11 Verbs, Actions, and Intentions

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Verbs are action words.

The preceding simple definition of verbs has more or less guided the study of children's learning of verbs and their meanings across the first several years of life (e.g. Tomasello & Merriman, 1995). However, this simple definition is also clearly oversimplified—verbs do more than just denote action. Verbs not only denote actions, but also denote the results of those actions, paths of actions, states such as sleep and possession, and many other aspects of the world. Verbs and their argument structures also express grammatically the relations between the multiple elements that play distinct roles in a sentence and in the world.

However, it is not only that verbs can denote many things other than actions and are the key predicates in sentence structure that leads to dissatisfaction with this simple definition. Actions themselves are not simple to conceptualize. In fact, over the past decade a great deal of attention has been paid to children's understanding and appreciation of the mental states that underlie human actions, most notably intentions (see Malle, Moses, & Baldwin, 2001; Zelazo, Astington, & Olson, 1999). Though it should be obvious that verbs can be used to denote not only human actions but the actions of other organisms and inanimate objects as well (e.g. "The plane flew over Missouri"), the relationship between intentions, actions, and the learning of verbs for human actions is a poorly understood and underexplored area of research. In this chapter, we investigate the interrelatedness of human actions, the intentions that guide those actions, and the language used to label and describe those actions. We describe several studies from our program of research, which has for the last several years attempted to empirically document the ways in which intentions, actions, and verbs are related in young children's growing understanding of the physical, mental, and linguistic world around them. Finally, we conclude by suggesting a model in which developmental achievements

in both language development and in early theory of mind—as documented by children's growing sophistication in their understanding of the intentional basis of human behavior—mutually and reciprocally influence each other in nontrivial manners. It is also important at this point to state what this chapter is not about, which is the issue of whether young children's word learning, in general, is predicated on an understanding of the referential intentions of others in their environments (e.g., L. Bloom & Tinker, 2001; P. Bloom, 2000; Tomasello, 1999). Though we do, by necessity, discuss this issue, it is not the focus of this chapter.s

Verbs

The past 15 years have seen a rapid increase in the interest in the acquisition of verbs and their underlying concepts. Perhaps due to the warning of George Miller, whom Medin and Smith (1984) quoted as stating that researchers interested in concept formation appeared to believe that "concept is spelled N,O,U,N" (p. 132), developmental and cognitive scientists alike turned their attention to verbs and their underlying concepts and representations. Much of this first wave of work was dedicated to fundamental issues and the acquisition of verbs and was detailed extensively in the first volume in the developmental literature dedicated exclusively to the topic of verbs (Tomasello & Merriman, 1995).

One of the fundamental issues addressed by this literature was that of comparing verb acquisition to noun acquisition. A number of studies of children's early vocabulary consistently showed that nouns were more common in early lexicons than verbs, often by a wide margin (e.g., Bates, Bretherton, & Snyder, 1988; Benedict, 1979; Gentner, 1982). Though individual and cross-linguistic differences in the noun advantage existed, the evidence was compelling enough for Gentner (1982) to posit her natural partitioning account of this advantage. Gentner argued, in essence, that verbs are tougher nuts to crack than nouns in large part due to the relational nature of verb concepts and, therefore, they are acquired more slowly and enter the child's lexicon later than nouns. An ensuing line of research was dedicated to testing the generalizability of the noun advantage and the natural partitioning explanation of why verbs are so difficult to learn. Much of this research involved cross-linguistic studies of children's early lexical development, with a focus on languages in which verbs appear in more salient (e.g., sentence-final) positions in natural language than in English and other primarily western languages that had been studied. A number of these studies (e.g., Choi & Gopnik, 1995; Tardif, 1996; Tardif, Gelman, & Xu, 1999) showed that the noun advantage was substantially smaller or nonexistent in children learning the languages in question, such as Korean and Mandarin, and the authors of these studies argued that any noun advantage in early lexical development was probably due to language-specific factors. However, reviews of this literature have come to the conclusion that even with these cross-linguistic studies included, there is strong

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evidence to support the position that verbs are less frequently observed in early lexicons across languages and methodologies (Bornstein & Cote, 2004; Gentner & Boroditsky, 2001). Certainly the characteristics of local languages can influence the degree of the noun bias in children's vocabulary but it seems clear that, ceteris paribus, children find verbs more difficult to learn than nouns.

A second fundamental issue addressed by this first wave of research on verb meanings was distinctions between different types of verbs, their underlying concepts, and the types of events that these verbs denoted. Common distinctions made along these lines were between action (or manner) verbs and result (or end-state) verbs, between manner and path verbs, and between causative and noncausative verbs. Early work in this area seemed to show a number of distinct patterns in children's acquisition of these different classes of verbs. For example, Huttenlocher, Smiley, and Charney (1983) showed that very young children's earliest verbs tended to be verbs for simple intransitive actions such as *run* and other simple action predicates including verb particles such as *up*. When change-of-state verbs first appeared in children's lexicons, children used these verbs to describe their own actions rather than the actions of others. Huttenlocher et al. argued that this pattern was due to the fact that young children had access to their own goals and intentions but not to those of other actors in the environment. This argument is not only relevant to the focus of this chapter but prescient in terms of how it anticipated the interest in young children's understanding of intentions that followed.

Additional research on early verb learning demonstrated specific biases in children's learning of novel verbs. Studies by Behrend (1990), Forbes and Farrar (1993), and Forbes and Poulin-Dubois (1997) showed that children between 2 and 5 years of age have a bias to interpret a novel verb used to label a novel event with both a clear manner of action and clear result as referring to the result or end state of the event. This bias also appeared to get stronger as children got older. Children rarely assumed that a novel verb referred to an instrumental component of the novel action, and Forbes and Farrar described children's mapping of novel verbs as "biased and conservative."

Once these relatively consistent biases were established, additional studies addressed the issue of how stable these biases were and what information in the word learning environment could influence these biases. Crucial among these studies were inquiries into syntactic bootstrapping of verb meanings (Gleitman, 1990). Seminal studies by Naigles (1990, 1996) elegantly demonstrated that children could use the syntactic context in which a novel verb was presented to distinguish between causative and noncausative verb meanings. In addition, Behrend, Harris, and Cartwright (1995) demonstrated that children learning English adjusted their learning biases as a function of how the verb was inflected during training. Specifically, preschoolers were more likely to make action verb interpretations of novel verbs presented with a progressive *-ing* ending than when presented with the past *-ed* ending. A third set of studies demonstrated that children's verb learning biases could be changed with experience. That is, children's result verb bias could be overridden if, during training, children saw events with

three different results labeled with a novel verb (e.g., Behrend, 1995; Childers & Tomasello, 2002). Finally, it was shown that word-learning principles similar to those used in noun learning could be applied to verb learning as well (e.g., Golinkoff, Jacquet, & Hirsh-Pasek, 1996). Q2

Thus, the initial wave of interest in and studies on children's verb learning demonstrated that children find verbs more difficult to learn than nouns, that their interpretation of novel verbs used to label human actions are biased, conservative, and susceptible to being overridden by information from the environment. Finally, this research showed that children are able to use multiple sources of information from the linguistic and learning contexts in order to shape the biases they demonstrate when entering into a novel word-learning situation.

Actions

Of course, the statement that verbs are action words raises not only the question of how verbs are learned but also the important question as to how best to define human actions and how children process and understand human action. Though this is not the place to get into a detailed account regarding the nature of human action, it is clear that the issues of the nature of action and children's verb learning are intimately related. It has been argued that the canonical actions are those in which an agent performs an action that produces some effect on the world (e.g., Slobin, 1981). Note that these actions can be described as causative or transitive actions, and, as such, are inherently more complex than simple intransitive actions such as running.

There are several dimensions along which events and the actions that comprise them differ that are relevant to the current discussion. A first dimension involves the number and types of roles that are involved in an action. In the canonical events described by Slobin (1981), there are typically two distinct roles: the actor or agent who performs the action and the patient or subject of that action. Early work in this area by Golinkoff and Kerr (1978) showed that very young children direct a disproportionate amount of their attention to events toward the agent or actor in the event. In addition, Forbes and Poulin-Dubois (1997) showed that toddlers differ in their willingness to extend a verb to an exemplar in which the agent of an action changed. One-year-olds with smaller expressive vocabularies were less likely to extend newly learned novel verbs to exemplars of actions in which the agent differed than 1-year-olds with larger vocabularies or 2-year-olds. This is an intriguing finding, as verbs are usually not restricted to applying to the actions of some agents but not others with the exception of restrictions between major ontological categories (e.g., animate versus inanimate).

Actions also have distinct temporal characteristics. Some have occurred in the past, some are presently occurring, and some have yet to occur. This temporal characteristic is that which is expressed by tense in natural languages. In addition, actions also have distinct temporal contours. Some actions have been completed

while some are ongoing; some occur in a smooth, continuous fashion while others occur repetitively or iteratively. These temporal characteristics of events are those characteristics that are expressed in most natural languages by aspect. Though tense and aspect are nearly hopelessly confounded in English, other languages make much clearer distinctions between when an event occurs in time in relation to the utterance (tense) and that action's temporal contour (aspect). Interestingly, the distinction between continuous and completed events in aspect often initially gets conflated with the action verb/result verb distinction in children's early use of verb inflections (Bloom, Lifter, & Hafitz, 1980; Bronckart & Sinclair, 1973). That is, children often use the progressive *-ing* inflection with manner of action verbs and the past *-ed* with result verbs in a way that suggests that they are marking this aspect of verb semantics rather than the temporal profile of the events (see also Behrend et al., 1995; Tomasello, 1992).

Intentions

A final aspect of human actions that is central to this chapter is the fact that most human actions stem from some sort of a prior mental plan or intention. Though the issue of intentions, per se, has been infrequently raised in the verb acquisition literature, the development of the understanding of intentions and intentionality in young children has been a recent and major focus in the literature on early cognitive development, theory of mind, and social cognition. Indeed, there is a vast philosophical literature and debate on the precise nature of intentions and intentionality (see Brentano, 1874/1973; and more recently Dennett, 1987; Searle, 1983), but for our purposes an intention refers to a mental state or plan that precedes the conduct of an action. An intention to perform an action does not always guarantee that the intended action is performed for several reasons. For example an actor may fail in an attempt to produce an intended action or may simply never get the opportunity to perform an intended action, and so on. It also not necessarily true that all actions performed fulfill some specific underlying intention as in the case of accidents—a child who spills a cup of milk typically (though not always!) does not intend to spill it.

Though this preceding discussion makes it clear that there is not a simple isomorphic relationship between intentions and actions, the understanding that most human action is preceded or accompanied by an intentional state is a cornerstone of the young child's developing theory of mind and, more generally, social cognitive capabilities (e.g., Malle et al., 2001). In Dennett's (1987) terms, when we interpret our own and others' actions in terms of the mental states that underlie those actions, we are taking the intentional stance toward those actions. That is, rather than simply relying on physical or other nonmentalistic explanations of others' behaviors, humans appear to be the only species (with chimpanzees the possible exception; see Povinelli, 2001) that regularly attribute behavioral causes

to internal, mental states. Thus, a hallmark of the human cognitive apparatus appears to be the ability to go beyond the information given in the behavioral stream and make inferences about the underlying mental causes of the actions that make up the stream.

Indeed, recent research on infants and young children's understanding of intentions has focused on the origins and development of these types of inferential abilities. Research using habituation and preferential looking paradigms with infants has shown that children as young as 6 months of age distinguish between animate and inanimate objects as well as the behaviors that actors will direct towards these different classes of objects (Legerstee, 2001; Legerstee, Barna, & DiAdamo 2000). Similarly, research by Woodward and her colleagues has demonstrated that infants appreciate that action is goal directed (e.g., Woodward, 1998, 1999; Woodward & Somerville, 2000). For example, Woodward (1998) found that 9-month-olds and, to a lesser extent, 5-month-olds encoded the goal of an actor's reach. That is, after these infants were habituated to a display in which they saw an arm reaching to one of two toys in a display, the infants dishabituated more strongly to a display in which the reach was directed to a different toy in the same location than to the same toy in a new location. Thus, even though the former scene was more perceptually similar to the training events than the latter scene, infants found the reach to the new object to be more different from the habituation events. Woodward inferred that this pattern of responses would only be demonstrated by infants who had inferred that the goal of the actor's reach was to obtain a particular toy and not simply to touch a particular location in the display.

Studies with slightly older infants have expanded upon the notion that infants have a nascent understanding of the intentional nature of human action. In a classic series of studies, Gergely, Nadasdy, Csibra, and Biro (1995) exposed children to an animate-like stimulus that traveled around an obstacle and then touched another similar stimulus. After being habituated to this scene, 12-month-old infants then saw the same scene without the obstacle present. In one version of this scene, the stimulus followed the same path as it did during the habituation events. In the other version, the stimulus took a direct, straight-line path to its goal. Gergely et al. found that children dishabituated more strongly to the scene in which the stimulus took its original path even though this path was identical to the path on which the children had been dishabituated. Gergely et al. concluded that 12-month-olds adopted the intentional stance and interpreted the stimulus's action in terms of an underlying intention to reach a particular goal (see also Csibra, Gergely, & Biro, 1999).

Meltzoff (1995) extended the exploration of children's understanding of intentions to 18-month-olds. Rather than using habituation procedures, Meltzoff pioneered the behavioral reenactment paradigm. In this paradigm, an experimenter models an action for a child, and then the child is given the opportunity to reenact the action with the same materials. Rather than modeling completed actions, however, Meltzoff modeled what appeared to be unsuccessful attempts at

a completed action. For example, in one event the experiment took a strand of beads and dropped the beads on a table next to a cup. When given the opportunity to reenact this behavior, most children did not simply imitate the exact action that had been modeled; rather, children were more likely to produce the presumed intended action (i.e., dropping the beads in the cup) than to precisely imitate the modeled action. A variety of control conditions and a second experiment using a mechanical (i.e., nonintentional) model allowed Meltzoff to conclude that the children's behavior was a consequence of their assuming that the experimenter intended to perform a specific action (e.g., put beads in the cup) and that imitative behavior in this age group is driven by inferences about another's intentions and not simply by a behavioral matching or mimicry process.

This paradigm has been used successfully by a number of other scholars. Some studies have demonstrated that autistic children, who typically do very poorly on tasks dealing with others' mental states (i.e., theory of mind), perform similarly to typically developing children on this task (Carpenter, Pennington, & Rogers, 2001). In addition, Huang, Heyes, and Charman (2001) used this paradigm and argued that at least some of children's tendency to produce the intended action might be a function of the affordances of the objects used as stimuli (see also Charman & Huang, 2002). In any case, the behavioral reenactment paradigm and other procedures in which children's understanding of intentions are inferred through young children's actions on objects (e.g., Carpenter, Call, & Tomasello, 2002) have enabled researchers to study the development of children's intentional understanding in age groups for whom habituation or preferential looking paradigms are not appropriate.

In our own research, we have used variants of these paradigms in order to understand the relations and interactions between children's growing understanding of others' intentions and the language used to express such intentions. We are by no means the first to note and investigate the relations between these two crucial domains in early development. First, producing language is an intentional action that requires plans for both the motor activities involved in speech as well as the content of the speech itself. Second, the act of labeling an object in the world for a listener may be motivated by referential intentions (e.g., Bruner, 1999). That is, a speaker may have some mental plan from which the act of providing a label for a novel or familiar object follows. Moreover, it has been argued recently that the word learner in this scenario must be aware of and comprehend such referential intentions to be able to benefit from such an ostensive provision of a label for an object (e.g., L. Bloom & Tinker, 2001; P. Bloom, 2000, 2002; Tomasello, 1999, 2001). Without such awareness of others' communicative intentions, the process of language development—and word learning in particular—becomes a much more difficult chore. Given the research documenting infants' and toddlers' propensity to interpret others' behavior in terms of their underlying intentions, it certainly does not appear to be a major leap to assume that children understand linguistic acts in terms of their underlying communicative intentions, referential or otherwise.

Rather than focusing on whether children's understanding of others' intentions (referential or otherwise) aid in the process of language acquisition (which it almost certainly does at some level), we have been interested recently in a much more specific question that has been asked very infrequently in the literature: Can the language used by a speaker in the course of producing an action provide a cue to the young child about the intentions of an actor? Specifically, we have asked whether the use of a novel verb uttered by a speaker to label an action can influence children's interpretations of that novel verb (Behrend & Wittek, 2003, 2004), especially when those actions are the sorts of failed attempts often demonstrated in behavioral reenactment paradigms.

To our knowledge, only Tomasello and Barton (1994) have addressed this question, though in a somewhat different manner than our approach. In that research, 2-year-olds were presented with an actor performing a sequence of two actions with a set of common toys. The actor used a novel verb (e.g., "I'm going to *gorp* it") prior to the onset of the action sequence, and then in the course of the two actions said "Oops!" when performing one of those actions. Children were then given the opportunity to play with the toys and to "*gorp*." Children were less likely to produce the action accompanied by "oops" even when that action was performed first (and, therefore, the action most likely being labeled by the verb that preceded the action sequence). In the terms of the current research, children used the experimenter's utterance of "oops" as a cue to the experimenter's intentions, specifically that she did not mean to perform the action that was followed by "oops."

Our Research Program

We and our colleagues have addressed these issues in a series of studies in our labs. In the first study, Angelika Wittek and I used a modified version of the behavioral reenactment paradigm with a large cross-linguistic sample (Behrend & Wittek, 2002, 2004). In this initial study, we simply added the presentation of a novel verb during the demonstration of novel actions in order to see whether the act of the experimenter labeling her action with a novel verb would alter children's reenactments of demonstrations of failed attempts. Specifically, we predicted that when a failed attempt was labeled with a novel verb that children would be more likely to reproduce the failed attempt than when the action was not accompanied by the novel verb. We reasoned that when an actor takes the time to label her action with a novel verb, then that label would provide a cue that the actor's behavior was *intended*, that is, that she really meant to drop the beads *beside* the cup. We tested both German- and English-speaking children between 18 and 30 months of age in this initial study.

This study was followed up by a series of studies (Childers & Behrend, 2003, 2004) in which the use of a novel verb to label a failed attempt was directly Q3

compared to other types of utterances that accompany actions that can provide cues to an actor's intentions (e.g., "uh-oh" or "oops"). Finally, we will discuss some ongoing research in our lab which turns around the question of the relationship between language and intentions by asking whether having knowledge of an actor's intentions before an action is performed helps young children to learn a novel verb used to label that action.

We (Behrend & Wittek, 2004) first addressed the question of the role played by novel verbs in children's interpretation of other's intentions by making several relatively simple modifications to Meltzoff's (1995) behavioral reenactment paradigm. First, we used Carpenter et al.'s (2001) modification, in which children were given a 20 second manipulation period with the stimuli prior to the demonstration of an action. If during that manipulation period, the child spontaneously performed the target action (e.g., dropping the beads in a cup), then the experimenter demonstrated an alternate target action (or failed attempt) during the demonstration phase of the experiment (e.g., circling the beads around the cup). This was done to control for potential actions suggested by the affordances of the objects (see Huang et al., 2001). Second, half of the actions demonstrated were accompanied by neutral language uttered by the experimenter (e.g., "Watch") and half were accompanied by a novel verb used by the experimenter to label the action (e.g., "Watch me. I'm meeking."). Finally, we used a within-subjects design in which all participants saw four actions, two accompanied by neutral language and two accompanied by novel verbs.

Do Novel Verbs Provide Cues to an Actor's Intentions?

Our participants were 143 children, with an approximately equal number of children in 18-month, 24-month, and 30-month age groups. Half of the children were native American-English speakers (tested in the United States) and half of the children were native German speakers (tested in Germany).

We created four stimulus sets that were modeled after those used by Meltzoff (1995) and Carpenter et al. (2001). Each set included materials that were easily manipulated by children as young as 18 months of age. The order of presentation of the stimulus sets was randomized across participants. With two of the stimulus sets, the experimenter modeled the actual target action for that stimulus set; that is, she put the beads in the cup or pulled the barbell apart. These two events were known as the target trials. For the other two stimulus sets, the experimenter modeled an failed attempt of the target action, that is, she dropped the beads next to the cup or had her hand slip off one end of the barbell while trying to pull it apart. These two events were known as the intention trials. Though it may be somewhat confusing to label these trials with the term intention, we did so in order to be consistent with previous work. The experimenter labeled her action in one of target trials and one of the intention trials with a different novel verb (i.e., "Watch

me *meek*" or "Watch me *tam*") and used neutral language including no verb (e.g., "Watch me") during the other target trial and intention trial. Thus, each child was exposed to one instance of each of four trial types: target-verb (TV), target–no verb (TNV), intention-verb (IV) and intention–no verb (INV). Following the demonstration of each action, the experimenter gave the stimuli to the child and said, "Now it's your turn" in the no-verb trials or "Now it's your turn to X" in the verb trials, where X stands for the novel verb. Of course, the German children received all linguistic input in German (for additional details on the procedure, see Behrend & Wittek, 2004).

Thus, in this experiment, the TV and TNV trials were essentially control trials, while the IV and INV trials were the experimental trials. In particular, we were interested in any differences in the children's production of the target action and the failed attempt between the IV and INV trials. If it is the case that young children used the act of the experimenter labeling her action with a novel verb as a cue that the actor intended to perform that action, then we expected that children will be more likely to produce that failed attempt on the IV trials than on the INV trials or be less likely to produce the target action in the IV trials than on the INV trials. We expected this result because we reasoned that the act of labeling an unfamiliar action with a novel verb would make the child more likely to believe that the performed action was, in fact, the intended action.

As our data were categorical in nature, all primary analyses were conducted using logistic regression. Contrary to our hypothesis, children were not significantly more likely to produce the failed attempt on the IV trials (28%) than on the INV trials (21%), though the effect was in the right direction. However, two results suggested that the presence of the novel verb did have an effect on children's interpretations of the intentions of the experimenter. First, when broken down by age group, the 30-month-olds were more likely than either of the younger two age groups to produce the failed attempt. Second, when we looked at the rates of production of the target action (i.e., putting the beads in the cup), significantly fewer children produced the target action on the IV trials (29%) than on the INV trials (50%). We believe this result suggests that although the presence of a novel verb did not significantly increase the rates at which children produced the failed attempt, it was a potent enough cue to the actor's intentions to draw the children away from the presumed intention of the experimenter. Thus, children were less likely to perform the target action and more likely to perform some other action including, at least for the 30-month-olds in our sample, the failed attempt at a target action. To our knowledge, this finding is the first to demonstrate that the simple act of labeling one's actions with a novel verb can influence children's inferences about an actor's intentions. Not only does this finding demonstrate that children can use language as a cue to an actor's intentions, but the fact that these verbs had never been heard before by the children suggests that there may be more important relations between verb learning and intentional understanding.

Do Novel Verbs Provide Different Cues Than Other Types of Language?

Given this initial finding that labeling an action with a novel verb can influence children's inferences about an actor's intentions, a relatively simple follow-up question presented itself. Perhaps the influence of the verb was not due specifically to the verb used by the experimenter to label her action but was due more generally to the fact that language—any language—accompanied the action. In order to test for this possibility, Jane Childers and I (Childers & Behrend, 2003) have conducted a series of studies in which we compared the effects of a novel verb's presence during the demonstration of a novel action with the effects of a linguistic cue such as "oops." Whereas the novel verb, in our view, is a cue that the actor intended to perform the action that was performed, a linguistic cue such as "oops" is a cue that the actor did not intend to perform that specific action. If the influence of language is a general influence, then there should be no difference between a verb condition and an "oops" condition. If, however, the effect of the verb is more specific, then there should be differential patterns of responding to events accompanied by these linguistic forms.

In Experiment 1, we presented 30 2.5-year-old children with a series of four events demonstrated by the experimenter. Each event had both accidental and intentional components. For example in one event a small toy was suspended in a basked hanging from the center of a tripod. When the experimenter retrieved the toy with her hand (intention) she knocked down the tripod (accident). Each such event was demonstrated three times to each child. Depending on the condition to which the child was assigned the experimenter accompanied the action with different language. In the verb condition, the experimenter said, "I'm going to gorp. I'm gorping! Did you see me gorp?" In the oops condition, the experimenter said, "Oops! Uh-oh. Oh dear." In the control condition, the experimenter said, "Watch. Look. Did you see?" Children were then given the stimuli and allowed to play with them for 30 seconds. Children's responses were coded as producing the intentional action, the accidental action, both actions, or other actions.

The results of this first study were disappointing in that there was no difference between the three experimental conditions. Contrary to our hypothesis, children apparently were not using the language that accompanied the action to help them determine which component of the action to imitate. In fact, children were equally likely to produce the intentional and accidental components of the events across all three conditions. However, there was a strong effect for response type. Across all conditions, children were significantly more likely to produce the intended action than the accidental action, even though both actions had been demonstrated during the training phase. In retrospect this result may not have been so surprising. Given prior findings that children will produce an intended action even when that action has not been directly demonstrated (e.g., Behrend & Wittek, 2004; Meltzoff, 1995), it makes sense that children would prefer to

produce an intended action when that intention is demonstrated for them and that a linguistic manipulation may not be strong enough to sway children away from this strong intentional bias.

Thus, in a second study, we presented 36 2-year-olds with two simpler events in which just the accidental result was demonstrated. This procedure was thus more similar to that used in the standard behavioral reenactment procedure. One event involved a ramp and a toy truck. All children saw the experimenter place the toy truck at the edge of the ramp and let it go. However, instead of rolling down the ramp, the truck was placed so it fell off the top edge of the ramp onto the table. The second event used an inverted plastic bowl with a slot cut into it. The experimenter took a wooden disk, placed it just above the slot (into which the disk could fit), and released it. Instead of falling in the slot, however, the disk slid down the side of the bowl and came to rest on a tray beneath the bowl. Again each child was assigned either to a verb condition, an oops condition, or a control condition.

Once again in this study, the results did not support the hypothesis, though they were in the expected direction. In this study, children frequently produced the intended action at rates similar to those found using the behavioral reenactment paradigm. However, there was again no overall difference in the number of intended actions produced across the three conditions. Though the oops condition, as expected, appeared to enhance this bias to produce the intended action, this condition differed only marginally from the other two conditions combined.

Given these two failed attempts to find the expected effect, we considered another possibility. Given children's strong bias to produce the intended action, perhaps the cue of a novel verb used during the course of an action was not a strong enough signal for children to change their intentional inferences. This may have been especially true for the events and objects in Experiment 2 for which there were clear affordances: A truck rolls down a ramp and a disk fits into a slot that is slightly larger than the disk. We reasoned that the power of a verbal cue to intentionality would be stronger in conditions in which there is not a clear affordance of the objects or in conditions in which there are multiple plausible actions or affordances that can be associated with those objects (see Huang et al., 2001). This interpretation makes sense given the findings that other types of social cues, such as facial expressions used during social referencing by infants and toddlers, are most potent in novel, ambiguous situations (see Feinman, 1983, for a review).

We set out to test this possibility in a third study in which we presented 36 2-year-olds with a series of four novel stimulus sets, each of which had multiple possible actions associated with them. For example, one stimulus set included a spatula with a magnetic strip on its underside and a pretend piece of bread with a magnetic strip on the top. Thus, one could pick up the bread with the spatula either by sliding it underneath the bread (affordance) or by touching the two magnets together and then raising the spatula (novel action). The experimenter

then demonstrated a failed attempt at the novel action; in this example, pressing the bottom of the spatula to the top of the bread and then lifting the spatula up without the bread. Children were once again assigned to either a verb condition, an oops condition, or a control condition. Children's responses were then coded as being either a direct imitation of the failed attempt, a production of the intended action (lifting the bread with the magnets), or a production of the afforded action (scooping up the bread with the spatula).

The results of this study were clear and compelling. Not only did children produce many fewer of the afforded actions but there was a significant difference between the verb condition and the oops and control conditions. In the verb condition, children were significantly more likely to reproduce exactly the failed attempt demonstrated by the experimenter and less likely to produce either the intended or afforded action. Though it could be argued that children in this study may not have known about the afforded action because this action was not demonstrated to them, recall that in the basic behavioral reenactment paradigm children are never shown the afforded action and they nonetheless produce it. Q6 Indeed, Huang et al. (2001) argue that object affordances are the driving force behind children's responses in the behavioral reenactment paradigm and not children's understanding of the actor's intentions. However, as this last study demonstrated that when a novel verb is used to label an unfamiliar action, this verb can be used as a potent cue to an actor's intention when the action to be performed is ambiguous and not simply afforded by the objects. In other words, though object affordances may play a role in children's responses in these types of paradigms, so do children's inferences about an actor's intentions. Not coincidentally, these conditions (i.e., labeling an unfamiliar action with a set of objects that may have multiple affordances) may be just those conditions that best characterize a child learning a novel action verb through ostension.

Thus, this series of studies replicated, extended, and specified the original results obtained by Behrend and Wittek (2004). First, these studies showed that in conditions in which a clear action is afforded by a set of stimuli, 2-year-old children have a strong tendency to produce the afforded, intended action when a failed attempt is demonstrated. Second, these studies established that different types of language used to accompany an action can lead 2-year-old children to make different inferences about an actor's intentions: Terms such as "oops" can strengthen children's existing tendency to produce the intended action, while a novel verb can weaken it. Third, this strong tendency to produce the intended action can overwhelm the more subtle effect that labeling an action with a novel verb has on children's inferences about another's intentions. Labeling an unfamiliar or unexpected action with a novel verb affects children's intention judgments specifically in those situations in which the intended action is not clearly afforded by the stimuli or situations in which there are multiple plausible actions that can be performed.

But what do these results have to say about verb learning per se? A lot, we think. It should be clear that the situation produced by adding a novel verb to the

basic behavioral reenactment paradigm (i.e., labeling an unfamiliar action [prior to the onset of the action] with a set of objects that may have multiple affordances) may be just those conditions that best characterize a child learning a novel action verb through ostension (Tomasello & Kruger, 1992). What our studies make clear is that in addition to considerations about which component of an action a novel verb labels (e.g., Behrend, 1990), the syntactic context in which the verb is used (e.g., Naigles, 1990), and children's basic verb-learning strategies (e.g., Golinkoff et al., 1996), children also use their knowledge of others' intentions and cues to those intentions when making an initial mapping of a novel verb's meaning. In other words, the simple act of labeling an action with a verb may provide multiple, important cues to the verb learner. We pursue this issue even further by asking in the next study whether having a priori knowledge of an actor's intentions can further aid the child who is learning a novel verb.

Does Knowing About Intentions Help Children Learn Novel Verbs?

To this point, our research has been focused on whether language—in the form of a novel verb used to label an action as well as more explicit cues such as "oops"—can inform the young child about an actor's intentions. Certainly it must be the case that children frequently encounter unfamiliar actions in the ongoing behavior stream. For example, while watching a parent work in the kitchen, a child might observe the parent *open* the refrigerator, *wash* the dishes, *grill* the chicken, and so on (cf. Baldwin, Baird, & Saylor, 2001). If the parent chooses to label any of those actions during such a sequence, the act of labeling can not only highlight the specific segment of the behavior stream but can also inform the child that the mother intended to do just what she is doing.

However, given our findings that suggest that a novel verb's impact is greatest in this area when an action is unfamiliar or ambiguous, an obvious additional question can be posed by simply turning the verb-intention relationship on its head: Does having prior knowledge of an actor's intentions aid in the child's learning of a new verb to label an action? Stated another way, will a child perform better in a verb learning experiment when conditions are manipulated such that in some conditions children have an expectation that a particular action is forthcoming while in others children have no such expectation or, at least, a diminished one?

There is some reason to believe that having access to another's intentions may indeed aid the child during verb learning. For example, some early verb learning studies by Tomasello (1995; Tomasello & Kruger, 1992) showed that children performed best on word learning tasks when a novel verb was presented before an action was performed as compared to when the verb was presented while the action was being presented or following the action. Though Tomasello and Kruger (1992) interpreted these results as demonstrating that children may learn words better in nonostensive conditions, an equally likely interpretation could be that

children performed better because the act of labeling an impending action signaled to the child the actor's intentions.

More recent research that is highly relevant to this issue was reported by Poulin-Dubois and Forbes (2002). The authors showed that 27-month-olds but not 21-month-olds used behavioral cues to an actor's intentions, such as eye-gaze and direction of reach, to distinguish between actions labeled by novel verbs. Following Searle, Poulin-Dubois and Forbes argued that by early in the second year of life, children make use of an actor's intention-in-action during verb learning. It is interesting to note that this finding can be contrasted with the earlier findings by Tomasello and Kruger (1992) who showed that children tended to learn verbs better when an actor's prior intentions were expressed when the actor labeled an impending action with a novel verb. At the very least, children are able to use cues to an actor's intentions while an action is occurring in ways that the earlier research did not consider.

The distinction between prior intentions and intention-in-actions is a useful one and one in which we are very interested. Specifically, we are interested in the role that knowledge of another's prior intentions plays during novel word learning. As mentioned previously, one way to demonstrate one's prior intention is to label an impending action with a novel verb. However, rather than examining the role played by the timing of the utterance of a novel verb in relation to the performance of an action (i.e., before, during, or after the action was performed; Tomasello & Kruger, 1992), we were interested in examining whether a child could distinguish between individuals who reliably achieve their stated intentions and those who do not when the child needs to make a decision about the meaning of a novel verb. In other words, can children use their knowledge of the reliability with which an actor fulfills prior intentions in order to choose that actor's behavior as a model action for a newly learned verb or the the behavior of another actor who less reliably fulfills her prior intentions?

Interestingly, a very similar question has been asked recently, but not with regard to verb learning. Koenig, Clement, and Harris (2004) studied whether 3- and 4-year-olds could use an individual's prior "testimony" in order to learn a novel word. Children were exposed to two models, one who correctly labeled a familiar object, and one who incorrectly labeled that object. Subsequently the models used the same novel word to label different objects, and the children were asked to choose which object was the referent of the novel word. In this experiment, children were more likely to choose the label that had been used by the model with a history of prior accurate testimony with regard to her labeling of familiar objects (see also Koenig & Echols, 2003).

Koenig et al. (2004) frame their results in terms of children's ability to rely on testimony given by knowledgeable or trustworthy speakers in order to learn novel words. However, when the words being learned are verbs, it is not simply the trustworthiness of the speaker that must be taken into account, especially when the actor is labeling their own impending action. In the case in which a speaker

says, "I am going to X" prior to performing an action, the speaker is not providing testimony inasmuch as they are expressing a prior intention to perform a specific action. Thus, it becomes an interesting question to ask whether young children will use the reliability of another's statement of their intentions when labeling actions in order to learn a novel verb for a new action.

We are currently addressing this question in our laboratory, using a procedure similar to that used by Koenig et al. (2004). Twenty-five 3- and 4-year-old children were shown a videotape of two female adults. During the training phase, each adult in turn said, "Watch me, I'm going to roll the ball," and then performed an action. However, one of the adults rolled the ball, and the other adult bounced the ball. This demonstration was repeated in reverse order with the same individuals performing the same actions. Thus, one adult was established as a "good intender" and the other as a "bad intender."

During the test phase, children were then shown a series of four test trials depicting the same two adults using a novel verb to label novel actions performed with simple objects. For example, in one test trial one of the adults said, "Watch me, I'm going to *meek* the pompom," and proceeded to flick the pompom over her shoulder. The other adult also said, "Watch me, I'm going to *meek* the pompom," and twirled the pompom above the table. After these two demonstrations, the experimenter (not one of the two models) produced the pompom and said, "Okay, now it's your turn to *meek* the pompom." Children's responses were coded as producing one of the two demonstrated actions or as producing an action that had not been demonstrated.

The results of this first study were intriguing and similar to those reported by Koenig and Harris (2004). Children showed a greater tendency to produce the Q7
action that was performed by the good intender than to produce the action performed by the bad intender, though this was only the case when responses other than the two performed actions were excluded from the analysis. In addition, there was a marginally significant trend for this effect to be stronger in the younger children than in the older children in our sample. These preliminary results suggest to us that children might need additional cues or reminders about which actor was the "good intender" during the test trials. We have modified the procedure and expect that with these additional reminders, all children will show the predicted effect and that we will see fewer irrelevant responses in our sample. Still, we believe that this initial study demonstrates that if a child knows that an actor reliably fulfills their stated intentions, they can then use this information to learn a novel verb for a novel action.

Putting It All Together

The research summarized in this chapter represents our initial efforts to explore the relations between developments in children's understanding of verbs, the

words most frequently used to label human actions, and their growing understanding of intentions, one of the crucial mental states that underlie these actions. Not surprisingly, there appear to be important relations between these two very important aspects of early cognitive and language development. There are three basic findings from these studies that we wish to emphasize. First, children between 18 and 30 months of age change their patterns of responding in a behavioral reenactment paradigm when a modeled "failed attempt" is accompanied by a novel verb. Specifically, these children are less likely to produce the successful target action in this condition compared to when the same action is not accompanied by a novel verb. Second, the influence of labeling an action with a novel verb on children's intentional inferences is greatest when an action is not directly afforded by the stimuli or when there are multiple plausible actions to perform. Given children's strong bias to produce a presumed intended action, this finding suggests that children will use language as a cue to an actor's intention when it is unclear just what that intention is. Third, we have preliminary evidence that suggests, conversely, that knowing the reliability with which an actor fulfills a stated prior intention may aid the child when learning a novel verb used to label a novel action.

These findings, taken together with prior research on children's understanding of intentions and intentional action, suggest that there are important, reciprocal relations between the young child's growing understanding of intentions and the development of the verb lexicon. We speculate here on what those relations might look like and suggest further avenues of research.

First, it seems apparent that infants and young toddlers have substantial competencies in their understanding of the intentional basis of human action prior to the time when children start adding verbs to their lexicon (Carpenter, Akhtar, & Tomasello, 1998; Gergely et al., 1995; Woodward, 1998). In addition, infants are also able to parse the ongoing stream of behavior into action segments that correspond with the initiation and completion of intentional behaviors (Baldwin & Baird, 2001; Baldwin et al., 2001). Baldwin and her colleagues argue that these low-level action parsing abilities are a key to the infant's abilities to make inferences about the underlying intentions of human action. We would add that the abilities to parse the behavior stream and to make intentional inferences late in the first year and early in the second year of life are prerequisites for the child to begin mapping novel verbs onto the actions they observe in their world. It remains intriguing that despite these apparently precocious abilities, the verb lexicon does not begin to grow rapidly until substantially later in the first or second year of life (e.g., Bates et al., 1988). Thus, while these abilities can be seen as necessary for verb learning, they may not be wholly sufficient, and children may use other general or specific word-learning strategies to aid them during early verb learning (e.g., Golinkoff et al., 1996; Hollich, Hirsh-Pasek, & Golinkoff, 2000).

Q8

Once the verb lexicon begins to develop in earnest during the third year of life, we believe that children then begin to use their understanding of verbs and their meanings as tools in their own right to help them make more sophisticated

sense out of the behavioral stream. Specifically, our finding that children can use information about the reliability of an actor's stated intentions to help them learn a novel verb suggests that by three years of age children can not only use language as a cue to an actor's intentions but they also can use their understanding of others' intentions as a cue to the meaning of a novel verb. Thus, we see a recursive relation between these two domains of early competencies: 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.

In fact, we believe that this mutually enhancing relationship between intentional understanding and language development have important implications for the development of other cognitive abilities during early childhood, especially those that have to do with the child's understanding of mental states other than intentions. If the child can come to the understanding that not all intentions are realized in behavior, that not all behaviors are the consequences of a specific intention (i.e., failed attempts, accidents, and mistakes), and that how one labels such actions may vary along these lines (e.g., *pour* vs. *spill*), then children may be compelled to look toward other mental states in order to determine why an agent performed a specific action. Indeed, the child's mastery of the understanding of mental states such as knowledge, belief, and desire make major advances during the preschool years (e.g., Perner, 1991; Wellman, 1992), and these advances may depend to some degree on the child's prior understanding of intentional action and the language used to express such actions. Of course, we are not the first to argue that language and theory of mind developments are related in nontrivial ways (see the chapters in Astington & Baird, in press). However, we believe that Q9
our research program is documenting a specific path through which children may achieve a more mature understanding of the relations between the actions that make up the behavior stream and the mental states of the agents who perform these behaviors (see also Olineck & Poulin-Dubois, 2004).

Conclusion

Verbs are action words. But because they are action words, they are also by necessity words that are intimately related to mental states such as intentions that underlie human actions. Though there are other linguistic forms and structures that can be used to express mental states (e.g., modals), the simple act of labeling one's action with a novel verb appears to influence the child's interpretations of that action. We liken this effect to the effect that a novel noun can have when a speaker labels an unfamiliar object. Just as providing a label for an unfamiliar object highlights object-relevant properties such as shape (e.g., Landau, Smith, & Jones, 1988) and category membership (e.g., Waxman & Markow, 1995), providing a label for an unfamiliar action highlights action-relevant properties such as manner

of action, the result of the action, and, as we have shown here, the intention that underlies that action. Our plans are to continue to investigate these crucial relations between verb learning and intentional understanding, and to focus more specifically on the mechanisms through which developments in these two domains influence one another.

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Chapter 11: Author Queries

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