

Action Abets Accomplishment: Progress on the Verb learning Front¹

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The time for *action* is now. It's never too late to do something.

Antoine de Saint-Exupery

This is a world of *action*, and not for moping and droning in.

Charles Dickens

When I was kidnapped, my parents snapped into *action*. They rented out my room.

Woody Allen

As the quotations above suggest, action is central to life -- and central to language. It is through action that we carry out our thoughts and plans. But we don't just *act*; we talk about action too, from the toddler who comments on his own actions (e.g., *Me run!*) to the adult who comments sarcastically on the unseen actions of others, e.g., *She said she went to Brazil but she really went to Brooklyn*. While not all verbs capture action per se, some events elicit many more verbs of action than others, as when we watch a football game or a tennis match. Verbs allow us to talk about the relationships that exist between the objects and individuals in our lives. Without verbs, we would be unable to specify just what took place between Sally, the brick, and John. At the critical juncture between words and grammar, lies the frontier of verb learning. Until recently,

¹ This is an introduction to *When Action Meets Word: How Young Children Learn Verbs* (Oxford University Press). We thank Amanda Brandone for her helpful comments.

however, the study of how young children learn how to talk about action has taken a back seat to how they talk about the objects found in their world. Arguably, the study of verb learning *is* the study of language learning. This volume signals the progress we have made in entering this frontier and appropriately elevating the expression of action to its central position in language learning.

What is a Verb?

Verbs are the architectural centerpiece of the grammar, determining the argument structure of a sentence. Verbs can be defined syntactically or semantically.

Syntactically, a verb is a word that takes a subject (or agent) or an object or both. Verbs, for example, can take different morphological forms based on gender, person, number, animacy, indefiniteness, and can be passivized or dativized in many languages.

Semantically, verbs are words that “encode events: A cover term for states or conditions of existence... processes or unfoldings...and actions or executive processes” (Frawley, 1992, p. 141). A verb is a description of a relation that occurs over time. However, verbs are not the only syntactic categories that express action and events and this surely complicates the child’s verb learning task! As Lidz (In press) points out, one can comment on events by using a noun, as in *The race was exciting*, or an adjective, as in *The birds are noisy today*. In general, however, the first relational terms are verbs and the first verbs are motion verbs. If verbs exist in the vocabulary of young children from the outset², why has noun acquisition has been the dominant focus for the field? Why

² There exists a debate on whether children have the syntactic category of *verb* (see Pinker, 1984) or whether they simply have the category of *action* word (see Olguin & Tomasello, 1995).

did the study of verbs fail to capture most researchers' interests (but see Bloom et al., 1975; Gleitman, 1990) while the study of nouns took center stage?

For early researchers in language acquisition, nouns offered a good foundation for studying word learning for a number of reasons. First, nouns appeared to be more predominant in the child's first 50 words (Fenson et al., 1994; Goldin-Meadow, Seligman, & Gelman, 1976). (Some might argue that even that claim was ethnocentric or limited to Western Indo-European languages, e.g., Tardif, 1996). Second, and importantly, nouns are learned quickly and easily compared to other types of words (e.g., Imai et al., in press; Childers & Tomasello, in press). Thus, for both researchers and children, nouns offered a convenient and tractable toe-hold into the word learning system.

Although the literature on nouns shaped theories of word learning, some heralded the importance of studying verbs (Landau & Gleitman, 1985; Bloom, Lifter, & Hafitz, 1980). Further, two influential papers appeared that jolted the field and moved it forward, chastising researchers in early word learning for their myopic attention to nouns (Bloom, Tinker, & Margulies, 1993; Nelson, 1988). Both papers pointed out that the field was studying word learning qua noun learning, despite the fact that children's early vocabularies included diverse word types. In response, researchers started to branch out and investigate other form classes including adjectives (Waxman & Klibanoff, 2000) and verbs (Tomasello & Merriman, 1995). Importantly, the initial focus on nouns and the call to include verbs set us on a trajectory that focused on word learning as it developed within particular syntactic categories. This lens often obscured our study of lexical acquisition in general. Thus, as the field progressed, we attempted to understand the

development of nouns or of verbs or of adjectives, rather than finding a more global and comprehensive theory of word learning.

Are Verbs Really Harder to Learn than Nouns?

A classic and influential article by Gentner (1982) makes this point. Gentner posits that verbs pose special challenges for word learners. Verbs label events that are comprised of components like manner (walk vs. swagger), instrument (hammer, shovel), path (ascend, descend), and result (open, break) – any of which can be the dominant focus for the label (Talmy, 1985). Further, across languages, different components are highlighted such that *manner* is often conflated in English verbs (e.g., *skip*) while *path* is often an integral part of Spanish verbs (e.g., *ascendere*, see Slobin, 2001 or Talmy, 2000 for reviews).

Verbs also describe events in the world and events are by nature more ephemeral than the objects that nouns tend to label (Langacker, 1987; Slobin, 2001). Furthermore, in speech to children, verbs often label these events even *before* the action has taken place (Tomasello & Kruger, 1992), while nouns tend to label enduring entities available for prolonged inspection. Another difference between nouns and verbs is that nouns have a tendency to have more restricted meanings than do verbs. For example, the average dictionary entry for the noun “ball” has only 2 definitions, while the verb “run” has a dramatic 53 entries, all under the classification verb (The American Heritage Dictionary, 1994). Finally, verbs are inherently relational; the use of a verb implies the presence of an actor to carry out that action. These factors (and more – see Golinkoff, Jacquet, Hirsh-Pasek, & Nandakumar, 1996) suggest that verbs are harder to learn than nouns.

Indeed, in the last 10 years both *word-count* studies and *experimental* studies of language acquisition support the claim that nouns and verbs are learned and processed quite differently. Overall, this work has largely affirmed the noun bias in early word learning and has supported the claim that verbs seem more difficult to learn than nouns.

Are Verbs Really Harder to Learn than Nouns?: The Evidence

Goldin-Meadow, Seligman, and Gelman, (1976) were the first to note that children's productive vocabularies were overwhelmingly comprised of nouns. Gentner's (1982) paper spawned even more work in this area as a flurry of studies literally counted the number of nouns and verbs in children's vocabularies. Gentner's original work collected data from 6 languages (English, German, Japanese, Kaluli, Mandarin Chinese & Turkish) and concluded that nouns were the largest and earliest class of words to be acquired with verbs lagging behind. Other studies in Spanish (Jackson-Maldonado et al., 1993), Italian (Caselli et al., 1995), and French (Bassano, 2000; Parisse & Le Normand, 2000; Poulin-Dubois et al., 1995), among others, affirmed this finding. The most recent large-scale study that counted nouns and verbs looked at the relative prevalence of word classes across comparable 20-month-old children from seven countries (Bornstein et al., 2004). Using the Early Language Inventory (a precursor of the CDI), 269 families participated in research that controlled for a number of factors including family income, birth order, and whether they lived in an urban or a rural area. Results suggest that the early vocabularies of children evidence more nouns than verbs in Spanish, Dutch, French, Hebrew, Italian, Korean and American English. Thus, even when the method of data collection was controlled and the sample sizes were large, there seems to be a substantial noun bias.

Though most of the comparison of noun and verb acquisition has occurred in the word counting studies, experimental studies also show the relative difficulty in learning verbs as opposed to nouns. One particularly interesting example comes from what Gleitman and her colleagues refer to as the “human simulation” project (Gillette, Gleitman & Gleitman, & Lederer, 1999; Snedeker & Gleitman, 2004). In these studies, adults viewed a series of video clips of a mother and child playing. A beep occurred coincident with either the missing noun or verb. Participants guessed what word the speaker might have used at that point. The findings in these studies were dramatic. Adults, who presumably had no conceptual difficulties with the objects and events represented on the tapes, correctly guessed the missing nouns in 45% of the cases. Their proportion correct for guessing the verbs however, was a paltry 15%. In fact, if one looked solely at responses for the mental verbs, the proportion of correct verb “guesses” dropped to zero! These results demonstrate that mapping from word to action is considerably more challenging than from word to object. There is a lesson in these studies on the difficulty of verb learning given that the participants were adults and the task was one of simply mapping *known* verbs to events.

For *children* learning a *novel* verb, the verb disadvantage appears to be even more pronounced. A number of investigators have found that verbs are harder to learn than nouns for a variety of reasons, including a preference to attach a new word to an unknown object rather than to its unknown action (Kersten & Smith, 2002; in press; Childers & Tomasello, 2002; Childers et al. in press); a preference for labeling simple actions over complex actions (Maguire et al., in preparation); and a preference for labeling actions of the self over the actions of others (Huttenlocher et al., 1983).

Importantly, this noun advantage is not limited to English, where verbs appear in a disadvantaged position in the middle of the sentence, but also holds true for languages such as Japanese and Chinese, where verbs can appear in isolation or at the end of the sentence (Tardiff, 1996; in press). Cross-linguistic experimental research in both Japanese and Chinese supports the claim that children are worse at mapping and extending labels to verbs than nouns (Imai & Haryu, 2001; Imai, et al., in press) even at the age of five and later! Thus, even in those languages that are thought to have a verb advantage, children struggle with verbs for years after they have mastered noun learning in seemingly identical situations.

Interestingly, there is a convergence in the neurological evidence. Studies have described a dissociation between the processing of nouns and verbs (Miceli, Silveri, Villa, & Caramazza, 1984; Miceli, Silveri, Nocentini, & Caramazza, 1988; McCarthy & Warrington, 1985; Saffran, Berndt, & Schwartz, 1989; Caramazza & Hillis, 1991; Goodglass, 1993; Hillis & Caramazza, 1995; Thompson, Lange, Schneider, & Schapiro, 1997). However, while it may be the case that nouns and verbs are processed differently in the adult brain, in early acquisition the distinction between nouns and verbs may not be that clear. There may be a better way to explain these data other than appeal to form class.

Is it really nouns versus verbs?

The data seem clear. Nouns are easier to process than verbs. But is the distinction really between these syntactic form classes or do the differences in learning across form classes represent a more general division in the types of concepts that words represent? That is, the relevant distinction may not be between nouns and verbs *per se* but rather

between concepts that are more or less abstract and relational. Gentner and Boroditsky (2001) and Snedeker and Gleitman (2004) first mentioned this alternative and Maguire et al. (In press) have developed the argument even further. Nouns and verbs might be better thought of as falling on a *continuum* defined by the concreteness (or imageability or individuability or shape – see Maguire et al. in press) of the named concept. At the “easy” end of the continuum are the words that children learn early – nouns like *shoe* and *car*, and verbs like *kiss* and *eat*. At the “difficult” end, however, are words for concepts that are less perceptually tied, and less context bound. So nouns like *uncle* (part of the kinship system) and *passenger* (a relation an individual has with respect to a vehicle) and verbs like *imagine* and *believe* (that require an understanding of theory of mind) will both be learned late.

The prediction this view makes is that children should first learn the names of concrete objects and of actions that are visible and part of routines. It also predicts that because verbs in general are inherently relational and capture ephemeral events, they are further along that continuum and should be on the whole learned somewhat later than nouns. This prediction also suggests that as Gleitman (1990) and Gentner and Boroditsky pointed out, when verb meanings are dependent on the linguistic system in which they are embedded for their meanings, they will be harder to learn. Second, when young children are said to have verbs in their vocabularies, the meanings of these verbs might be somewhat impoverished. They might not rise to the relational level that they do in adults (Gallivan, 1988; Theakston et al., 2002).

Whether this view is correct or not, the important point is this: The very fact that a debate has emerged about whether there is a distinction between nouns and verbs or

between concrete and abstract words, is a sign of progress made in the area of verb learning. In the last ten years, aspects of verb learning not previously considered have come to the fore.

Verb learning is on the Move

Another way to gauge progress in the area of verb learning (or word learning in general) is to compare the present volume with its precursor. In 1995, Tomasello and Merriman (hereafter referred to as TM) edited the first compendium on verb learning entitled, *Beyond Names for Things: Young Children's Acquisition of Verbs* (1995). This volume was a capstone for the burgeoning interest in verb learning. The TM volume had three sections: 1) "Early words for action," 2) "basic principles of verb learning", and 3) "the role of argument structure." In "Early Words for Action," there were three papers each using observational data to study verb learning. The last ten years have added to that database yielding many studies that probe verb learning in the laboratory. Although there is no substitute for good observational data, moving the study of verb learning to the lab also has its advantages. First among these advantages is that laboratory research permits manipulation of the factors putatively involved in verb learning, allowing us to gain insight into the *process* of verb learning. Further, laboratory studies allow us to uncover the meanings of the verbs children use by systematically studying their extension.

In TM's second section, "Basic Principles of Word Learning", five papers discussed either the fast mapping of verb meanings, building on related work with nouns, or on the social and discourse contexts in which verbs are learned. In 1995, inclusion of the effects of social context and discourse represented an advance. By 2005, the fact that

multiple factors play a role in verb learning seems commonplace. Indeed, there have been many calls for a multifactor theory of word learning (Woodward & Markman, Nelson, Karmiloff-Smith etc.). For example, the Emergentist Coalition Model (Hollich et al., 2000; Maguire et al., in press; Poulin-Dubois & Forbes, in press) posits a word learner that is influenced by perceptual, social, and linguistic cues in establishing reference for a new term. Furthermore, these factors are weighted in development such that word learning is first influenced by the perceptual salience of the concepts words encode, then by the social factors that help establish a referent and refine word meaning, and finally by linguistic information that children were not able to use earlier in the process, such as the frames surrounding the verb. The recognition that verb learning (and word learning in general) is a product of numerous factors is pervasive in the current volume.

Finally, research continues apace on the topic of the third section of the TM volume, “The Role of Argument Structure” (see Naigles & Hoff, in press; Fisher & Song, in press). New research is teasing apart the elements in the sentence surrounding a verb that children exploit to extract the verb’s meaning. For example, young children seem to be sensitive to argument number as a clue to meaning (Fisher, in press; Lidz, in press; Hirsh-Pasek, Golinkoff, & Naigles, 1996) as well as to the noun phrase position (e.g., Fisher, Hall, Rakowitz, & Gleitman).

The volume edited by TM filled a significant gap in language acquisition research at the time. Furthermore, by its inclusion of appealing and pioneering work, it implicitly invited new researchers to contribute to the area. Work described in that volume continues, and some of the same researchers appear in the present volume. However, our

new understanding of the process of verb learning allows us to divide the present volume into four different sections, three of which could not have been included 10 years ago. Although we are just breaking through the verb learning frontier, we can now talk about four preliminary tasks (Golinkoff, Hirsh-Pasek, Liu, Brand, 2002) that children must conquer to master the verb system in any language. These tasks mirror the sections that appear in this volume. First, children must be able to locate the verb in the stream of speech. Second, infants must attend to, individuate, and form categories of actions in their environment. In other words, they must find ways to conceptualize actions and events. Third, children must be able to *map* words to actions and action categories. And fourth, they must map verbs to actions in language specific ways, as languages differ in the kinds of meanings they conflate in their verbs (Talmy, 1985). Next we discuss the organization of the volume and why these four sections fall out of the work currently being conducted in the field.

Organization of this Volume

Our goal for *Action meets word: How children learn verbs* was to provide readers with a volume that might impact the field, serving as a heuristic and spurring researchers on to grapple with questions raised in its pages. The four parts of the volume contain chapters that focus on key issues in verb learning.

Part I: Prerequisites to verb learning: Finding the verb. The first task children face in learning verbs is to locate the verb in the stream of speech. Since 1995 when TM emerged, the field has exploded with studies of how infants find units in the speech stream, through the use of metrical information such as word stress (Jusczyk, 1997), statistical and distributional computations (Saffran, Aslin, Newport, 1996), and even the

phonological properties of frequently heard names (Bortfeld, Morgan, Golinkoff, & Ratbun, in press). Finding the verb in the stream of speech does not mean that infants label it as such, or that, at first, they even recognize that the verb refers to an event. Yet, without this discovery, verb learning could not proceed.

How do children find the verb? Christiansen and Monaghan make a useful distinction between the kinds of cues children might use to find verbs in sentences, a distinction that seems to be adopted implicitly by all the papers in this section. “Language-internal” cues include “aspects of phonological, prosodic, and distributional information that indicate the relation of various parts of language to each other,” while “language-external” cues refer to the correlations between language and the world. Clearly, as pointed out by Gleitman (1990), language-external cues cannot be sufficient for locating the verb or discerning its meaning. This leaves us to determine which language-internal cues (prosodic, distributional, or phonological) children rely on to find the verbs in sentences.

Of the three chapters in this section, each takes a slightly different tack in their attempt to uncover how babies find the verb. The Nazzi and Houston chapter is an excellent review of how babies segment speech into nouns using prosodic and phonological cues with a frank admission that the work on verbs is just beginning. These authors trace infants’ transformation from language-generalist to language-specialist, as infants discover the particular properties of their native language. In particular, they discuss research on how infants might zero in on the acoustic correlates of the word classes of noun and verb. They describe how verbs are at a disadvantage (at least in English) from the start, given that they have “...shorter durations, lower frequency of

appearing in syntactic/prosodic constituent-final positions, and predominant stress pattern being the opposite of that of the majority of English words.” Nazzi and Huston report that verbs are isolated from the speech stream by 13.5 months, about 6 months later than when babies isolate nouns.

Mintz discusses distributional evidence in the form of what he calls “frames” for finding the verb. In Mintz’s words, “The general hypothesis is that words of the same grammatical form-class category (e.g., noun, verb, adjective, etc.) occur in similar distributional patterns across utterances, and that this information could be a basis for learners to identify verbs, as well as other categories.” To see whether frames could help babies find verbs, Mintz reports a frequent frame analysis of six corpora of child-directed speech conducted computationally and shows that these frames yield a high degree of predictability for a word’s form class. For example, a large number of verbs occur in the frame “you...it” suggesting that if babies can exploit these regularities, they would be on their way to verb identification. Mintz finds that by 12 months – an age not far from the 13.5 months Nazzi and Huston suggested -- babies are able to extract the category of verb from the input. Babies seem to expect verbs to appear in certain frames. Although Mintz is cautious about interpreting his findings as strictly supporting infants’ use of frames, his analysis of how infants use non-adjacent dependencies to categorize elements (although not how to ‘label’ those elements as ‘verb’) is provocative. Mintz fully recognizes, however, that there are often correlated cues available in the input (such as bigram frequency and phonological information) and that it is too soon to know what babies actually rely on to find the verbs in the stream of speech.

Finally, Christiansen and Monaghan embrace a multiple cues approach and try to evaluate the usefulness of one family of cues over others. They perform computational analyses on two sets of child-directed corpora and come to the conclusion that the set of cues a child might use to identify nouns is different than the set of cues used to identify verbs. For verbs, phonological cues might be required to draw together a coherent lexical category. For nouns, distributional cues rather than phonological cues may prove sufficient. However, nothing is simple. They identify 16 different types of phonological cues that operate at the word level, as well as at the syllable and phoneme level.

Whether children rely mainly on distributional cues, as Mintz argues, or acoustic correlates of form class, as Nazzi and Houston and Christiansen and Monaghan suggest, or both, is clearly an issue that must be resolved empirically. Furthermore, as predicted by a model like the Emergentist Coalition model (Hollich et al., 2000), the extraction of form classes from the speech stream may be a moving target in that cues that are useful for verb segmentation in the first year of life may yield to other cues in the second year of life once the child has some language. At that point, language-external cues may become useful as well.

Part II: Prerequisites to verb learning: Finding actions in events. The second task that children must solve to learn a verb is finding individual actions in events. Verbs are about events and infants must attend to and individuate actions in their environment. Research suggests that infants are keenly aware of movement and use movement to individuate objects (e.g., Mandler, 1992, 1998) and actions (Wynn, 1996; Sharon & Wynn, 1998), and even to predict action outcomes (Wagner & Carey, 2005). However, just as finding a verb is not enough, finding the action is not enough: infants must also be

able to form *categories* of actions without language. The action of jumping, for example, refers to a decontextualized category of jumping motions that include different kinds of jumps made by the same actor (e.g., Elmo jumping off tables and chairs), and the same action performed by different actors (e.g., Elmo jumping off the chair and Lala jumping off the chair). Language's efficiency in communication is rooted in the fact that we do not need a new label for each non-identical instance of an action. Importantly, finding actions is itself only a beginning as verbs label relations that go well beyond attention to only action or movement.

The seven chapters in this section of the volume could not have been written in 1995 when the first volume on verb learning was published. At that time there was a large amount of work on infants' categorization of objects in the world (e.g., Oakes & Rakison, 2003) that dovetailed well with the field's focus on noun learning. However, other than work on object permanence that involved dynamic events, and some studies on support (e.g., Keil, 1994), causation (e.g., Cohen, 1993), and discrimination of action roles in events (Golinkoff, 1975; Golinkoff & Kerr, 1978), studies on concepts foundational to verb use were few and far between. Only Choi and her colleagues (e.g., Choi & Bowerman, 1991; Choi, McDonough, Bowerman, & Mandler, 1999) conducted research on how infants conceptualized dynamic spatial events encoded in verbs in Korean.

Mandler's work (1992a, b), stimulated researchers to consider using the framework of the cognitive linguists (Langacker, 1987; Talmy, 1985) to conceptualize how infants viewed events and how that knowledge interfaced with language learning. In her chapter here, Mandler takes the position that, "Actions are central in organizing the

beginning conceptual system” and that a list of prelinguistic primitives (or for Mandler, “image-schemas”) is needed to understand how infants acquire their first verbs. Since, depending on the language, either verbs or prepositions are used to encode dynamic relations, she prefers to use the term “relational words.” Her review of the research from her own lab and other labs leads her to the conclusion that children are in possession of the foundations for verb learning by the end of the first year of life. On Mandler’s read of the research, for example, infants know about the fact that actions are goal-directed and related to other actions when actions are causal. Further, actions can result in many spatial outcomes such as fitting *tightly* or *loosely*.

The chapters that follow by Pulverman, Hirsh-Pasek, Golinkoff, Pruden, and Salkind; by Casasola, Bhagwat, and Ferguson; and by Choi fit beautifully with Mandler’s chapter as they investigate questions about children’s conceptual base prior to verb learning. The relationship between language and thought is a fundamental issue that runs through these chapters and one that will require a good deal more research to sort out. The Pulverman et al. chapter evaluates whether difficulty in analyzing and conceptualizing nonlinguistic events contributes to the documented difficulty in verb learning (see also Maguire et al., in press; Imai et al., in press; Gentner, in press). In particular, research is reported from our labs on two semantic components of nonlinguistic events: *Path*, or the trajectory of an action with respect to a ground (e.g., above or under a ball); and *manner*, or how the action is performed (e.g., jumping and running are different manners) (e.g., Pulverman, Sootsman, Golinkoff, & Hirsh-Pasek, 2003; Pruden, Hirsh-Pasek, Maguire, & Meyer, 2004; Salkind, Golinkoff, & Brandone, 2005). Their findings suggest that infants not only make discriminations between events

based on these components, but that they are capable of forming some *categories* of events along these lines. Furthermore, there is a relationship between infants' ability to see certain distinctions in nonlinguistic events and their level of language development. They conclude much as Mandler did, that infants can look *within* motion events to find the primitives that form the basis for verb learning and can even form categories based on these primitives.

The chapter by Casasola et al. also has as its focus the infants' understanding of motion events and, in particular, how language shapes organization and understanding of these events in the manner required for linguistic expression. They too, explore events in which manner and path are varied and find sensitivity to these distinctions before much language is acquired. In addition, they report on research (similar to Hespos & Spelke, 2004; Choi & Bowerman, 1991) in which infants are familiarized with the spatial relation of containment. Both 10- and 18-month-old English-reared infants are capable of forming this category. However, not all categories relevant to language may be formed early and or without language. Casasola et al. (Casasola, 2005; Waxman & Markow, 1995) provide evidence that the superimposition of language itself may play a pivotal role in highlighting categories for infants that will be relevant to the learning of relational words (see Yoshida & Smith, 2005). The mechanism by which this effect occurs begs for more research.

Choi's chapter addresses several key questions about the relationship between category formation and language in the domain of the same spatial concepts Casasola et al. and Mandler discuss. Choi's work is directed at understanding the kinds of spatial categories that are formed preverbally and how these interact with the language-specific

semantic categories that will later be expressed as either verbs (Korean) or prepositions (English). Choi's data bear on the question of whether there is a universal conceptual core. To address these fundamental issues, Choi used the Intermodal Preferential Looking paradigm (Golinkoff, Hirsh-Pasek, Cauley, & Gordon, 1987; Hirsh-Pasek & Golinkoff, 1996) with Korean and English-reared babies of various ages. Since Korean cuts up the categories of *in* and *on* differently than English, these two languages make excellent test cases. Choi's results fit with those of Casasola et al. and Hespos and Spelke (2004) who report that containment relations seem to be understood at an early age while support relations, possibly because they are more heterogeneous, are more difficult for children to learn.

The rest of the papers in this section are concerned with how children find the action in an event and when and whether they use the actor or speaker's intention as a cue to locating and identifying an action. Buresh, Woodward, and Brune ask whether children analyze events for their meanings or whether they focus on more superficial perceptual aspects of events. In addition, they probe whether infants are aware of what other people attend to in the environment. They report that infants do not begin their action analysis with the general expectation that human actions are goal-directed. However, by the end of the first year, babies are capable of flexible action analysis in situations with highly familiar actions like grasping. They then examine the way children use action words in situ and conclude that the emergence of well-organized action representations precedes their expression in verbs by about a year. They point out that, "having an organized idea does not automatically provide a word meaning," a conclusion similar to that reached by the authors of the next chapter, Loucks and Baldwin.

Loucks and Baldwin are concerned with the same question that Buresh et al. pose. Do infants focus on superficial, perceptual aspect of events or do they analyze what they see in conceptual ways? They review their work on how infants (and adults) find units in the stream of action in the world, units that will have relevance for the learning of verbs. For example, consider a scene of someone working in her kitchen and picking up a fallen dishtowel. How should this scene be divided into units? Loucks and Baldwin raise the possibility that action analysis can actually be hierarchical, analogous to the organization of language. Thus, it can occur at a number of levels, from noting rapid changes in movement, or what they call “featural information” (e.g., a unit might occur when the woman bends to pick up the towel), to analyzing the inferred intentions of the actors, or what they call “configural information,” or global relations among motion elements (e.g., she wanted to rehang the towel). They go on to consider how infants form categories of action, relying on the established literature on face processing as a guide to the questions research might consider. Although more questions exist than have answers, their findings and speculations are relevant to the way in which language influences event segmentation since different languages seem to parse events at different levels of generality.

The final chapters in this section by Poulin-Dubois and Forbes and by Behrend and Scofield increase the grain size of our analysis by asking how children’s cognitive, social, and linguistic abilities interact to enable them to analyze action in events and to learn novel verbs. Both chapters focus on the role that understanding the intention of the actor and speaker plays in learning verbs. Poulin-Dubois and Forbes conclude that “infants are not only competent in discriminating human actions and object motion, but also understand that many different agents are capable of performing the same actions by

the beginning of the second year.” However, these achievements are insufficient for verb learning and extension since toddlers must become aware of the intentions of the actor. Borrowing from the Emergentist Coalition Model (Hollich et al., 2000), Poulin-Dubois and Forbes conclude that verb learning and extension first occur based on a superficial perceptual analysis of how the action *looks*, followed by learning and extension based more on what the actor intends to do.

The chapter by Behrend and Scofield is also concerned with how children interpret the intentions of others and how that effects their judgment about which action is the referent of a novel verb label. Behrend and Scofield turn the sensitivity to actor and speaker intent on its head, studying the effects of whether labeling an action influences whether children interpret the action as either accidental or intentional. By the time children are learning verbs, they need to be sensitive to whether, for example, an intended action was completed or failed. And children must learn the distinction between intended action (as in the verb, *pour*) versus accidental action (as in *spill*). The authors conclude that information about an actor’s stated intentions helps children learn novel verbs at least by three years of age. They reach the interesting conclusion that a recursive relation exists between understanding intention and learning verbs. They write, “...children can bootstrap their way into the verb lexicon as a result of their early understanding of language and intentions, and then they can use their growing competencies with verbs to help them further refine their understanding of actors’ intentions.”

Part III: When action meets word: Children learn their first verbs. The first two sections of the volume were primarily concerned with the underpinnings implicated in

verb learning. This section addresses how children *map* words to actions and action categories. The fact that infants have action words among their first words is testimony to the fact that they can successfully form some word-action mappings (e.g., Bloom, 1993; Smith & Sachs, 1990). Since the TM volume appeared in 1995, there is much more work on the fast mapping of verbs and on the factors that influence verb learning and extension. It is still unclear, however, what specific parameters guide the extension of action labels to action categories. Furthermore, the papers in this section harken back to the papers in the last section. Even if nonlinguistic studies suggest that children are able to form categories of action, we still need to explain why children have such difficulty learning and extending new verbs. Several of the papers in this section attempt to do just that.

This part of the volume has four papers that address a range of questions on the factors that influence first verb learning. Childers and Tomasello's chapter addresses the way in which novel verbs are presented and how factors like number of exposures, time between exposures, and number of models influences verb learning. They also enter the debate about whether nouns are easier to learn than verbs by controlling a number of variables neglected in prior studies. For example, they controlled for the frames in which nouns and verbs were presented, created stimuli where both objects (labeled with nouns) and actions (labeled with verbs) were both moving, and where self or other was the actor of the action. Under a range of manipulations, verbs were indeed harder to learn than nouns. Indeed, children who had no trouble in a nonverbal condition remembering and understanding an action, still had trouble learning a name for it! Their findings in this

study support the view that, "...noun learning is more robust, and less vulnerable to variations in presentations, than is verb learning."

Naigles and Hoff are concerned with these "variations in presentations' that Childers and Tomasello focused on. However, they construe these variations in terms of the nature of the linguistic input to the child as opposed to the number of times and over what days children hear a verb linguistically instantiated. They are interested not just in learning but in what factors allow children to *extend* a verb meaning to a new situation. While limits to extendability have been well documented, the reasons for young children's conservatism are not clear (see also Bloom, 2000; Dromi, 1987; Golinkoff, Mervis & Hirsh-Pasek, 1994). As a result of their research, Naigles and Hoff believe that the verbs one-year-olds know may be highly idiosyncratic and that differences in input may be responsible. They conclude that, "Rather than examine verb knowledge cross-sectionally and at a single point in time, we believe that what is needed are intensive studies of individual children, who are studied longitudinally from their first use of their first verb." In other words, Naigles and Hoff believe that we could explain much about both early verb learning and extension in individual children if we knew what input they had received.

Maguire, Hirsh-Pasek and Golinkoff accept the findings of studies like Childers and Tomasello's (In press) as a starting point, in that they accept the conclusion that verbs are more difficult to learn and extend than nouns. Similar to Childers and Tomasello's findings on the ease with which children can remember actions without labels, they provide a unique example of the verb learning problem. They describe a study in which infants from 9 to 12 months form a *nonlinguistic* category of an action

(Salkind et al., 2002) that they prove unable to map a verb to a full year later (Maguire et al., 2002). These data are relevant to what they called, the “verb learning paradox”:

Verbs are difficult to learn, but appear in children’s earliest vocabularies. Inspired by Gentner and Boroditsky (2001) and Snedeker and Gleitman (2004), Maguire et al. posit that the problem in verb learning is not a problem with the form class of verbs *per se* but with *relational* words, which include verbs and some nouns, e.g., *uncle* or *passenger* (see Hall & Waxman, 1993; Keil & Batterman, 1984). They argue that “...to learn *any* word – noun or verb -- children must coordinate perceptual, social, and linguistic inputs to uncover more precise word meanings.” By viewing word learning through the lens of the Emergentist Coalition Model (Hollich et al., 2000), a theory blind to word class, they conclude that the ECM offers a unified account of word learning.

Fisher and Song’s chapter specifically focuses on children’s use of linguistic cues to verb meaning in the context of syntactic bootstrapping, or the theory that children can glean information about verb meaning from the syntax surrounding a verb (Landau & Gleitman, 1985; Gleitman, 1990; Naigles, 1990; Hirsh-Pasek, Golinkoff, and Naigles, 1996; Fisher, 1996). As such, Fisher and Song do not focus on the verb *per se* but on a key element in the sentence that offers information about the verb: the sentence subject. Two broad questions motivate Fisher and Song: “What aspects of sentence structures are informative to young children, and what semantic information is conveyed to young children by the structure of sentences?” Fisher and Song, in three experiments, asked what information learners can gain if they identify the noun phrase serving as a sentence’s grammatical subject. This then leads to the question of how children find the grammatical subject to begin with. Fisher and Song suggest that there are a number of

cues to sentence subject (such as agency, animacy, first or second person), which provide probabilistic links between form and meaning. Just as these patterns show up “as powerful tendencies” in English, other, related patterns may show up in other languages. In sum, the identification of sentence subject by whatever means, may influence verb interpretation in important ways.

Part IV: How language influences verb learning: Cross-linguistic evidence. In 1995, TM had only a single chapter on verb learning in a language other than English (Choi & Gopnik, 1995). There has been tremendous progress in studying verb learning in languages other than English, and the six chapters here are testament to that assertion. Such data are crucial for understanding verb learning since languages partition the meanings of verbs in different ways. More interestingly, cross linguistic research is going beyond the description of verb learning in other languages to use other languages as a laboratory for asking questions about *process*.

Lidz eloquently describes the problem of verb learning in general and how constraints from linguistic theory might impact on the child’s verb learning. Then Lidz asks how cross linguistic regularities in children’s verb learning inform us about what linguistic universals likely exist. Given that linguistic universals are arguably based in principled constraints on what a human language is, he examines verb learning to see what generalizations seem to be operating. Lidz notes that causation is universally expressed with transitive sentences, although transitive sentences are not necessarily causal. In experiments on syntactic bootstrapping, children seem to use transitivity as a cue to causation, e.g., Naigles, 1990; Hirsh-Pasek, Golinkoff, & Naigles, 1996; Naigles, Gleitman, & Gleitman, 1992). But does sentential transitivity signal causation to children

because they interpret input that way or because they expect transitivity and causation to be linked across languages? To disentangle this issue, Lidz focused on the language Kannada, spoken in India. Kannada provides an excellent test case since it has a reliable morphemic marker that indicates causation. Using an experimental, “act-out” method (Naigles et al., 1992b), Lidz reported that 3-year-olds uniformly relied on argument number (i.e., transitivity) and not on the morphology that signaled causation more reliability than the syntax! Lidz concludes that some aspects of syntax to semantic mappings need not be learned. From this and another study, Lidz concludes that, “children are constrained to hypothesize verb meanings for novel verbs in just the ways that those verbs are represented in adult languages.”

Four of the five remaining chapters focus on Asian languages. It has been argued that Chinese, Japanese, and Korean present a test case for the early claim – mostly based on data from English --that nouns are easier to learn than verbs. If nouns are truly easier to learn than verbs, then the particular language learned should be irrelevant. But if the nature of the language has an impact on verb learning, then children learning one of these languages should find verb learning easier given the presence of prodrop and SOV sentence structure, which places the verb in the privileged sentence-final position.

Tardif (here and see Tardif, 1996) reports that the vocabularies of children learning Chinese contain roughly equal numbers of nouns and verbs. Tardif’s chapter examines the factors that may give Chinese children their advantage in verb learning and to answer a question posed to her by the late Liz Bates, “But are they really verbs?” Tardif answers with a resounding “yes” and goes on to describe the data sources of the verb advantage as well as a study with adults using the Gillette, Gleitman, Gleitman, and

Lederer (1999) “Human Simulation” paradigm. Both English-speaking and Chinese-speaking adults who are asked to guess missing verbs when they observe scenes of a Chinese mother and child at play, also show a verb advantage (Snedeker, Li, & Yuan, 2003). Why should Chinese verbs be easier for children to learn and for adults to guess? Tardif suggests that the factors responsible include a combination of frequency in the input as well as the specificity of Chinese verb meanings compared to English verb meanings. In fact, recent research by Ma, Golinkoff, Tardif, Hirsh-Pasek, Lannon, Colleen (in preparation) provide confirmatory data: Chinese verbs learned early by young children are more imageable than the verbs English children learn early.

The next chapter however, questions the assumption that verbs in languages like Chinese, Korean, and Japanese are easy to learn and extend, despite the comparable ratio of nouns and verbs in these children’s early vocabularies. Imai, Haryu, Okada, Lianjing, and Shigematsu criticize the data used to support the early verb claims. In particular, they criticize the use of checklist and production data, especially on the grounds that the use of a word does not mean that its meaning is fully mastered. In contrast, Imai et al. report on experimental research using a dynamic action event to examine how verbs are fast mapped in Japanese and Chinese as well as in English (Meyer et al., 2003). In their studies, they show children a novel action being performed with a novel object as they label the scene in various ways. The question they ask is whether children will map a new verb to the new action, and then extend it to an exemplar involving a new object. In a noun condition, they ask whether children can fast map a new noun to the novel object. Their results are startling: While children in all languages readily learn and extend the novel noun by 3 years of age, even 5-year-olds were not at ceiling in the verb condition.

English-speaking American children could in fact only fast map a verb at age 5 if they had a sentence with full syntax, as in “The girl miffed it!” More striking yet is the data from Chinese children. It was not until the age of 9 that they could reliably map the novel verb to the novel action. Imai et al. conclude that their data overwhelmingly support a noun advantage for fast mapping – even in Chinese and Japanese – and that it is the structure of the verb lexicon that is to blame. That is, verbs do not all extend in the same way because languages (and verbs within languages) differ in their conflation patterns (e.g., manner vs. ground vs. cause). Imai et al. endorse Tomasello’s (1995) view that verbs are learned, therefore, one verb at a time, with rules for extension extracted only slowly and with considerable language experience.

Kersten, Smith, and Yoshida also study English, a language that conflates manner of motion in its verbs, and Japanese, a language that tends to conflate path into its verbs. They begin from the assumption that the meanings of verbs in general are more flexible and changeable across different semantic contexts than the meanings of nouns, having the effect that verbs take longer to learn than nouns. They argue too, that the meanings of verbs are more dependent on the objects with which they are involved. For example, we understand that the meaning of say, *run*, implies that its actor has legs. If it is true that knowledge about the object involved in an event is important to learning a new verb, then verb learning should occur more readily in the presence of a known rather than a novel object. Earlier work by Kersten and Smith (2002) demonstrated this was in fact the case. Recall however, that Japanese has many path verbs. Would it still be true that verbs are more likely to be learned in the presence of a known object when path rather than manner of motion is conflated into the verb’s meaning? The answer surprisingly, was yes: Even

Japanese children learning more “extrinsic” path than “intrinsic” manner verbs were sensitive to the object used in the sentence. Whether the lack of difference between English and Japanese children is due to a general need for object information in verb learning or whether attention to the object is a generalization from noun learning is unclear. However, the link between Kersten et al.’s and Imai et al.’s is striking. Object knowledge may be key to learning new verbs.

Lavin, Hall, and Waxman endorse a multifactor view of word learning, opting for a social explanation based in cultural factors. Using a modification of the Gillette and Gleitman “Human Simulation” paradigm, Lavin et al. asked adult subjects (Western students, Japanese students, and second generation Japanese students) to guess the words an American mother was saying to her child in the play scenes. They did not specify the form class of the word to be supplied. The general prediction was that Asian students would focus on actions more than nouns and vice versa for the Western students. They found that all three groups identified more nouns than verbs but that this effect was hugely more pronounced with the Western students. However, there were no differences in the number of correct matches for nouns between the 3 groups, or for the accuracy of the verbs guessed. Reasoning from these data gathered with adults, Lavin et al. conclude that cultural factors may indeed influence the English-speaking child to learn more nouns than verbs. The contrast between Lavin et al.’s findings and Tardif’s report of similar findings (Snedeker, Li, & Yuan, 2003) needs to be reconciled. In future studies, it will be important to disentangle cultural effects from the effects of input.

It is appropriate for Gentner to have the last chapter in this section as she has been a major theorist in discussions of noun and verb learning, as witnessed by the citation of

her papers in virtually every chapter. She first reviews her earlier work and points out the two predictions that the Natural Partitions/Relational Relativity hypotheses make for language acquisition. First, her prediction of a universal early noun advantage seems to be supported by a number of chapters in this volume (e.g., Childers and Tomasello; Imai et al.; Maguire et al.), although Gentner evaluates conflicting claims on this prediction and offers some additional evidence for it. Second, she predicts that knowing many nouns assists in learning relational terms like verbs and prepositions. She goes on to evaluate more predictions that flow from her theorizing and to review four possible reasons why verbs seem to universally lag behind nouns. The thrust of her paper is that verbs are more difficult to learn than nouns because of issues with *mapping*. That is, since verbs do not map transparently to events, children seem to be very conservative in their learning of verbs.

As has been clear from our review of the papers in this volume, substantial progress has been made in the study of verb learning. Indeed, it can be argued, that collectively we have conceptualized the study of verb learning in a far more diverse and empirically grounded way than in 1995 when TM was published. Given the wealth of current research we are finally in a position – although preliminary – to offer a more coherent treatment of the field. In examining the chapters here, there appear to be four new trends worthy of discussion.

The Mapping Problem with Verbs (Is it Unique to Verbs?)

In comparison to 1995, there appears to be a recognition that the problem with verb learning has to do with *mapping*. New research suggests that the conceptual underpinnings for many (but not all) verb concepts are present early (see Mandler;

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Pulverman et al.; Casasola et al.). Furthermore, nouns are readily mapped to novel objects while children appear reluctant to map and extend verbs to novel actions (Gentner; Imai et al.; Maguire et al.; Kersten et al.; Childers & Tomasello; Buresh et al.; Naigles & Hoff; Behrend & Scofield). A parallel set of studies show that in the same experimental design where children mapped nouns to novel objects, children are a full year older before they can map verbs to novel actions (Golinkoff, Hirsh-Pasek, Bailey, & Wenger, &, 1992; Golinkoff et al., 1996). Candidate factors responsible for the problem with mapping verbs to actions are suggested in this volume. In fact, researchers may be starting to gain some purchase on the factors that facilitate mapping in young children. For example, when verbs label visible actions (Maguire et al.), occur with high frequency in the input (Naigles & Hoff), and are performed by known objects (Kersten et al.) they are more likely to be learned than when these factors are not present.

Interestingly, there is also a dawning recognition that the mapping problem may not be unique to verbs but may also extend to abstract nouns, as well as words from other more abstract word classes such as prepositions (Gentner; Maguire et al.). When words are ‘abstract’ (also discussed by various authors as less imageable, less likely to share a common shape, or less individuable) they appear to be harder to learn. This is not a surprise. Consider struggling as a second language learner with a noun like *polite* compared to a word like *pen*. More instances of use, more surrounding linguistic context, and more computation of speaker and actor intentions would be necessary to learn the former than the latter term. Recent work too, suggests that language itself may contribute to solving the mapping problem. When perceptually diverse objects and scenes are labeled with the same word, toddlers appear to interpret this as a cue that the items

labeled are equivalent in some way as well (Waxman & Markow, 1995; Balaban & Waxman, 1977; Casasola et al., in press).

The Search for Multiple Factors

Once we grant that multiple factors influence the mapping process, we are beyond naïve theories of verb learning. The recognition that learning verbs is difficult because, as Slobin (2003) pointed out, “utterances are not verbal film clips of events’ (p. 159), and because verbs encode relations (Gentner, 1982), requires a more complex theory of verb learning. Gleitman and Bloom and their colleagues led the way here, pointing out early and often that verb learning, while central to grammar, must be explained by complex theories. Gleitman captured this insight well in one of her paper titles, “A picture is worth a thousand words and that’s the problem” (Gleitman & Gleitman, 1992). The basic point was that any theory of verb learning that claimed that children could read the meanings of verbs directly from their observation of events could never succeed.

While the insight came early that relying on event perception was insufficient for verb learning, researchers have more recently begun to search for multiple interacting factors in the verb learning process. Lidz, for example, includes observation of events, sentence structure, and morphology in his work. An emphasis on multiple factors was not as prominent in 1995 but today there is an attempt in the field to meet the challenge raised by Hollich et al. (2000) “...of creating a model that considers the impact of multiple sources of information in solving the complex task of word learning (p.109).” The field has begun to move beyond “smoking gun” theories that account for verb learning with one particular process or type of input. This change is also responsive to calls for multifactored approaches to language learning (e.g., Gelman & Williams, 1998;

Siegler, 1996; Nelson, 1996; Thelen & Smith, 1994; Karmiloff-Smith, 1992; Woodward & Markman, 1998). Maguire et al., for example, attempt to expand the Emergentist Coalition Model (Hollich et al., 2000) initially posited for noun learning to cover verb acquisition. That model describes the role of perceptual, linguistic, and social cues and how their weightings change over the course of word learning and development. Many other chapters grant that multiple factors matter for verb learning. Other examples come from chapters by Lavin et al. who point to cultural factors in verb learning while Buresh et al. suggest the importance of social processes for learning verbs.

The Importance of Social Cues

Even in 1995 in the TM volume, two papers discussed the role of *linguistic* cues in verb learning (Gillette, Gleitman, Gleitman, & Lederer 1999; Naigles, Fowler, & Helm, 1992). Yet, few researchers (other than perhaps Tomasello and his colleagues and Nelson, 1996) considered the role that social factors might play in verb learning. In this volume, there are numerous examples of the impact of social cues on verb learning and some of them are stunning. For example, Imai et al. found that 9-year-old Chinese children in their study interpreted a novel verb as a noun. When Imai et al. examined their videos to try to understand this phenomenon, they noted that the actor held the object for a second before the action began. Children apparently noted this subtle extralinguistic and interpreted object holding as a signal that the object, and not the action, was being named. When this extra second was removed, Chinese children were significantly more likely to map the verb to the action!

Another example of the impact of social cues in verb learning comes from Poulin-Dubois and Forbes. They created actions that were only distinct by whether they

appeared to be accidental or on purpose. Children noted this distinction in their verb learning (see also Behrend & Scofield and Buresh et al). Furthermore, to learn verbs like “think” “believe” and “promise” and use them as adults do, children must have a theory of mind, else the computation of these verbs’ meanings would not hit the mark. In addition, many verbs turn on intention for their meanings. Verbs such as *spill* and *pour*, and *slide* and *slip*, label actions that look remarkably similar but are distinguished mainly by whether they were performed with or without intention. To learn these verbs, children must discern an actor’s intention.

The Search for the Underpinnings for Verb Learning

In 1995 there were some chapters in the TM volume that focused on the perceptual and conceptual groundwork of verb learning (Smiley & Huttenlocher, 1995; Choi & Gopnik, 1995; Golinkoff, Hirsh-Pasek, Mervis, Frawley, & Parillo, 1995). However, the laboratory research on these underpinnings was just beginning. In this volume, there are two sections that could not have been included in 1995. The first section on *finding the verbs* addresses the fundamental question of how children isolate verbs in the stream of speech. The second is the section on finding the actions in events. To learn verbs, children must be able to view an event and find its components. Until recently, there has been very little work on how adults, let alone children, parse events (but see Tversky & Sachs, 2001). This will soon be remedied with an edited collection on event perception (Shipley & Sacks, forthcoming), as well as the present collection of chapters that probe infants’ understandings of the events that verbs label. Various approaches (e.g., intention analysis, statistical units, image-schemas, and finding nonlinguistic analogues to linguistic constructs) have been proposed in this volume (e.g.,

Loucks & Baldwin; Pulverman et al.; Mandler; Poulin-Dubois & Forbes). Research is yielding exciting new findings about how infants find actions (Loucks & Baldwin; Casasola et al.; Mandler), note their language relevant components (Pulverman et al.; Maguire et al.), categorize them (Casasola et al.; Pulverman et al.; Buresh et al.), focus on their intentional underpinnings (Loucks & Baldwin; Buresh et al.; Poulin-Dubois & Forbes), and use their native language to shape their nonlinguistic concepts (Choi).

Conclusions

What does it take to learn a verb? This is the fundamental question this volume considers. By investigating this question, we enhance our understanding of the building blocks of language and develop new ways to assess key aspects of language growth. The chapters in this volume have provided preliminary answers from a number of different perspectives and involving a number of different causal factors in interaction. Despite the fact that Shakespeare wrote, “Suit the action to the word, the word to the action,” the chapters in this volume show us that that is no simple task! Given the nuances of verb meaning, there are many verbs that can be used to describe the same action. Part of the task that children face is to uncover the meanings of the verbs they hear, even when different verbs are used in exactly the same setting. Furthermore, as these chapters have detailed, children must first find the verbs in the input before they can make conjectures about their meanings. And they must perceive events in the world in ways that align with the concepts encoded in verbs. As the chapters in the volume indicate, none of these steps in the verb learning process are straightforward -- for the child or the researcher to crack.

How shall we evaluate our efforts to gain some purchase on the verb learning problem? Hemingway reminds us that we must, “Never mistake motion for action.” Ten

years hence when this volume is evaluated by its successor, we hope that its chapters will be taken to represent action forward on the verb learning front and not just motion.

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