J. Child Lang. **29** (2002), 759–781. © 2002 Cambridge University Press
DOI: 10.1017/S0305000902005287 Printed in the United Kingdom

Does preemption help children learn verb transitivity?*

PATRICIA J. BROOKS AND OTTO ZIZAK
The College of Staten Island and the Graduate School of the City University of New York

(*Received* 11 *June* 2001. *Revised* 17 *December* 2001)

ABSTRACT

Children's acquisition of the transitivity status of novel verbs was examined to test whether preemption helps children learn to avoid non-conventional uses of verbs. Given that many English verbs alternate between transitive and intransitive usage (e.g. *break*, *roll*), how do children learn the fixed transitive status of verbs such as *hit* or the fixed intransitive status of verbs such as *fall*? 48 four-year-olds and 48 six- and seven-year-olds learned two novel verbs, with one verb modelled as transitive and the other as intransitive. Exposure conditions varied the occurrence and type of preemptive evidence potentially facilitating learning of the verbs' transitivity status. In comparison to a No Preemption group, only six- to seven-year-olds exposed to novel verbs in alternative constructions (that allowed them to talk about the actions from the perspective of the agent or patient without changing the verbs' assigned transitivity) produced fewer utterances violating the verbs' fixed transitivity. The results identify limits in children's usage of indirect negative evidence in acquiring verb argument structure constructions.

INTRODUCTION

Children seem to learn languages faster, and more effortlessly than most adults. As researchers, parents, or casual observers we are often amazed by their innovative approach to conquering new territories of speech. Clearly,

[*] We thank the parents, teachers, and children at Castleton Hill Moravian Preschool, The Tanglewood School, St. Adalbert School and St. Teresa School for their participation. We also thank Haven Bernstein, Virginia Boga, and Michelle Sherry for their assistance with data collection. A portion of this work was presented at the Biennial Meeting of the Society for Research in Child Development in Minneapolis, MN, April 2001. Address for correspondence: Patricia J. Brooks, Department of Psychology, Sociology, Anthropology, and Social Work, 4S-223, The College of Staten Island of the City University of New York, Staten Island, NY 10314, USA. e-mail: pbrooks@postbox.csi.cuny.edu

https://doi.org/10.1017/S0305000902005287 Published online by Cambridge University Press

children are not afraid to put new 'twists' on words and phrases they already know – making them fit what it is they are trying to say. For the most part, children's ability to form generalizations seems to be the driving force leading to their production of thousands of word combinations by the time they reach the age of three (Bates, Bretherton & Snyder, 1988; Bloom, 1991). Every once in a while we raise our eyebrows upon hearing a delightful snippet of uninhibited speech: *Mommy, I disappeared my orange juice; It won't cough me no more*. What ultimately enables children to constrain their nascent linguistic constructions to avoid making such overgeneralizations has not yet been firmly established (Bowerman, 1988; Pinker, 1989; Braine & Brooks, 1995; Goldberg, 1995; Brooks & Tomasello, 1999a; Brooks, Tomasello, Dodson & Lewis, 1999).

Roughly speaking, two types of overgeneralization error have been described in the literature: morphological overgeneralizations and argument structure overgeneralizations. The first type involves incorrect application of a morphological rule, with over-extension of the English past tense rule generating the most commonly cited examples (e.g. *breaked*, *bringed*, *goed*). It is widely accepted that morphological rules are productive in nature, in that they allow speakers to meld new words into new forms to express new meanings (Berko, 1958). The process of acquiring a productive morphological rule shows a discernable developmental progression comprising a U-shaped developmental path (Marcus, Pinker, Ullman, Hollander, Rosen & Xu, 1992; Marchman & Bates, 1994). Initially, children's usage of a morphological form seems to be limited to a few high frequency words. Gradually, as vocabulary size increases, the type frequency of usage of the form increases, and overgeneralization errors begin appearing (indicating productivity of the morphological rule). Finally, with further development the frequency of such errors declines (Marcus *et al.*, 1992). Many researchers (e.g. Bowerman, 1988; Braine & Brooks, 1995; Pinker, 1999) have assumed that use of indirect negative evidence in the form of preemption explicates the disappearance of morphological overgeneralization errors. The basic idea is that as an irregular word form gains strength in associative memory it blocks application of the morphological rule (e.g. learning *broke* blocks *breaked*). In some cases, involving so-called 'suppletive' forms, the preempting irregular form may be morphologically unrelated to the word it preempts (e.g. *better* preempts *gooder*, *went* preempts *goed*).

A second type of overgeneralization error involves children's productive use of verbs in non-conventional syntactic contexts, such as those associated with verb argument structure constructions (e.g. *He stayed it there; Don't giggle me*). As with morphological rules, U-shaped development occurs in children's mastery of syntactic constructions (Tomasello, 2000). There is now considerable evidence (e.g. Akhtar & Tomasello, 1997; Tomasello, Akhtar, Dodson & Rekau, 1997; Akhtar, 1999) that children initially learn

https://doi.org/10.1017/S0305000902005287 Published online by Cambridge University Press

verb argument structures on a verb-by-verb basis (so-called verb island schemas, cf. Tomasello, 1992). Starting in their third year, children begin generalizing across verb island schemas to form abstract constructions that may be overly general in the sense that they may be used with verbs that are not conventionally used in the construction in the adult language. Finally, over a period of several years, children acquire constraints on their use of syntactic constructions that enable them to avoid non-conventional usage. The role of preemption in helping children avoid syntactic overgeneralization errors has not been firmly established, and several researchers (e.g. Bowerman, 1988; Pinker, 1989) have discounted its role in the acquisition of verb argument structures.

Braine & Brooks (1995) argued for a broader view of the role of preemption in enabling children to avoid syntactic overgeneralization errors. They suggested a novel form of preemption consisting of a unique argument structure preference: as a child repeatedly hears a verb used in a particular argument structure construction, the child will come to assume that the verb does not occur in other argument structure constructions, unless the alternative constructions have been independently learned. Thus, for a fixed transitivity verb such as *go* or *remove* (i.e. *go* occurs only in intransitive constructions and *remove* occurs only in transitive constructions), as the child's knowledge of how the verb is used by adults becomes entrenched over time, this knowledge tends to block their usage of the verb in any argument structure construction that violates its fixed transitivity. Brooks *et al*. (1999) tested this 'entrenchment' hypothesis by presenting children with English verbs of fixed transitive or intransitive usage that were more or less familiar to them (e.g. *hit* versus *strike*, *disappear* versus *vanish*). Elicitation questions were used to encourage children to produce overgeneralization errors. In support of the hypothesis, Brooks *et al*. (1999) found that children of ages three to eight years were more likely to violate the fixed transitivity of the less familiar verbs (e.g. children were more likely to say *She vanished it* than *She disappeared it*).

Goldberg (1995) proposed another way in which indirect negative evidence could help a child identify cases where a particular verb is not conventionally used in a particular argument structure construction. Because argument structure constructions are not synonymous, in any discourse context some constructions will be more felicitous and others will be less felicitous. If a particular verb consistently occurs in a non-optimal construction in a discourse context associated with a different construction, the child may detect a mismatch between the expected (optimal) and the observed (non-optimal) constructions, and posit that the expected construction is not used with that verb. For example, the simple transitive (causative) construction is prototypically associated with the notion of direct causation (Fodor, 1970; Gergely & Bever, 1986; Taylor, 1998). If a child repeatedly hears a verb used

https://doi.org/10.1017/S0305000902005287 Published online by Cambridge University Press

in a periphrastic causative construction, e.g. *The magician made the rabbit disappear*, in situations involving direct causation, the child may infer that *The magician disappeared the rabbit* is not conventional. That is, according to Goldberg (1995), the repeated occurrence of a verb in a periphrastic causative construction in situations involving direct causation preempts the child's usage of the verb in the simple transitive construction.

Brooks & Tomasello (1999a) tested Goldberg's hypothesis by exposing children to two novel verbs, either with or without preempting alternative constructions. Each verb was associated with a novel action; as the experimenter acted out the action using puppets and small props, she modelled usage of the novel verbs in specific argument structure constructions. In the Preemption group, if a verb was introduced as intransitive, the child heard periphrastic causative utterances, such as *The cat is making the pencil meek*, as well as simple intransitive utterances, such as *The pencil is meeking*, as descriptions of the enacted events. If the verb was introduced as transitive, the child heard passive utterances such as *The sock is getting tammed*, along with the simple transitive utterances, such as *The bear is tamming the sock*. In the No Preemption group, each verb was modelled only in the simple intransitive construction, or only in the simple transitive construction. Acquisition of the verbs' assigned transitivity was evaluated using elicitation questions prompting children to talk about the actions from the perspective of the agent (*What is the cat doing?*) or patient of the action (*What is happening with the pencil?*). It was predicted that children in the Preemption group would obey the assigned transitivity of the novel verbs to a greater extent than children in the No Preemption group. Interestingly, the predicted beneficial effect of exposure to the alternative constructions was reliable only for the oldest children tested (six- to seven-year-olds). Brooks & Tomasello (1999a) interpreted the lack of a benefit in younger children (two-year-olds and four-year-olds) as due to their failure to relate information about transitivity across construction types. In other words, the younger children may have failed to recognize that a verb in a periphrastic causative construction shares the same transitivity status as a simple intransitive, and a verb in a passive construction has the same transitivity status as a verb in a simple transitive construction.

Unfortunately, in the Brooks & Tomasello (1999a) study, preemption and entrenchment were confounded: the No Preemption group heard each novel verb used 88 times in a simple intransitive (or transitive) construction, whereas the Preemption group heard each verb used 44 times in a simple intransitive (or transitive) construction and 44 times in a periphrastic causative (or passive) construction. As children in the No Preemption group heard each verb modelled in twice as many simple transitive or intransitive sentences as children in the Preemption group, these children may have had greater awareness of each verb's assigned transitivity. To the extent that the

https://doi.org/10.1017/S0305000902005287 Published online by Cambridge University Press

transitivity of the novel verbs was more solidly entrenched for the No Preemption group, these children would be expected to respect the assigned transitivity of the novel verbs to a greater extent (cf. Brooks *et al.*, 1999). In other words, the trade-off between entrenchment and preemption may have masked any beneficial effects of exposure to the preempting alternative constructions in the younger children.

A major goal of the present study was to reexamine Goldberg's (1995) hypothesis that preempting alternatives help children avoid argument structure errors, using a design in which Preemption and No Preemption groups had equal exposure to novel verbs in simple (intransitive or transitive) constructions. In addition, we tested a more diverse set of preempting models by introducing suppletive forms to one group of participants. The efficacy of suppletive forms in blocking syntactic overgeneralization errors (e.g. *kill* blocking use of *die* in a transitive construction; *rise* blocking use of *raise* in an intransitive construction) has been discussed in the literature (e.g. Bowerman, 1988) but has never been tested experimentally.

In a context of a play situation, children learned two novel verbs that described salient actions involving puppets. One verb was modelled as transitive and the other as intransitive. We compared two types of preemption to evaluate their role in helping children learn the transitivity status of the novel verbs, as defined by the experimenter's usage. Children in each exposure condition heard each novel verb used 36 times in a simple intransitive (or transitive) construction, with agent and patient varying with each enactment. In the English Suppletive condition, children heard an additional 12 preempting utterances in which the action was described using a familiar English verb. When the novel verb was introduced in a transitive construction (e.g. *The turtle is tamming the house*), the preempting utterances described the action from the patient's perspective (e.g. *The house is swinging*). When the novel verb was introduced in an intransitive construction (e.g. *The car is docking*), the preempting utterances described the action from the agent's perspective (e.g. *The rabbit is bouncing the car*). In the Alternative Construction condition, children heard an additional 12 preempting utterances in which the novel verb was used in a construction that allowed them to talk about the action from the perspective of the agent or patient without changing the verb's assigned transitivity. When the novel verb was introduced in a simple transitive construction, children also heard it in a passive construction (e.g. *The house is getting tammed*), and when the verb was introduced in a simple intransitive construction, children also heard it in a periphrastic causative construction (e.g. *The rabbit is making the car dack*). We predicted that exposure to preemption in the form of English suppletives or usage of the novel verbs in alternative constructions would enhance learning of the novel verbs' assigned transitivity relative to a No Preemption control group.

https://doi.org/10.1017/S0305000902005287 Published online by Cambridge University Press

In addition to exploring the effect of preemption on the acquisition of verb transitivity, the present study reexamined the role of semantic features in constraining children's syntactic overgeneralizations. Pinker (1989) proposed that children base their usage of verbs in particular argument structure constructions on membership in narrowly defined semantic classes. For example, Pinker described three classes of verbs (i.e. verbs of extrinsic change of physical state, verbs of motion in a particular manner, and verbs of manner of locomotion or instrument of transportation) that occur in both transitive (causative) and intransitive (inchoative) constructions, as in *Jordan broke the vase; The vase broke*. He further described several classes of intransitive verbs (e.g. verbs of coming or going out of existence, verbs of motion in a lexically specified direction) and several classes of transitive verbs (e.g. verbs of killing, creating, or destroying, verbs of causation of directed motion) that do not alternate between transitive (causative) and intransitive (inchoative) usage. The essential point is that verbs in each narrow semantic class behave in a like manner with respect to the argument structure constructions in which they appear. According to Pinker (1989), overgeneralization errors can occur if a child does not properly understand the meaning of a verb, leading to an error in assigning the verb to its appropriate narrow semantic class. In other words, if a child has not yet fully grasped a verb's meaning, the child may inadvertently use the verb in a construction that does not occur with members of the narrow semantic class to which the verb belongs. Once the child has corrected their semantic representation of the verb, placing it in the right narrow semantic class, overgeneralization errors should automatically stop.

Brooks & Tomasello (1999a) tested Pinker's theory by exposing children to two novel verbs and examining their acquisition of the verbs' experimentally assigned transitivity. One novel verb belonged to a fixed transitivity semantic class that does not participate in the causative-intransitive alteration (i.e. intransitive verbs of motion in a lexically specified direction or transitive verbs of causation of directed motion). The other novel verb belonged to a bitransitive semantic class (i.e. verbs of motion in a particular manner) that participates in the causative-intransitive alternation, as in *Chris bounced the ball; The ball bounced*. Each novel verb was modelled only in transitive constructions or else only in intransitive constructions. In agreement with predictions derived from Pinker (1989), children four years of age and older observed the experimentally assigned transitivity of the novel verb from the fixed transitivity, directional motion class to a greater extent than the assigned transitivity of the novel verb from the bitransitive, manner of motion class. This was an important finding because it provided the first experimental evidence for the positive effect of membership in narrow semantic verb classes constraining children's usage of verbs in argument structure constructions.

https://doi.org/10.1017/S0305000902005287 Published online by Cambridge University Press

Brooks & Tomasello (1999a) interpreted their findings cautiously due to concerns about their choice of actions: were the children responding to the narrow semantic verb classes or to other semantic features of the modelled play activities that distinguished the two novel verbs? Two potential differences in meaning were identified by Brooks & Tomasello (1999a) that would compromise their evidence in support of Pinker (1989). First, the agent acted more directly on the patient for the bitransitive action in comparison to the fixed transitivity action, which might have encouraged greater usage of the transitive (causative) construction as a description of the bitransitive action. Second, the agent acted more continuously on the patient for the fixed transitivity action than for the bitransitive action. This might have discouraged children from using the simple intransitive construction in describing the fixed transitivity action, because it leaves the continuously acting agent 'out of perspective'.

To address these concerns, the present study varied the directness and the continuity of the actions, while holding constant the semantic class to which the novel verbs belonged, to determine children's sensitivity to the different semantic factors. Two novel actions were selected from the bitransitive class of verbs of motion in a particular manner. Based on Brooks & Tomasello (1999a), the use of bitransitive verbs would lead us to expect children to produce a lot of 'errors' involving failure to match the verbs' experimentally assigned transitivity. This is methodologically advantageous, in that it prevents any ceiling effects (i.e. no observed 'errors'), and thus, allows an examination of whether the specific semantic features manipulated (i.e. directness and continuity) influence children's patterns of verb usage.

One novel action was identical to that used in Brooks & Tomasello (1999a) and involved a puppet swinging a toy object attached to a pendulum. For this action, the agent (the puppet) acted directly, but not continuously on the patient (the toy object) to set it swinging. Once its motion was initiated, the toy object swung on its own. The second novel action was designed to involve less direct contact between the agent and patient (i.e. the puppet used a wooden spoon to bounce a rubber toy against a mat), but to require continuous action by the agent (the puppet) to keep the patient (the rubber toy) in motion. It was predicted that if children base their usage of the novel verbs on membership in narrow semantic classes, no difference in pattern of usage of the two verbs would be observed. However, if children respond to the features of directness and continuity, and do not base their usage on membership in narrow semantic classes, it was predicted that they would use the verb corresponding to the more direct, less continuous action more flexibly than the verb corresponding to the less direct, more continuous action.

To summarize, the present study sought to replicate and extend the findings of Brooks & Tomasello (1999a) indicating that both preemption and

https://doi.org/10.1017/S0305000902005287 Published online by Cambridge University Press

membership in narrowly defined semantic classes constrain children's usage of verbs in argument structure constructions and aid in their learning the transitivity status of novel verbs.

METHOD

Participants

Forty-eight four-year-old ($M = 4;4$, range 3;11–4;10, 27 girls and 21 boys), and 48 six- to seven-year-old ($M = 6;8$, range 6;2–7;5, 26 boys and 22 girls) English speaking children took part in the study. Children at each age were quasi-randomly assigned to one of three exposure groups, with approximately equal numbers of boys and girls, and equivalent ages in months, per exposure group at each age. The children were recruited and tested at two preschools and two parochial elementary schools in Staten Island, New York. Five additional children were tested but were replaced due to experimenter errors (three children) or because they never used the novel verbs (two children). All children received a small gift for participating.

Materials

Each of two novel verbs, *tam* and *dack*, was used to describe a novel action that was performed with a novel apparatus. Both novel actions were members of the semantic class of verbs of motion in a particular manner (Pinker, 1989), and roughly corresponded in meaning to the English verbs *swing* and *bounce*. The novel actions differed in two important ways: first with respect to the directness of the agent's contact with the patient, and second with respect to the continuity of the agent's actions towards the patient.

The first action was described using the novel verb *tam*. It involved a puppet swinging a small object that was attached with velcro to a rope suspended from a tri-pod. For each enactment, one of several puppets (e.g. mouse, turtle) was used as agent to swing the toy object, and one of several toy objects (e.g. tree, boat) was used as the object swinging on the rope (i.e. as patient). *Tam* was used to describe either the action of the puppet (when modelled as a transitive verb, as in *The mouse is tamming the tree*) or else the action of the object swinging on the rope (when modelled as an intransitive verb, as in *The tree is tamming* or *The tree is tamming all around*). With each enactment, the puppet made direct contact with the toy object to set it in motion; once set in motion, the toy object swung on its own until the puppet repeated the action, or a new toy object was introduced.

The second action, described using the novel verb *dack*, involved a puppet (e.g. a monkey) holding a wooden spoon on which a rubber toy (e.g. a shoe) was attached with velcro. To perform the action, the puppet used the spoon

https://doi.org/10.1017/S0305000902005287 Published online by Cambridge University Press

to bounce the rubber toy against a cardboard mat. *Dack* was used to describe either the action of the puppet (when modelled as a transitive verb, as in *The monkey is dacking the shoe*) or else the action of the object bouncing against the mat (when modelled as an intransitive verb, as in *The shoe is dacking* or *The shoe is dacking all around*). For each enactment, one of several puppets representing familiar animals (e.g. puppy, rabbit) was used as the agent, and one of several rubber toys (e.g. car, block) was used as the patient of the action. In performing the action, the puppet always used the spoon to make contact with the toy object, rather than touching it directly. The toy object bounced each time the puppet moved the spoon, and only when the puppet moved the spoon. Further, the toy object's bouncing motion stopped as soon as the puppet's motion stopped.

Design and procedure

Children were tested individually in 30-minute sessions. Two tape recorders were used to record each session and, in addition, a hand-written log was kept of the children's utterances. Two experimenters conducted the procedure: one experimenter interacted with the child while the other wrote down what the child said.

Children at each age were quasi-randomly assigned to one of three exposure groups. During the exposure phase, six sequences of models were provided for each verb, with each sequence comprising a series of six simple transitive or intransitive utterances describing the novel action of a particular pair of objects, along with two preempting utterances for the two preemption groups (see below). For half of the children in each exposure group at each age, the novel verb *dack* was introduced in a transitive construction and the novel verb *tam* was introduced in an intransitive construction, whereas for the other half of the children the opposite assignment pattern was used. For example, for the transitive verb *dack* the child would hear utterances such as *The rabbit is dacking the car*, and for the intransitive verb *tam* the child would hear utterances such as *The house is tamming*. Children in all three groups heard the novel transitive verb modelled in 36 simple transitive utterances, and the novel intransitive verb modelled in 36 simple intransitive utterances, with tense and aspect of the verbs free to vary across the models as appropriate to the situation (i.e. preparation with *gonna*, enactment with *-ing*, and post-action comment with *-ed*). The order of introduction of the verbs was counterbalanced across children.

In addition to hearing each novel verb modelled in 36 simple transitive or intransitive sentences, the two preemption groups were provided with 12 additional preempting utterances that might block their tendency to use the novel verb in constructions that violated the verb's experimentally assigned transitivity. For the Alternative Construction group, children heard 12 additional utterances with the novel verb used in a construction that allowed

https://doi.org/10.1017/S0305000902005287 Published online by Cambridge University Press

them to talk about the action from the perspective of the agent or patient without changing the verb's transitivity. When the novel verb was introduced in a transitive construction, children also heard it in a passive construction (e.g. *The house is getting tammed*), and when the verb was introduced in an intransitive construction, children also heard it in a periphrastic causative construction (e.g. *The rabbit made the car dack*).

For the English Suppletive group, children heard 12 additional utterances with the action described using a familiar English verb. When the novel verb was introduced in a transitive construction (e.g. *The turtle is tamming the house*), the preempting utterances described the action from the patient's perspective (e.g. *The house is swinging*). When the novel verb was introduced in an intransitive construction (e.g. *The car dacked*), the preempting utterances described the action from the agent's perspective (e.g. *The rabbit bounced the car*). For both preemption groups, the idea was that no matter which participant the child wished to use as subject (agent or patient), he or she had heard a way to describe the action without violating the novel verb's assigned transitivity.

In contrast, the No Preemption group heard each verb used only in the simple transitive or intransitive construction. In this case, if the child wanted to change the participant he or she had heard as subject for that verb, the child had to use the verb in a construction he or she had not heard from the experimenter.

Children's usage of the novel verbs was encouraged in several ways. First, at regular intervals the experimenter invited the child to name the action by saying, *This is called dacking* (*or tamming*). *Can you say dacking? Say dacking*. Second, the experimenter asked a set number of questions which encouraged the child to talk about the dacking and tamming games from the perspectives of both the agent and the patient. The questions promoted children's usage of the novel verbs in transitive and intransitive constructions. Three question formats were used: *What is the* (*agent*) *doing?*, *What is happening with the* (*patient*)*?*, and *What is happening now?* – called agent-focused question, patient-focused question, and neutral question, respectively. Each child heard one of each of these types of question in each of the six modelling sequences of the exposure phase.

For each verb, after the sixth sequence of models, a final elicitation task was administered in an attempt to solicit uses of the verb in the absence of any new linguistic models. The elicitation task allowed us to examine the extent to which children had mastered the assigned transitivity of the verbs. First, two new objects were introduced and placed on one apparatus. The experimenter then asked one agent-focused question, one patient-focused question, and one neutral question in a random order. The elicitation task was repeated three times with unique pairs of objects, providing the child with nine additional opportunities to use the novel verb without prior

https://doi.org/10.1017/S0305000902005287 Published online by Cambridge University Press

linguistic models using those objects. The entire procedure was then repeated for the second verb.

To summarize, for each novel verb the children were given a total of nine questions that encouraged an answer with the agent as subject (agent-focused questions), nine that encouraged an answer with the patient as subject (patient-focused questions), and nine that were neutral questions. Each question type was presented six times during the exposure phase and three times during the final elicitation task. This is important because it means that children were provided with equal numbers of opportunities in their discourse with the experimenter to use transitive and intransitive constructions with each of their newly learned verbs.

Coding

Children's utterances containing the experimental verbs were placed into one of four mutually exclusive 'target' categories based on the syntactic construction involved: transitive (e.g. *the mouse dacked the block*), passive (e.g. *the block got dacked*), intransitive with patient subject (e.g. *the block dacked*), and periphrastic causative (e.g. *the mouse made/helped/let the block dack*). Typical deviations, counted as examples of these categories, were utterances with the subject omitted (e.g. *dacked the block*, *got dacked*, *gonna dack all around*, *make the block dack*), and utterances containing pronouns (e.g. *he dacked the block*, *it got dacked*, *it dacked all around*, *she made it dack*). Minor variations, such as the presence of adjectives, verb particles, and prepositional phrases, were ignored. All single word utterances were discarded because it was impossible to categorize them by construction (e.g. *dacked* could be an attempt at either an intransitive or a passive utterance). Utterances in which children used English verbs in talking about the games were examined separately.

Children produced a total of 4085 multi-word utterances containing the experimental verbs of which the overwhelming majority (99%) were categorized into the four target categories described above. A total of 46 multi-word utterances containing experimental verbs were excluded from further analysis. The excluded utterances comprised 26 intransitive utterances with agent subjects (e.g. saying *the mouse dacked* when the mouse dacked the block), 10 utterances in which the child used the wrong experimental verb (e.g. saying *it tammed the block* when the mouse dacked the block), 8 errors in which the child reversed the positions of agent and patient nominals in the sentence (e.g. saying *it dacked the mouse* or *the mouse got dacked* when the mouse dacked the block), and 2 utterances with the verb functioning as a noun (*make the dack*; *the dack*).

https://doi.org/10.1017/S0305000902005287 Published online by Cambridge University Press

RESULTS

Children had little difficulty learning the novel verbs, with each four-year-old producing an average of 36 target utterances, and six- to seven-year-olds averaging 48 target utterances containing the novel verbs (see Table 1).

TABLE 1. *Average numbers of child utterances containing each novel verb as a function of its experimentally assigned transitivity and child age* (*In parentheses are the mean percentages of child utterances that matched the experimenter's usage in transitivity*)

	Novel verb	
	tam (direct, non-continuous action)	*dack* (indirect, continuous action)
Four-year-olds		
Mean	**17·8 (69·0)**	**18·6 (73·2)**
Transitive models	18·7 (85·9)	21·2 (86·7)
Intransitive models	16·8 (52·1)	16·0 (59·7)
Six- to seven-year-olds		
Mean	**23·9 (82·6)**	**23·9 (77·0)**
Transitive models	24·6 (95·6)	23·3 (89·7)
Intransitive models	23·3 (69·6)	24·4 (64·3)

Overall, children's patterns of usage of the novel verbs *dack* and *tam* were highly similar. At each age, children tended to obey the experimentally assigned transitivity of the novel verb more closely when it was introduced in transitive constructions than when it was introduced in intransitive constructions. In the analyses reported below, we analysed the proportion of child utterances that matched the transitivity of the experimental models. To simplify the presentation of the results, across all analyses we collapsed utterances across question types. In general, children produced simple transitive and/or periphrastic causative utterances in response to agent-focused questions, simple intransitive and/or passive utterances in response to patient-focused questions, and a mixture of all utterance types in response to neutral questions.

Exposure phase

The first set of analyses examined the proportion of child utterances produced during the exposure phase that matched the transitivity of the experimental models. For the transitively introduced verb, matching utterances comprised children's simple transitives and passives, and for the

https://doi.org/10.1017/S0305000902005287 Published online by Cambridge University Press

intransitively introduced verb, matching utterances comprised children's simple intransitives with patient subjects and periphrastic causatives. Table 2 presents the mean percentage of utterances matching the transitivity of the

TABLE 2. *Mean percentages of child utterances in the exposure phase that matched the transitivity of the experimental models as a function of child age and exposure condition*

	Exposure condition		
	No preemption	English suppletive	Alternative construction
Four-year-olds			
Mean	**67·9**	**84·3**	**77·3**
Transitive models	86·5	90·0	90·3
Intransitive models	49·4	78·6	64·3
Six- to seven-years-olds			
Mean	**73·3**	**84·6**	**94·6**
Transitive models	86·2	93·3	96·2
Intransitive models	60·4	76·0	92·9

experimental models as a function of the exposure condition (No Preemption, English Suppletive, or Alternative Construction), child age (four-year-olds, six- to seven-year-olds), and the assigned transitivity of the verb (Transitive, Intransitive). A(2) × (3) × (2) mixed-design ANOVA was used to examine the effects of the within-subject factor of novel verb (*dack* versus *tam*), and the between-subjects factors of exposure condition and age. The dependent variable was the proportion of utterances that matched the transitivity of the experimental models, with utterances collapsed across construction types. All proportions, here and throughout the paper, were arcsine transformed prior to statistical analysis, as is recommended for proportional data (Cohen & Cohen, 1983).

Overall, the six to seven-year-olds matched the transitivity of the experimental models in a greater percentage of their word combinations than the four-year-olds, $F(1, 90) = 6{\cdot}68$, $p < 0{\cdot}05$, 84·2 % versus 76·5 % matching utterances. In addition to the effect of age, the main effect of exposure condition, $F(2, 90) = 14{\cdot}71$, $p < 0{\cdot}001$, and the interaction of age and exposure condition, $F(2, 90) = 5{\cdot}12$, $p < 0{\cdot}01$, were significant. As predicted, children exposed to preempting alternatives (English Suppletive and Alternative Construction groups) matched the transitivity of the experimental models to a greater extent than children in the No Preemption group. Planned comparisons conducted at each age indicated that both the four-year-olds and the six to seven-year-olds in the English Suppletive group, and the six to seven-year-olds in the Alternative Construction group, produced

https://doi.org/10.1017/S0305000902005287 Published online by Cambridge University Press

a greater percentage of matching utterances than their counterparts in the No Preemption group, $Fs(1, 90) \geqslant 6{\cdot}96$, $ps \leqslant 0{\cdot}01$, see Table 2 for means. In contrast, the percentages of matching utterances for the four-year-olds in the Alternative Construction and No Preemption groups were statistically equivalent. The main effect of the novel verb was not significant, nor were any of the interactions involving this factor: children averaged 80·1 % matching utterances in describing the indirect, continuous action called *dacking* and 80·6 % matching utterances in describing the direct, non-continuous action called *tamming*.

To examine the effect of assigned transitivity on children's utterances, an additional ANOVA was conducted on the proportions of child utterances matching the experimental models. For this analysis, the within-subjects factor was the assigned transitivity of the novel verb (transitive, intransitive), and the between subjects factors were exposure condition, child age, and participant subgroup (defined by crossing the two novel verbs with the two possible assignments of verb transitivity, i.e. Subgroup 1: *dack* with intransitive experimental models, *tam* with transitive experimental models; Subgroup 2: *dack* with transitive experimental models, *tam* with intransitive experimental models).

Overall, children showed a strong bias to produce transitive utterances as descriptions of the novel actions, leading them to produce a greater percentage of matching utterances for the transitive novel verb than for the intransitive novel verb, $F(1, 84) = 36{\cdot}09$, $p < 0{\cdot}001$, 90·4 % versus 70·3 % matching utterances. This effect of assigned transitivity did not interact with any of the other experimental variables. There was, however, a significant main effect of participant subgroup, $F(1, 84) = 5{\cdot}68$, $p < 0{\cdot}05$: Children who were exposed to *dack* as an intransitive verb and *tam* as a transitive verb produced a somewhat greater proportion of matching utterances than children exposed to *dack* as a transitive verb and *tam* as an intransitive verb, with means of 82·5 % and 78·2 % matching utterances, respectively.

Final elicitation test

The second set of analyses examined the proportion of child utterances produced during the final elicitation test that matched the transitivity of the experimental models of the exposure phase. These analyses examine the extent to which children followed the assigned transitivity of the verbs when experimental models were no longer provided. Data for four children (three four-year-olds in the English Suppletive group and one four-year-old in the Alternative Construction group) could not be included because these children failed to use one or both novel verbs in any multi-word utterance in the final elicitation test.

https://doi.org/10.1017/S0305000902005287 Published online by Cambridge University Press

Table 3 presents the mean percentage of utterances matching the transitivity of the experimental models as a function of the exposure condition (No Preemption, English Suppletive, or Alternative Construction), child age (four-year-olds, six- to seven-year-olds), and the assigned transitivity of the verb (transitive, intransitive). A(2) × (3) × (2) mixed-design ANOVA was used to examine the effects of the within-subject factor of novel verb (*dack* versus *tam*), and the between-subjects factors of exposure condition and age. The dependent variable was the arcsine-transformed proportion of utterances that matched the transitivity of the experimental models, with utterances collapsed across construction types.

As in the analysis of matching utterances produced during the exposure phase, six to seven-year-olds were more likely than four-year-olds to obey the assigned transitivity of the verbs in the final elicitation test, $F(1, 86) = 10{\cdot}25$, $p < 0{\cdot}01$, 71·9% versus 61·3% matching utterances. Although the main effect of exposure condition was not significant in the final elicitation test, there was a significant interaction of age and exposure condition, $F(2, 86) = 4{\cdot}12$, $p < 0{\cdot}05$. Planned comparisons of the No Preemption and Preemption groups found no significant differences among exposure conditions in the percentages of matching utterances for the four-year-olds. For the six to seven-year-olds, children in the Alternative Construction group matched the assigned transitivity of the novel verbs to a greater extent than children in the No Preemption group, $F(1, 86) = 4{\cdot}79$, $p < 0{\cdot}05$, see Table 3 for means. The six to seven-year-olds in the English Suppletive and No Preemption groups did not differ. The main effect of novel verb was not significant, and there were no significant interactions involving this factor. Children averaged 66·6% matching utterances with the novel verb *dack* and 67·0% matching utterances with *tam*.

An additional mixed design ANOVA was conducted to examine the effect of assigned transitivity on children's matching utterances. The assigned transitivity of the novel verb (Transitive, Intransitive) was a within-subject factor and exposure condition, child age, and participant subgroup (defined by crossing the two novel verbs with the two possible assignments of verb transitivity) were between-subjects factors. Children showed a strong bias to use transitive constructions when describing the novel events and thus followed the assigned transitivity of the novel transitive verb to a much greater extent than the assigned transitivity of the intransitive verb, $F(1, 80) = 66{\cdot}36$, $p < 0{\cdot}001$, 87·7% versus 45·9% matching utterances. The effect of verb transitivity did not interact with any of the other factors, and there were no significant effects involving participant subgroups.

https://doi.org/10.1017/S0305000902005287 Published online by Cambridge University Press

TABLE 3. *Mean percentages of child utterances in the elicitation test that matched the transitivity of the experimental models as a function of child age and exposure condition*

	Exposure condition		
	No preemption	English suppletive	Alternative construction
Four-year-olds			
Mean	**67·2**	**58·1**	**57·7**
Transitive models	84·1	70·5	87·6
Intransitive models	50·2	45·7	27·7
Six- to seven-year-olds			
Mean	**65·9**	**70·1**	**79·6**
Transitive models	89·9	92·0	98·6
Intransitive models	41·9	48·1	60·7

English verbs used by children

In addition to utterances containing the experimental verbs, children sometimes used English verbs to talk about the actions, both in their spontaneous talk and in answering the experimenter's questions. Overall, children produced a total of 800 utterances containing English verbs, with the majority (65 %) produced by children in the English Suppletive group. These children, having heard the experimenter use the English verbs *swing* and *bounce* as descriptions of the novel actions, tended to use the same verbs in their own descriptions of the actions, averaging 16·2 utterances with English verbs across the exposure phase and final elicitation test.

Children in the Alternative Construction and No Preemption groups produced relatively few utterances containing their own English verbs as descriptions of the novel actions, averaging only 4·4 such utterances per child. Although not conclusive, their usage of English verbs provides some evidence that the children interpreted the novel actions as intended. For the swinging motion associated with the novel verb *tam*, the most commonly produced English verb was *swing*, used in 60 utterances by 17 of 64 children in the Alternative Construction and No Preemption groups. Other verbs used by four or five children were *spin*, *turn*, *go*, *do*, *tap*, and *push*. For the bouncing motion associated with the novel verb *dack*, there was less consistency in English verb usage. Five verbs, *bounce*, *bang*, *do*, *go*, and *make*, were each produced by 5 or 6 of 64 children and were the most widely used English substitutions (with *make* occurring in fragments of periphrastic causative constructions produced by children in the Alternative Construction group). In addition to these verbs, four children used *hold* to comment on the puppet's holding the spoon. Across children in the Alternative Construction and No Preemption groups, 58 different English verbs occurred in descrip-

https://doi.org/10.1017/S0305000902005287 Published online by Cambridge University Press

tions of the two novel actions, with 41 of the verbs produced by only one or two children. Some English substitutions were phonologically related to the target novel verbs (e.g. *whack*, *stack*, and *smack* for *dack*; *slam*, *ram*, *tap*, and *tag* for *tam*). Others were thematically related to objects acted on (e.g. *drive*, *fly*, *ring*, *bite*, *eat*, *light*), or neutral comments regarding the puppet's role in the action (e.g. *do it*, *play*).

DISCUSSION

Children are by no means entirely conservative in combining words, and sometimes they produce non-conventional uses of verbs in argument structure constructions (Bowerman, 1982a, 1982b; Mazurkewich & White, 1984; Braine, Brody, Fisch, Weisberger & Blum, 1990). Given children's apparent flexibility in coining novel uses of verbs, the present study sought to gain understanding of the mechanisms underlying their learning the fixed transitive or intransitive status of verbs such as *remove* and *disappear*. Although children do not receive extensive amounts of DIRECT negative feedback from parents (Marcus, 1993), there are sources of INDIRECT negative evidence in discourse that could aid children in learning to avoid non-conventional uses of words (Braine, 1971; Braine & Brooks, 1995; Goldberg, 1995). Specifically we examined whether children would make use of indirect negative evidence in the form of preemption to aid their learning the experimentally assigned transitivity of two novel verbs. We contrasted the effectiveness of so-called suppletive forms (e.g. *hide* blocking use of *disappear* in a transitive construction) with usage of verbs in alternative constructions preserving the verbs' fixed transitivity status (e.g. *make disappear* blocking use of *disappear* in a transitive construction). Although suppletive forms (e.g. *went* blocking *goed*) are assumed to play an important role in children's recovery from morphological overgeneralization (Pinker, 1999), this is the first study to explore their contribution to the acquisition of verb argument structure. Finally, to address concerns raised in previous work of Brooks & Tomasello (1999a), we examined whether specific semantic features of the verbs (i.e. the directness and continuity of the actions) would affect the patterns of novel verb usage.

To evaluate the effect of exposure to preemption on children's acquisition of the assigned transitivity of the novel verbs, we examined separately children's utterances occurring in the exposure phase and those occurring in the final elicitation test. The former results served as a manipulation check to ensure that the children were paying attention to the models as they were presented. The latter results addressed the issue of whether exposure to the preempting models enhanced children's retention of the assigned transitivity of the novel verbs, as reflected in their use of the verbs in the absence of experimental models. During the exposure phase, both four-year-olds and six to seven-year-olds in the English Suppletive group, as well as six to

https://doi.org/10.1017/S0305000902005287 Published online by Cambridge University Press

seven-year-olds in the Alternative Construction group, obeyed the transitivity of the adult models to a greater extent than children in the No Preemption control group. This result indicates that, with the exception of the four-year-olds in the Alternative Construction group, children who were exposed to preemption tended to use the preempting alternatives in their responses to questions interspersed with the experimental models.

In the final elicitation test, when the experimental models were no longer provided, only six to seven-year-olds in the Alternative Construction group followed the assigned transitivity of the novel verbs to a greater extent than children in the No Preemption control group. These results for the Alternative Construction condition replicate Brooks & Tomasello (1999a) who reported benefits of exposure to preempting alternative constructions in six to seven-year-olds. The present results add to their findings in two ways. First, this study was designed to eliminate confounding between preemption and entrenchment. Unlike Brooks & Tomasello (1999a), all participant groups in the present study had equal exposure to the novel verbs in simple transitive and intransitive constructions. Second, the benefits of preemption were observed with participants exposed to many fewer models of the preempting alternative constructions (i.e. 12 preempting models in the present study in comparison to 44 preempting models in Brooks & Tomasello, 1999a). Our results indicate that, for six to seven-year-olds, hearing a verb used in an alternative construction, that allows one to talk about the action from the perspective of the agent or patient without changing its transitivity, aids the child in inferring the verb's transitivity status. This is a robust effect that persists despite variation in procedure. In both studies, the consistent lack of a benefit for four-year-olds exposed to novel verbs in preempting alternative constructions suggests that it may take several years for children to develop an understanding of how one argument structure construction is related to another in terms of its transitivity. It is important for future work to examine whether a decrease in children's argument structure overgeneralization errors in spontaneous speech coincides with their developing understanding of the transitivity status of individual construction types (e.g. how simple transitive and passive constructions are related).

The present experiment provided the first assessment of the effectiveness of preempting suppletive forms in blocking argument structure overgeneralization errors. The English Suppletive group, however, failed to show enhanced learning of the assigned transitivity of the novel verbs, and was statistically equivalent to the No Preemption group in the final elicitation test. Together with the positive result for the Alternative Construction group, this null result is informative in determining what sorts of statistics children routinely compute regarding the distribution of verbs across argument structure constructions.

https://doi.org/10.1017/S0305000902005287 Published online by Cambridge University Press

Previous work has established that from quite early on, children pay attention to how individual verbs are used in argument structure constructions. Over a decade ago, Gropen, Pinker, Hollander, Goldberg & Wilson (1989) observed in their novel verb experiments, testing usage of the dative alternation, that preschool and elementary school age children had a strong tendency to use each experimental verb in the exact same construction they heard the experimenter use it. Tomasello & Brooks (1998) and Brooks & Tomasello (1999b) observed the same pattern, with transitive, intransitive, and passive constructions, in children as young as two years to two and a half years old. They found it to be a great challenge at this age to elicit any novel usage of an experimental verb in the absence of an explicit model. In a study with fixed transitive and intransitive English verbs, Brooks *et al.* (1999) found that children as young as three years of age made fewer overgeneralization errors with verbs that were more familiar to them. This indicates that young children have long-term knowledge of patterns of usage of individual verbs that varies in strength as a function of the frequency (entrenchment) of verb usage. The present study provides evidence that by age six to seven, children can use their knowledge of the range of argument structure constructions occurring with any verb in their vocabulary to determine the transitivity status of that particular verb. At this same age, however, children do not compare complementary patterns of usage of different verbs occurring in the same communicative contexts as a means of determining a verb's range of permissible argument structure constructions. In other words, we have found no evidence that hearing a verb such as *drop*, used whenever one causes something to fall, plays any role in a child's learning the fixed intransitive status of *fall*. It remains to be determined whether such distributional statistics would be computed at any age under any circumstance.

In claiming that children fail to register complementary distributions of verbs as a source of information indicating the non-occurrence of particular verbs in particular constructions, we do not claim that children never relate information about usage patterns across verbs in their developing vocabularies. Indeed, it is quite likely that some sort of 'structure mapping' or similarity driven abstraction (cf. Gentner & Medina, 1998) plays a central role in the formation of abstract linguistic constructions such as the simple transitive, intransitive, passive, and periphrastic causative constructions considered here. Furthermore, to create the narrow semantic verb classes described by Pinker (1989) would presumably require that the child relate similarities in distributional and semantic properties across sets of verbs.

This leads us to the secondary goal of the present study, which was to examine whether specific semantic features of the actions would influence children's usage of the novel verbs. Previous work (Brooks & Tomasello, 1999a) tested Pinker's hypothesis (1989) that membership in narrowly defined semantic classes constrains children's usage of verbs in argument

https://doi.org/10.1017/S0305000902005287 Published online by Cambridge University Press

structure constructions. Children were exposed to a novel verb from Pinker's class of verbs of 'motion in a particular manner' that alternate between transitive and intransitive usage and a second novel verb from a non-alternating class (i.e. Pinker's intransitive verbs of motion in a lexically specified direction or transitive verbs of causation of directed motion). As predicted, children followed the experimentally assigned transitivity of the novel verb from the non-alternating class to a greater extent than the verb from the bitransitive (alternating) class. Unfortunately, this result did not provide unambiguous support for Pinker's theory due to a confound between semantic class membership and other semantic features distinguishing the two novel verbs. In particular, the bitransitive action involved more direct contact between the agent and patient, and did not require continuous action on the part of the agent in order for the patient to remain in motion. To test whether these semantic features were sufficient to induce differential treatment of the novel verbs, in the present study we introduced children to two novel verbs from Pinker's class of verbs of 'motion in a particular manner' that differed with respect to the directness and continuity of the associated actions. Contrary to the prediction that children would use the novel verb with the more direct, less continuous action more flexibly than the verb with the less direct, more continuous action, the children treated the two verbs as essentially equivalent. This null result is consistent with Brooks & Tomasello's (1999a) interpretation of their results that children were attending to the narrow semantic classes to which the verbs belonged.

Overall, the observed rate of 'errors' involving use of the novel verbs in constructions violating their experimentally assigned transitivity was considerably higher here than in our previous studies (e.g. Tomasello & Brooks, 1998; Brooks & Tomasello, 1999a, 1999b; Brooks *et al.*, 1999). This is likely a consequence of our selecting novel verbs from a bitransitive class that alternates between transitive and intransitive usage. We would have predicted a much lower error rate had we chosen novel verbs from a fixed transitivity class. However, in this case, if children were to respond primarily to verb class membership, as predicted by Pinker (1989), they would not be expected to generate many 'errors'. As a consequence, we might not have observed the effect of our preemption manipulation as clearly, and we might not have provided a fair test of the semantic features hypothesis. In addition to the choice of verbs, there are at least three other factors that may have contributed to the observed high rate of transitivity violations. First, as summarized by Tomasello (2000), children's ability to generalize the transitive construction to novel verbs introduced in other constructions varies significantly as a function of age, with older children producing more novel transitive utterances than two- to three-year-olds. Thus, given the fact that we tested four-year-olds and six- to seven-year-olds, we would expect more violations of the verbs' experimentally assigned transitivity than in studies

https://doi.org/10.1017/S0305000902005287 Published online by Cambridge University Press

with younger participants. Second, in comparison to Brooks & Tomasello (1999a), we provided our children with much less exposure to preemption, which would lead us to expect less learning of the verbs' assigned transitivity. Finally, it should be noted that our elicitation procedures are specifically designed to encourage children to use verbs in a range of constructions. These exact procedures have elicited overgeneralization error rates as high as 20–30% with English verbs (e.g. *disappear*, *vanish*) of fixed intransitive usage (Brooks *et al.*, 1999).

Although our participants did not vary their usage of the two novel verbs as a function of the directness and continuity of the corresponding actions, they did respond differentially to the verbs as a function of their experimentally assigned transitivity. Children exhibited a strong bias to use transitive constructions, as opposed to intransitive constructions, in response to the experimental questions. In fact, in over 50% of their utterances with the intransitive-introduced verb, children generated transitive utterances. As a consequence they obeyed a novel verb's experimentally assigned transitivity much more closely when it was introduced as transitive. This finding of a transitive bias concurs with the results of other novel verbs studies (e.g. Maratsos, Gudeman, Gerard-Ngo & DeHart, 1987) as well as studies of spontaneous and elicited overgeneralization (Bowerman, 1982a; Brooks *et al.*, 1999) showing a preponderance of transitive errors. An important issue for future work is to determine the generality of this pattern. One possibility is that the transitive bias seen here is largely an artifact of experimental procedures that emphasize the actions of puppets, and thus encourage children to talk about the actions from the agent's perspective. Naturalistic studies are needed to determine whether English speaking children generally favour transitive constructions in their spontaneous speech, and whether a similar bias appears in the speech produced by children learning languages other than English.

At this point we simply do not know enough about the role of input in shaping children's use of argument structure constructions, nor do we fully understand how distributional learning is limited by information processing constraints in the developing child. The present results are informative with respect to these issues by demonstrating children's selective use of indirect negative evidence in constraining their use of novel verbs. Our study complements the naturalistic observations of Naigles & Hoff-Ginsberg (1998) that hearing a verb used in a wide range of syntactic contexts facilitates learning its usage. Importantly, the distributional statistics used by our participants (i.e. the frequency of occurrence of particular verbs in particular argument structure constructions) are among those posited to play a crucial role in language comprehension and production in adults (e.g. MacDonald, Pearlmutter & Seidenberg, 1994; Trueswell, Tanenhaus & Garnsey, 1994; MacDonald, 1999). Given these links, one would expect the adult sentence

https://doi.org/10.1017/S0305000902005287 Published online by Cambridge University Press

processing literature to be a rich source of hypotheses regarding language acquisition processes in children.

REFERENCES

Akhtar, N. (1999). Characterizing English-speaking children's understanding of SVO word order. *Journal of Child Language* **26**, 339–56.

Akhtar, N. & Tomasello, M. (1997). Young children's productivity with word order and verb morphology. *Developmental Psychology* **33**, 952–65.

Bates, E., Bretherton, I. & Snyder, L. (1988). *From first words to grammar : individual differences and dissociable mechanisms*. Cambridge: CUP.

Berko, J. (1958). The child's learning of English morphology. *Word* **14**, 150–77.

Bloom, L. (1991). *Language development from two to three*. Cambridge: CUP.

Bowerman, M. (1982a). Evaluating competing linguistic models with language acquisition data: implications of developmental errors with causative verbs. *Quaderni di Semantica* **3**, 5–66.

Bowerman, M. (1982b). Reorganizational processes in lexical and syntactic development. In E. Wanner & L. R. Gleitman (eds), *Language acquisition : the state of the art*. New York: Cambridge University Press.

Bowerman, M. (1988). The 'no negative evidence' problem: how do children avoid constructing an overly general grammar? In J. A. Hawkins (ed.), *Explaining language universals*. Oxford: Blackwell.

Braine, M. D. S. (1971). On two types of models of the internalization of grammars. In D. I. Slobin (ed.), *The ontogenesis of grammar : a theoretical symposium*. New York: Academic Press.

Braine, M. D. S., Brody, R. E., Fisch, S. M., Weisberger, M. J. & Blum, M. (1990). Can children use a verb without exposure to its argument structure? *Journal of Child Language* **17**, 313–42.

Braine, M. D. S. & Brooks, P. J. (1995). Verb argument structure and the problem of avoiding an overgeneral grammar. In M. Tomasello & W. E. Merriman (eds), *Beyond names for things : young children's acquisition of verbs*. Hillsdale, NJ: Erlbaum.

Brooks, P. J. & Tomasello, M. (1999a). How children constrain their argument structure constructions. *Language* **75**, 720–38.

Brooks, P. J. & Tomasello, M. (1999b). Young children learn to produce passives with nonce verbs. *Developmental Psychology* **35**, 29–44.

Brooks, P. J., Tomasello, M., Dodson, K. & Lewis, L. (1999). Young children's overgeneralizations with fixed transitivity verbs. *Child Development* **70**, 1325–37.

Cohen, J. & Cohen, P. (1983). *Applied multiple regression/correlation analysis for the behavioral sciences*. Hillsdale, NJ: Erlbaum.

Fodor, J. A. (1970). Three reasons for not deriving *kill* from *cause to die*. *Linguistic Inquiry* **1**, 429–38.

Gentner, D. & Medina, J. (1998). Similarity and the development of rules. *Cognition* **65**, 263–97.

Gergely, G. & Bever, T. G. (1986). Related intuitions and the mental representation of causative verbs in adults and children. *Cognition* **23**, 211–77.

Goldberg, A. E. (1995). *Constructions : a construction grammar approach to argument structure*. Chicago, IL: The University of Chicago Press.

Gropen, J., Pinker, S., Hollander, M., Goldberg, R. & Wilson, R. (1989). The learnability and acquisition of the dative alternation in English. *Language* **65**, 203–57.

MacDonald, M. C., Pearlmutter, M. J. & Seidenberg, M. S. (1994). Lexical nature of syntactic ambiguity resolution. *Psychological Review* **101**, 676–703.

MacDonald, M. C. (1999). Distributional information in language comprehension, production, and acquisition: three puzzles and a moral. In B. MacWhinney (ed.), *The emergence of language*. Mahwah, NJ: Erlbaum.

https://doi.org/10.1017/S0305000902005287 Published online by Cambridge University Press

Maratsos, M., Gudeman, R., Gerard-Ngo, P. & DeHart, G. (1987). A study in novel word learning: the productivity of the causative. In B. MacWhinney (ed.), *Mechanisms of language acquisition*. Hillsdale, NJ: Erlbaum.
Marchman, V. A. & Bates, E. (1994). Continuity in lexical and morphological development: a test of the critical mass hypothesis. *Journal of Child Language* **21**, 339–66.
Marcus, G. F. (1993). Negative evidence in language acquisition. *Cognition* **46**, 53–85.
Marcus, G. F., Pinker, S., Ullman, M., Hollander, M., Rosen, T. J. & Xu., F. (1992). Overregularization in language acquisition. *Monographs of the Society for Research in Child Development* **57** (4, Serial No. 228).
Mazurkewich, I. & White, L. (1984). The acquisition of the dative alternation: unlearning overgeneralizations. *Cognition* **16**, 261–83.
Naigles, L. & Hoff-Ginsberg, E. (1998). Why are some verbs learned before other verbs? Effects of input frequency and structure on children's early verb use. *Journal of Child Language* **25**, 95–120.
Pinker, S. (1989). *Learnability and cognition : the acquisition of argument structure*. Cambridge, MA: MIT Press.
Pinker, S. (1999). *Words and rules : the ingredients of language*. New York: Basic Books.
Taylor, J. R. (1998). Syntactic constructions as prototype categories. In M. Tomasello (ed.), *The new psychology of language : cognitive and functional approaches to language structure*. Mahwah, NJ: Erlbaum.
Tomasello, M. (1992). *First verbs : a case study of early grammatical development*. Cambridge: CUP.
Tomasello, M. (2000). Do young children have adult syntactic competence? *Cognition* **74** (3), 209–53.
Tomasello, M., Akhtar, N., Dodson, K. & Rekau, L. (1997). Differential productivity in young children's use of nouns and verbs. *Journal of Child Language* **24**, 373–87.
Tomasello, M. & Brooks, P. J. (1998). Young children's earliest transitive and intransitive constructions. *Cognitive Linguistics* **9**, 379–95.
Trueswell, J. C., Tanenhaus, M. K. & Garnsey, S. M. (1994). Semantic influences on parsing: use of thematic role information in syntactic disambiguation. *Journal of Memory and Language* **33**, 285–318.

https://doi.org/10.1017/S0305000902005287 Published online by Cambridge University Press