bishop, D., North, T. & Donlan, C. (1996). Nonword repetition as a behavioural marker for inherited language impairment: Evidence from a twin study. *Journal of Child Psychology and Psychiatry, 37*, 391-403.
- Bloom, L. (1971). Why not pivot grammar? *Journal of Speech and Hearing Disorders, 36*, 40-50.
- Bloom, L. (1973). *One Word at a Time*. The Hague: Mouton.
- Bloom, L. (1992). *Language Development from Two to Three*. Cambridge: Cambridge University Press.
- Bloom, L., Tinker, E., & Margulis, C. (1993). The words children learn: Evidence for a verb bias in early vocabularies. *Cognitive Development, 8*, 431-450.
- Bowerman, M. (1976). Semantic factors in the acquisition of rules for word use and sentence construction. In D. Morehead & A. Morehead (eds), *Directions in normal and deficient child language*. Baltimore: University Park Press.

- Braine, M. (1963). The ontogeny of English phrase structure. *Language*, 39, 1-14.
- Braine, M. (1971). On two types of models of the internalization of grammars. In D.I. Slobin (Ed.), *The ontogenesis of grammar*. New York: Academic Press.
- Braine, M. (1976). Children's first word combinations. *Monographs of the Society for Research in Child Development*, 41(1).
- Bridges, A. (1984). Preschool children's comprehension of agency. *Journal of Child Language*, 11, 593-610.
- Brown, R. (1973). *A first language: The early stages*. Cambridge, MA: Harvard University Press.
- Brown, A., & Kane, M. (1988). Preschool children can learn to transfer: Learning to learn and learning from example. *Cognitive Psychology*, 20, 493-523.
- Bruner, J. (1975). The ontogenesis of speech acts. *Journal of Child Language*, 2, 1-20.
- Bybee, J. (1985). *Morphology: A study of the relation between meaning and form*. Amsterdam: John Benjamins.
- Bybee, J. (1995). Regular morphology and the lexicon. *Language and Cognitive Processes*, 10, 425-455.
- Cameron-Faulkner, T., Lieven, E., & Tomasello, M. (2003). A construction based analysis of child directed speech. *Cognitive Science*, 27, 843-873.
- Chomsky, N. (1968). *Language and mind*. New York: Harcourt Brace Jovanovich.
- Chomsky, N. (1980). Rules and representations. *Behavioral and Brain Sciences*, 3, 1-61.
- Conti-Ramsden, G. (2003). Processing and linguistic markers in young children with specific language impairment (SLI). *Journal of Speech, Language and Hearing Research*, 46, 1029-1037.
- Croft, W. (1991). *Syntactic categories and grammatical relations: The cognitive organization of information*. Chicago: University of Chicago Press.
- Croft, W. (2001). *Radical Construction Grammar*. Oxford: Oxford University Press.
- DeVilliers, J., & DeVilliers, P. (1973). Development of the use of word order in comprehension. *Journal of Psycholinguistic Research*, 2, 331-341.

- Dick, F., Bates, E., Wulfeck, B., Utman, J., Dronkers, N., & Gernsbacher, M.A. (2001). Language deficits, localization, and grammar: Evidence for a distributive model of language breakdown in aphasics and normals. *Psychological Review*, 108(4), 759-788.
- Fillmore, C. (1988). The mechanisms of construction grammar. *Berkeley Linguistics Society*, 14, 35-55.
- Fillmore, C. (1989). Grammatical construction theory and the familiar dichotomies. In R. Dietrich & C.F. Graumann (Eds.), *Language Processing in Social Context*. North Holland: Elsevier Publishers.
- Fillmore, C., Kaye, P., & O'Conner, M. (1988). Regularity and idiomaticity in grammatical constructions: The case of let alone. *Language*, 64, 501-38.
- Fisher, C. (1996). Structural limits on verb mapping: The role of analogy in children's interpretations of sentences. *Cognitive Psychology*, 31, 41-81.
- Fisher, C. (2002) Structural limits on verb mapping: the role of abstract structure in 2.5-year-old's interpretations of novel verbs. *Developmental Science*, 5:1, 55-64.
- Galloway, C., & Richards, B.J (1994). *Input and Interaction in Language Acquisition*. Cambridge: Cambridge University Press.
- Gathercole, S. & Baddeley, A. (1990). Phonological memory deficits in language disordered children: Is there a causal connection? *Journal of Memory and Language*, 29, 336-360.
- Gathercole, V., Sebastián, E., & Soto, P. (1999). The early acquisition of Spanish verbal morphology: Across-the-Board or piecemeal knowledge? *International Journal of Bilingualism*, 3, 133-182.
- Givón, T. (1995). *Functionalism and grammar*. Amsterdam: John Benjamins.
- Goldberg, A. (1995). *Constructions: A construction grammar approach to argument structure*. Chicago: University of Chicago Press.
- Gomez, R., & Gerken, L. (1999). Artificial grammar learn by 1-year-olds leads to specific and abstract knowledge. *Cognition*, 70, 109-135.

- Gopnik, A., & Choi, S. (1995). Names, relational words, and cognitive development in English and Korean speakers: Nouns are not always learned before verbs. In M. Tomasello & W.E. Merriman (Eds.), *Beyond names for things: Young children's acquisition of verbs*. Hillsdale, NJ: Lawrence Erlbaum Associates.
- Greenfield, P.M., & Smith, J.H. (1976). *The structure of communication in early language development*. New York: Academic Press.
- Hakuta, K. (1982). Interaction between particles and word order in the comprehension and production of simple sentences in Japanese children. *Developmental Psychology*, 18, 62-76.
- Hauser, M., D. Weiss, D., & Marcus, G. F. (2002). Rule learning by cotton-top tamarins. *Cognition*, 86 (1) B15-B22.
- Hirsh-Pasek, K., & Golinkoff, R.M. (1996). *The origins of grammar: Evidence from early language comprehension*. Cambridge, MA: MIT Press.
- Hirsh-Pasek, K., & Golinkoff, R.M. (1991). Language comprehension: A new look at some old themes. In N. Krasnegor, D. Rumbaugh, M. Studdert-Kennedy, & R. Schiefelbusch (Eds.), *Biological and behavioral aspects of language acquisition*. Hillsdale, NJ: Lawrence Erlbaum Associates.
- Hopper, P., & Thompson, S. (1984). The discourse basis for lexical categories in universal grammar. *Language*, 60, 703-52.
- Hornstein, D., & Lightfoot, N. (1981). *Explanation in Linguistics*. Longman, London.
- Howe, C. (1976). The meaning of two-word utterances in the speech of young children. *Journal of Child Language*, 3, 29-48.
- Howlin, P, Goode, S., Hutton, J. & Rutter, M. (2004). Adult outcome for children with autism. *Journal of Child Psychology and Psychiatry*, 45, 212-229.
- Jarrold, C., Baddeley, A.D., & Phillips, C.E. (2002). Verbal short-term memory in Down syndrome: A problems of memory, auditor or speech? *Journal of Speech, Language and Hearing Research*, 45, 531-544.

- Karmiloff-Smith, A., Tyler, L.K., Voice, K., Sims, K., Udwin, O., Davies, M., and Howlin, P. (1998) Linguistic Dissociations in Williams Syndrome: Evaluating Receptive Syntax in on-line and off-line tasks. *Neuropsychologia*, 36, 4, 342-351
- Kirkham, N., Slemmer, J., & Johnson, S. (in press). Visual statistical learning in infancy: Evidence for a domain general learning mechanism. *Cognition*.
- Langacker, R. (1987a). *Foundations of cognitive grammar, Volume 1*. Stanford, CA: Stanford University Press.
- Langacker, R. (1987b). Nouns and verbs. *Language*, 63, 53-94.
- Langacker, R. (1991). *Foundations of cognitive grammar, Volume 2*. Stanford, CA: Stanford University Press.
- Laws, G. & Gunn, D. (2004). Phonological memory as a predictor of language comprehension in Down Syndrome: A five-year follow up study. *Journal of Child Psychology and Psychiatry*, 45, 326- 337.
- Leonard, L.B. (1998). *Children with specific language impairment*. Cambridge, MA: MIT Press.
- Leonard, L., Deevy, P., Miller, C., Rauf, L., Charest, M. & Kurtz, R. (2003). Surface forms and grammatical functions: Past tense and passive participle use by children with specific language impairment. *Journal of Speech, Language and Hearing Research*, 46, 43-55.
- Lieven, E., Pine, J., & Baldwin, G. (1997). Lexically-based learning and early grammatical development. *Journal of Child Language*, 24, 187-220.
- Lindner, K. (2003). The development of sentence interpretation strategies in monolingual German-learning children with and without specific language impairment. *Linguistics*, 41, 2, 213-254
- Mandler, J. M. (2000). Perceptual and conceptual processes in infancy. *Journal of Cognition and Development*, 1, 3-36.
- Maratsos, M. (1982). The child's construction of grammatical categories. In E. Wanner & L. Gleitman (Eds.), *Language acquisition: State of the art*. Cambridge: Cambridge University Press.

- Maratsos, M., Gudeman, R., Gerard-Ngo, P., & DeHart, G. (1987). A study in novel word learning: The productivity of the causative. In B. MacWhinney (Ed.), *Mechanisms of language acquisition*. Hillsdale, NJ: Erlbaum.
- Marcus, G. F., Vijayan, S., Bandi Rao, S., & Vishton, P. M. (1999). Rule learning by seven-month-old-infants. *Science*, 283, 77-80.
- McCune, L. (1992). First words: A dynamic systems view. In C. Ferguson, L. Menn, & C. Stoel-Gammon (Eds.), *Phonological development: Models, research, and implications*. Parkton, MD: York Press.
- McNeill, D. (1966). The creation of language by children. In J. Lyons & R.J. Wales (Eds.), *Psycholinguistic papers. The Proceedings of the 1966 Edinburgh Conference*. Edinburgh: Edinburgh University Press.
- Mervis, C., Morris, C., Bertrand, J., & Robinson, B. (1999). Tager-Flusberg, H. (Ed.), *Neurodevelopmental disorders*. Cambridge MA: MIT Press.
- Naigles, L. (1990). Children use syntax to learn verb meanings. *Journal of Child Language*, 17, 357-374.
- Nelson, K. (1985). *Making sense: The acquisition of shared meaning*. New York: Academic Press.
- Nelson, K. (1996). *Language in cognitive development*. New York: Cambridge University Press.
- Nelson, K., Hampson, J., & Shaw, L. K. (1993). Nouns in early lexicons: Evidence, explanations and implications. *Journal of Child Language*, 20, 61-84.
- Nelson, K. (1995). The dual category problem in the acquisition of action words. In M. Tomasello & W. Merriman (Eds.), *Beyond names for things: young children's acquisition of verbs*. Hillsdale, NJ: Erlbaum.
- Newport, E.L., Aslin, R.N., & Hauser, M.D. (2001). *Learning at a distance: Statistical learning of non-adjacent regularities in humans and tamarin monkeys*. Boston University Conference on Language Development, November.
- Ninio, A. (1992). The relation of children's single word utterances to single word utterances in the input. *Journal of Child Language*, 19, 87-110.

- Ninio, A. (1993). On the fringes of the system: Children's acquisition of syntactically isolated forms at the onset of speech. *First Language*, 13, 291-314.
- Pawley, A., & Syder, F. (1983). Two puzzles for linguistic theory. In J. Richards & R. Smith (Eds.), *Language and communication*. New York: Longmans.
- Piaget, J. (1935/1952). *The origins of intelligence in children*. New York: Norton.
- Pine, J., & Lieven, E. (1993). Reanalysing rote-learned phrases: Individual differences in the transition to multi word speech. *Journal of Child Language*, 20, 551-571.
- Pine, J., Lieven, E., & Rowland, G. (1998). Comparing different models of the development of the English verb category. *Linguistics*, 36, 4-40.
- Pinker, S. (1989). *Learnability and cognition: The acquisition of verb-argument structure*. Cambridge, MA: Harvard University Press.
- Pinker, S. (1981). A theory of graph comprehension. In R. Freedle (Ed.), *Artificial intelligence and the future of testing*. Hillsdale, NJ: Erlbaum.
- Pinker, S. (1984). *Language learnability and language development*. Cambridge, MA: Harvard University Press.
- Pinker, S. (1999). *Words and rules*. New York: Morrow Press.
- Pizzuto E., & Caselli M.C. (1992). The acquisition of Italian morphology: Implications for models of language development. *Journal of Child Language*, 19, 491-557.
- Ramus, F., Hauser, M.D., Miller, C., Morris, D., & Mehler, J. (2000). Language discrimination by human newborns and by cotton-top tamarin monkeys. *Science*, 288, 349-351.
- Rispoli, M. (1994). Structural dependency and the acquisition of grammatical relations. In Y. Levy (Ed.), *Other children, other languages: Issues in the theory of language acquisition*. Hillsdale, NJ: Lawrence Erlbaum Associates.
- Rispoli, M. (1991). The mosaic acquisition of grammatical relations. *Journal of Child Language*, 18, 517-551.
- Rispoli, M. (1998). Patterns of pronoun case error. *Journal of Child Language*, 25, 533-544.

- Roberts, K. (1983). Comprehension and production of word order in stage 1. *Child Development, 54*, 443-49.
- Rubino, R., & Pine, J. (1998). Subject-verb agreement in Brazilian Portuguese: What low error rates hide. *Journal of Child Language, 25*, 35-60.
- Saffran, J.R., Johnson, E.K., Aslin, R.N., & Newport, E.L. (1999). Statistical learning of tone sequences by human infants and adults. *Cognition, 70(1)*, 27-52.
- Saffran, J., Aslin, R., & Newport E. (1996). Statistical learning by 8-month old infants. *Science, 274*, 1926.
- Schlesinger, I. (1971). Learning of grammar from pivot to realization rules. In R. Huxley & E. Ingram (Eds.), *Language acquisition: models and methods*. New York: Academic Press.
- Serrat, E. (1997). Acquisition of verb category in Catalan. Unpublished Dissertation.
- Slobin, D. (1970). Universals of grammatical development in children. In G. Flores D'Arcais & W. Levelt (Eds.), *Advances in psycholinguistics*. Amsterdam: North Holland.
- Slobin, D. (1982). Universal and particular in the acquisition of language. In L. Gleitman & E. Wanner (Eds.), *Language acquisition: The state of the art*. Cambridge: Cambridge University Press.
- Slobin, D., & Bever, T. (1982). Children use canonical sentence schemas: A crosslinguistic study of word order and inflections. *Cognition, 12*, 229-265.
- Slobin, D. (1973). Cognitive prerequisites for the development of grammar. In C. Ferguson & D. Slobin (Eds.), *Studies of child language development*. New York: Holt, Rinehart, Winston.
- Slobin, D. (1985). Crosslinguistic evidence for the language-making capacity. In D.I. Slobin (Ed.), *The crosslinguistic study of language acquisition, Volume 2: Theoretical issues*. Hillsdale, NJ: Lawrence Erlbaum Associates.
- Snow, C.E., & Ferguson, C.A. (1977). *Talking to children*. Cambridge: Cambridge University Press.
- Stoll, S. (1998). The acquisition of Russian aspect. *First Language, 18*, 351-378.

- Tallal, P. (2000). Experimental Studies of language learning impairments: From research to remediation (pp. 131-156). In D. Bishop & L. Leonard (Eds.), *Speech and Language Impairments in Children*. Hove, UK: Psychology Press.
- Tardif, T. (1996). Nouns are not always learned before verbs: Evidence from Mandarin speakers' early vocabularies. *Developmental Psychology*, 32(3), 492-504.
- Tomasello, M. (1992). *First verbs: A case study of early grammatical development*. Cambridge: Cambridge University Press.
- Tomasello, M. (1999). *The Cultural Origins of Human Cognition*. Cambridge, MA: Harvard University Press.
- Tomasello, M. (2000). Do young children have adult syntactic competence? *Cognition*, 74, 209-253.
- Tomasello, M., Akhtar, N., Dodson, K., & Rekau, L. (1997). Differential productivity in young children's use of nouns and verbs. *Journal of Child Language*, 24, 373-87.
- Tomasello, M. (1998). Reference: Intending that others jointly attend. *Pragmatics and Cognition*, 6, 229-244.
- Tomasello, M. (1998b). *The New Psychology of Language, Volume 1: Cognitive and Functional Approaches to Language Structure*. Mahwah, NJ: Lawrence Erlbaum.
- Tomasello, M. (1998c). One child's early talk about possession. In J. Newman (Ed.), *The Linguistics of Giving*. John Benjamins.
- Tomasello, M. (2003). *Constructing a Language: A Usage-Based Theory of Language Acquisition*. Harvard University Press.
- Weist, R. (1983). Prefix versus suffix information processing in the comprehension of tense and aspect. *Journal of Child Language*, 10, 85-96.
- Wells, G. (1983). *Learning through interaction: The study of language development*. Cambridge: Cambridge University Press.
- Wittek, A. & Tomasello, M. (submitted). German-speaking children's syntactic and morphological productivity.

Table 1. Most general construction types mothers use in talking to their two-year-old children.

	Cameron-Faulkner et al. (2003)	Wells (1983)
FRAGMENTS	.20	.27
one word	.07	.08
multi-word	.14	.19
QUESTIONS	.32	.22
wh-	.16	.08
yes/no	.15	.13
IMPERATIVES	.09	.14
COPULAS	.15	.15
SUBJECT-PREDICATE	.18	.18
transitives	.10	.09
intransitives	.03	.02
other	.05	.07
COMPLEX	.06	.05

Figure 1. Percentage of children that produce transitive utterances using novel verbs in different studies (adapted from Tomasello, 2000).

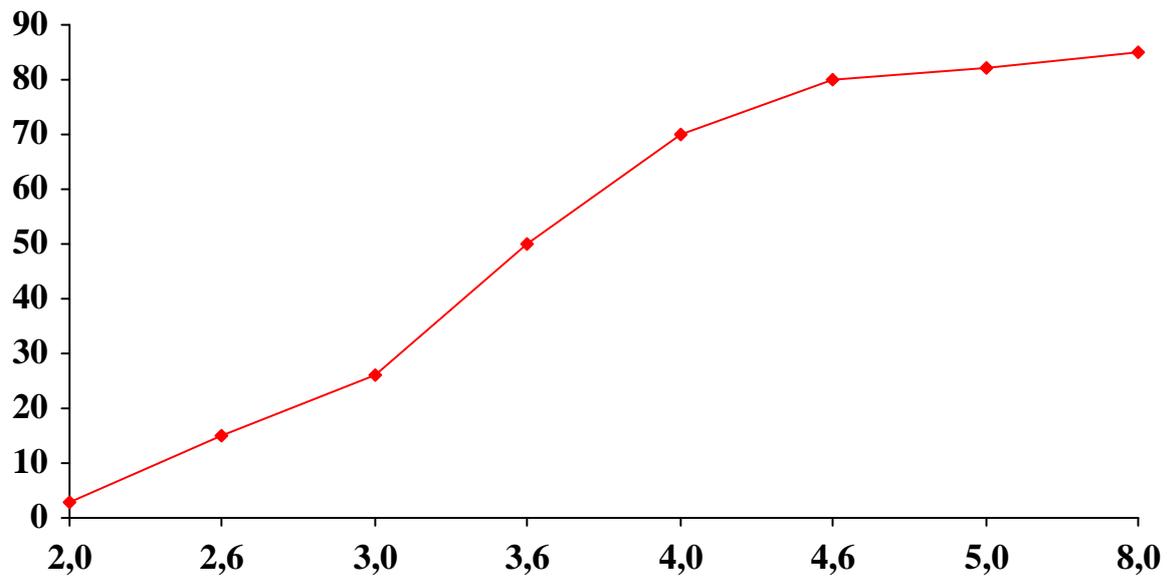


Figure 2. Percentage of utterances in which children “corrected” weird word order to canonical English SVO with familiar and unfamiliar verbs in two studies (Akhtar, 1999; Abbot-Smith et al., 2001).

