

# Experimenting with the Causative Alternation

Clifton Pye and Diane Frome Loeb

The University of Kansas

1998

## 1. Introduction

The acquisition of verb argument structures is critical to the construction of a child's grammar. Each verb comes with its own expectations about the number of noun phrases (arguments) it associates with (Bresnan 1978; Chomsky 1981; Fillmore 1973; Goldberg 1995). Semantically similar verbs (e.g., attempt/try, fall/drop, shake/shudder, like/please, eat/dine, give/donate, hide/conceal, try/attempt) can have very different argument structures (Green 1978). To produce grammatical sentences, children must learn semantic representations for each verb as well as the syntactic features (argument structure) appropriate to each verb. Given the delicacy of this process, it is not surprising to find that children occasionally make mistakes, producing sentences like: 'The ball threw' or 'Come it over here' (Bowerman 1974; Pinker 1989). The wonder is that such mistakes are so rare, given the thousands of sentences children construct each day. Still more surprising is that children eventually recognise their mistakes and acquire adult intuitions about appropriate verb usage without receiving overt correction from caretakers. We explore the acquisition of verb argument structure in this paper by focusing on the development of the causative alternation.

Investigators have devised a variety of explanations to account for the acquisition of verb argument structure. Martin Braine (1971) was the first investigator to recognize the difficult learnability issues raised by the acquisition of verb argument structure. He proposed a 'sieve-like' memory filter that allowed general features of the grammar to pass into the permanent memory

store while enabling word specific information to block the application of lexical generalizations. Baker (1979) argued that children learned verb argument structure conservatively because argument structure errors cannot be corrected by observing the speech of others (i.e., from positive evidence). Bowerman (1974) reported many examples of such mistakes from her two daughters and other children using verbs in non-adult contexts. She proposed a theory of argument structure generalization that featured a semantic partitioning of the causative construction and the generalization of the semantic/syntactic feature CAUSE to all intransitive verbs. Lord (1979) reported that her two children overgeneralized the causative alternation with both fixed intransitive verbs (e.g., I danced the bears), and fixed transitive verbs (e.g., The car fixed). Lord proposed a system of paradigm formation to account for the bidirectional nature of the causative overgeneralizations she observed. Braine et al. (1991) report a similar bidirectional pattern of causative overgeneralizations in their experimental data. They propose an account that is similar to Lord's in respect to the extraction of a general argument structure frame for transitive and intransitive verbs.

More recently, theorists have focussed on the problem of accounting for the acquisition of constraints on argument structure alternations. Following work by Hale & Roeper (1985) and Levin (1985), linguists have appealed to systematic relations between verb meaning and verb argument structure in their explanation of constraint acquisition. Dixon (1979), for example, observed that the verb cut was transitive in every language he had studied. Pinker (1984) proposed a paradigm construction account similar to Lord's, but added the feature of stereotypy to explain how children learn to constrain the causative alternation. Pinker (1989) proposed a two-tiered set of broad and narrow range semantic rules to account for both the overgeneralization of verb argument structures as well as children's eventual acquisition of the

relevant restrictions on argument structure alternations. Pinker assumes that children have access to a set of innate broad range rules that establish the basic range of alternations possible with a given verb. The broad range rule for the causative alternation is sensitive to a component of change in a verb's semantic representation. The broad range rule leads children to produce overgeneralizations of verb argument structure that can only be corrected by the acquisition of the correct, language particular, narrow range restrictions, e.g., whether the change further specifies manner of motion. Wilkins (1993/1994) proposes that children use an ability to detect mismatches between conceptual structure and syntactic structure to correct verb argument structures.

Each of these accounts is unsatisfactory in some respect. The early theories of Bowerman and Lord do not address the learnability of constraints on the causative alternation. Theories based on universal mappings between verb meaning and verb argument structure underestimate the difficulty of establishing the crosslinguistic uniformity of the mapping. Semantically-based theories do not provide an independently motivated account of critical features of verb meaning. Finally, none of these theories provide a sufficiently detailed explanation of the development of the causative alternation. An adequate understanding of the causative alternation is critical to an account of the acquisition of verb argument structure. We begin by placing the causative alternation in its proper syntactic context. We then discuss the acquisition data that is presently available for the causative alternation, including new data collected by our group. We end with a discussion of the current theories in light of the available data, and propose our own account for the acquisition of the causative alternation.

## 2. The Syntax and Semantics of the Causative Alternation

Current syntactic theory views the verb lexicon as the repository of a rich set of syntactic and semantic information (Bresnan 1978; Chomsky 1993; Disciullo & Williams 1986; Williams 1994). Semantic information is charted in the form of Lexical Conceptual Structures (LCS) that display verb meanings in the form of structured relations between a number of semantic primitives, e.g., GO, BE, STAY, etc. (Hale & Laughren 1983; Jackendoff 1983, 1990; see also Dowty 1979).<sup>1</sup> Figure 1 displays an LCS from Jackendoff (1990) for the verb drink. Figure 1 conceptualizes the act of drinking in terms of a causal event resulting in the conveyance of a liquid to someone's mouth. The LCS contains two prominent argument roles: the initiator of the causal event and the stuff being consumed. These arguments are projected into the syntax as the external and internal arguments of the verb respectively.

INSERT FIGURE 1 ABOUT HERE

The causative alternation is typically presented as an addition of a semantic feature CAUSE to a verb's underlying semantic representation (Dowty 1979; Grimshaw 1990; Hale & Keyser 1986; McCawley 1972). The example in (1) illustrates this addition with a corresponding change in the verb's transitivity.

1. a. The stick broke.
- b. Ian broke the stick.

The subject of the intransitive verb in (1a) bears the same thematic role as the direct object of the transitive verb in (1b). The sentence in (1b) contains an additional verb argument to express the instigator of the action affecting the direct object.

The sentences in (1) illustrate the lexical form of the causative alternation that prevails in English. Many languages employ a derivational morpheme to effect a similar change in verb transitivity. K'iche', a Mayan language of Guatemala adds the causative suffix -(i)sa to produce transitive verbs (Mondloch 1978).<sup>2</sup>

2. a. ka-0-xojow le: achija:b'

ASP-3A-dance the men

'The men are dancing.'

b. k-0-u-xojow-isa-j le: achija:b'

ASP-3A-3E-dance-CAUSE-TV the men

'She/he is dancing the men.'

Languages like K'iche' restrict the causative morpheme to attributions of conventional or stereotypical causation. This limits the use of the causative affix to verbs whose meanings allow a 'direct' or conventional connection between the action of an agent and the effect on a patient (Fodor 1970; Hopper & Thompson 1980; McCawley 1972). The attribution of conventional causation is subject to an array of language particular influences such as the medical procedures currently in vogue (whence the acceptability of the phrase 'to bleed a patient').<sup>3</sup>

Japanese uses its causative affix -(s)ase for both conventional and unconventional causation. The sentence in (3a) illustrates the use of the causative affix for conventional causation, while (3b) illustrates the use of the affix for unconventional causation (Ichihashi 1991).

3. a. Taroo-ga Hanako-o kuruma-kara ori-sase-ta

Taro-NOM Hanako-ACC car-from get\_out-CAUSE-PAST

Taro got Hanako out of the car.

b. [Shibatani 1976:267]

Taroo-wa Hanako-o yorokob-ase-ta.

Taro-TOP Hanako-ACC happy-CAUSE-PAST

Taro made Hanako happy.

Japanese verbs such as tomaru 'stop' have both lexical and morphological causative forms. The lexical form expresses conventional causation while the morphological form expresses unconventional causation (McCawley 1972). Some Japanese verbs, such as kusaru 'freeze', only have a morphological causative. Such verbs lack a lexical form of the causative. Still other verbs, such as hae 'grow' only have lexical causative forms and not morphological forms.

English uses the distinction between lexical forms and periphrastic forms to express the difference between conventional and nonconventional causation, e.g. (4).

4. a. Ian broke the stick.

b. Ian made the stick break.

The sentence in (4b) implies that Ian used an unconventional means to achieve his end. English verbs such as those in (5) lack a lexical form of the causative, and thus use the periphrastic form to express external causation.

5. a. Dillon made the bears dance.
- b. Natelise made her parents laugh.
- c. Laughter makes the world go round.
- d. Blaine made me leave.
- e. David Copperfield made the World Trade Center disappear.

Such cases raise the issue of how one determines the range of conventional causation independently of verb argument structure. Simply assuming a correlation between verb argument structure and conventional attributions of causation leads to circular arguments when verb argument structure is used as evidence of conventional causation. Cross-linguistic comparisons show the fallacy of this assumption. Mandarin and Thai, for example, use a compound verb form to express most cases of conventional causation. Lexical alternations are only available for a few verbs (e.g., Mandarin kai 'open'). The example in (6) illustrates the manner in which Mandarin speakers use resultative verb compounds to express cases of conventional causation (Li & Thompson 1981). The lexical alternation shown in (6c) is unacceptable.

6. a. bei-zi pò lè

cup break ASP

`The cup broke.'

- b. Lisi nòng-pò lè bei-zi

Lisi manipulate-break ASP cup

`Lisi broke the cup.'

c. \* Lisi pò lè bei-zi

The discussion to this point has only presented the causative alternation from the perspective of adding an external agentive argument to the verb. It is important to recognize the bidirectional nature of the causative alternation. Levin & Rappoport (1994) suggest using the selectional restrictions for English verbs to establish their basic transitivity. Thus, they suggest that the English verb break is basically transitive since it has more transitive than intransitive uses, see (7).

7. a. Blaize broke the silence/her promise.

b. \*The silence/her promise broke.

Many languages support an anticausative alternation that intransitivizes a transitive verb stem. Mandinka, a Niger-Congo language of West Africa, uses a verb affix to effect this change. The transitive form of kati 'stick\_break', for example, has a corresponding intransitive form kati-ta. K'iche' Maya uses an antipassive affix to make this change on a subset of transitive verbs (Mondloch 1981). The antipassive morpheme in K'iche' typically suppresses the internal argument and changes a transitive verb stem to an intransitive stem (8). For a few verbs, the antipassive morpheme doubles as an anticausative morpheme which results in the suppression of the external argument, see (9).

8. a. x-0-u/tze'-j le: ak'ala:b' le: a Wan

ASP-3A-3E/laugh-TV the children the FAM John

'John laughed at the children.'

b. x-0/tze'-n le: a Wan

ASP-3A-laugh-AP the FAM John

'John laughed.'

9. a. x-0-u-q'upi-j le: che' l-a Wan

ASP-3A-3E-break-TV the stick the-FAM Wan

'John broke the stick.'

b. x-0-q'upi-n le: che'

ASP-3A-break-AP the stick

'The stick broke.'

Spanish and other Romance and Slavic languages use a reflexive clitic as an anticausative (10). The clitic converts underlying transitive or unaccusative verbs to intransitive forms that express the result of an action on a theme. Movement of the theme NP to the overt subject position is optional in Spanish (Cossé de Perez 1995).

10. a. Raul rompió el palo.

'Raul broke the stick.'

b. Se rompió el palo.

'The stick broke.'

The anticausative alternation is sensitive to the conventions governing when an object can

undergo an action spontaneously (Levin & Rappaport 1994). Otherwise, the language must use a passive verb form to indicate the result of an action without naming an agent, see (10). The ambiguity between anticausative and passive forms in Romance and Slavic languages is not accidental. The scope of the anticausative alternation includes the passive as one of the means languages employ to express the outcome of an action without overtly specifying an agent (Levin & Rappaport 1994).<sup>4</sup> A theoretical account of acquisition of the causative and anticausative alternations must situate the causative alternation among all the means languages employ to alternate verb argument structure, as well as the constraints on each process.

10. a. \* The ball threw.
- b. The ball was thrown.

A brief survey of the crosslinguistic facts demonstrates that verbs do not have identical argument structures in all languages (cf. Haspel Smith 1994; Nedyalkov & Silnitski 1973). The form of the causative alternation varies across languages, depending on whether the verb root is transitive or intransitive in the language, and whether a lexical, morphological or periphrastic form of the causative is available. Some crosslinguistic examples of the causative alternation for the verb break are shown in Table 1. Such differences demonstrate that languages have considerable freedom in assigning an underlying verb argument structure to particular events.<sup>5</sup> The only universal feature of the causative alternation across languages is that lexical forms are more likely to express stereotypical forms of causation than morphological forms, and morphological forms express stereotypical causation more than periphrastic forms. Lexical verb forms also express the spontaneous result of an action more directly than passive forms. Thus, each language provides a causative alternation that is more or less stereotypical or spontaneous

**relative** to the other available forms in the language. No single form of the causative is universal or necessary to express stereotypical causation or spontaneous action. Constraints on the causative alternation reflect language particular conventions and lexical inventories.

INSERT TABLE 1 ABOUT HERE

A possible response to such crosslinguistic variation would be to insist that these verbs do not refer to the same concept in each language, and therefore any variation in argument structure can be attributed to a difference in meaning (cf. Grimshaw 1990; Levin & Rappaport Hovav 1994). Any proposal for a uniform mapping from semantics to verb argument structure must demonstrate semantic uniformity independently of argument structure uniformity. The lack of independent semantic controls reduces much of current argument structure theory to handwaving (Baker 1988; Chomsky 1981, 1993; Grimshaw 1990; Jackendoff 1983, 1993; Levin & Rappaport Hovav 1994; Wilkins 1993/1994). One must demonstrate that crosslinguistic variation in mapping is due to specific differences in meaning as well as demonstrating that crosslinguistic mapping uniformity is correlated with a significant degree of semantic similarity. The verbs in Table 1 are all translations of the English verb break. There are significant differences in their range of use (Pye, Loeb & Pao 1995), but we have no objective criteria for determining how significant such semantic differences must be to affect verb argument structure. The verbs listed in Table 1 are all used to describe an event of stick breaking.

Quine (1960) discussed a related predicament in the context of radical translation. Whether translating between languages with minimum contact or speakers of the same language, there is no evidence that speakers can use to insure that their translations refer to the same concept. Speakers can make their lexical concepts similar by adjusting the meaning they attribute to other words in the language. Although Quine used the difficulty of translating between human languages to illustrate his point, the paradox applies with equal force to the difficulty of

translating between human languages and a language of the mind (Fodor 1975; Jackendoff 1983, 1990). Quine uses translation (ordinary and radical) to argue against the possibility of determinate concepts, but granting the existence of fixed concepts would not help a child decide if the verb they encounter refers to the English, Garifuna, K'iche', Mandink, Thai, etc. concept of breaking. In other words, we are claiming the putative semantic primitives cited in work on verb argument structure, theta theory, lexical conceptual structure, etc. are unlearnable. While concepts may not be indeterminate as Quine speculates the evidence available to children is never sufficient to determine verb meanings. Children rely on underdetermined meanings that are relatively autonomous from syntax, including verb argument structure.

This conclusion makes the acquisition of the causative alternation and its constraints all the more mysterious. To the extent that there are uniform relationships between verb meaning and verb argument structure, one could assume that children note these correlations and exploit them in acquiring the causative alternation. However, the preceding discussion has shown that: 1. the case for uniform mapping is overstated, and 2. the supposed semantic features are too subtle to learn. Assuming that children do not rely upon direct or indirect negative evidence to acquire constraints on the causative alternation (Marcus 1993; Pinker 1989), we must find an explanation that is not based on word meaning. We will propose an explanation that does not rely upon subtle semantic distinctions or overt correction. First, we discuss the data currently available for the acquisition of the causative alternation.

### 3. The Acquisition of the Causative Alternation

Although many excellent developmental studies of the causative alternation exist, none tackle the full range of issues associated with the acquisition of the alternation. In this section, we will survey the acquisition data for the causative alternation and report some new data that

provide further insight on its acquisition.

The study of the causative alternation began in earnest with Bowerman's 1974 report that her daughters sometimes overextended their verbs to express an additional causal agent. The examples in (11) are typical:

#### 11. Intransitive verbs

a. C (2;3) I come it closer so it won't fall.

(= make it come closer; bring it closer)

b. C (2;8) Daddy go me around. (= make me go around)

c. C (3;7) I want to stay this rubber band on.

(= let it stay on; leave it on)

d. M (3;1) I'm singing him. (= making him sing)

e. M (3;5) Be a picture of Emily and me.

(= cause to be; exist; make)

#### 12. Transitive verbs

a. C (3;3) See, she can't eat. But I can't eat her.

(= make her eat; feed her)

b. C (3;4) I'm gonna guess it to him.

(= let him guess it)

Bowerman originally reported overgeneralizations of the causative alternation that resulted from the addition of an external argument. Lord (1979) added to Bowerman's

observations with data from her own children that provide examples of novel alternations in the opposite direction, from transitive to intransitive (13)-(14).

### 13. Transitive verbs

a. B (3;3) We have two kinds of corn: popcorn, and corn. Popcorn: it crunches.

And corn doesn't crunch; it eats!

b. B (3;9) What does it read about?

c. B (3;11) You're bothering me! You keep on talking to her! And that makes me  
bother!

d. J (2;9) I can't hear it. (puts clock to ear) It can hear now.

e. J (8;3) Do you think it'll fix.

### 14. Ditransitive verbs

a. B (2;8) She calls 'Fluffy Cat'. (= She is called ...)

b. J (2;10) I wanna take it out so it can't put on my nose. (= so it won't get ...)

Such examples can easily be multiplied with examples from other children. We have recorded several ourselves.

### 15. Added agent

a. N (5;2) First I have to die it some more. (= kill)

b. C (3;6) Mommy has to talk the king. (= make the king talk)

c. C (3;10) Let me see you a secret ... (= show)

d. C (6;3) It was that one easy plan that survived me. (= let me survive)

e. C (7;9) I'm going to wait him there ... (= make him wait)

f. C (9;0) If you're so good, then why haven't they skipped you?

(= let you skip a grade in school)

#### 16. Absented agent

a. C (7;0) If they were metal they would detect in the metal detector (= be detected)

Researchers have supplemented these spontaneous productions with experimentally elicited overgeneralizations of the causative alternation. Braine et al. (1990) demonstrated that children between 2 and 4 years old would overgeneralize the causative under the pressure of discourse. For example, Braine initially presented fixed transitive verbs in transitive contexts, e.g., 'I am throwing the ball. Can you throw the ball?' This introduction was followed by an 'Agent-question' to elicit a transitive use of the verb, e.g., 'What did I (you) do?' Once the children had used the verb in its appropriate syntactic context, the investigators followed with a question that would elicit a use of the verb in a novel transitivity context. They used 'Patient-questions' for transitive verbs, e.g., 'What did the ball do?' Braine et al. found that children overgeneralized fixed transitive and intransitive verbs in approximately 33 percent of their coded responses.

The available data help to constrain theories that would account for the acquisition of the causative alternation. The spontaneous production data indicate that children overgeneralize the causative alternation throughout childhood. Bowerman reported that her subjects overgeneralized the causative alternation by adding an external argument to the verbs. Lord reported a significant number of overgeneralizations that resulted from the omission of an agentive argument. The

discrepancy between Bowerman's and Lord's findings indicates that significant differences exist in the way individual children acquire verb argument structure.

The rate of causative overgeneralization is another important detail. Bowerman and Lord only reported the verbs that their children overgeneralized, not their frequency. Maratsos et al. (1985) estimated that Bowerman's daughters overgeneralized the causative alternation in one of every 10,000 utterances. This rate is much less than that reported by Braine et al. These differences can be partially reconciled by noting that the possibility for overgeneralizing the causative alternation only exists in situations where an argument is being added or absented from a verb with fixed transitivity. A large number of English verbs such as break and turn participate in the causative alternation. Furthermore, children tend to use verbs with fixed transitivity such as dance and cut in the appropriate syntactic contexts. Children rarely have an opportunity to use verbs with fixed transitivity in contexts that demand a transitivity alternation. Thus, experimental evidence will be crucial in determining children's knowledge of the constraints on verb argument structure.

Experimental investigations can only target a subset of the fixed transitivity verbs in any given language. Braine's group studied two fixed intransitive verbs (dance, fall) and two fixed transitive verbs (put, throw). Braine's group included six novel verb stimuli in their study (e.g., blooge, kaze), but novel verbs create significant methodological challenges. Experimenters assume that presenting such verbs in a single context provides enough information for adult subjects to acquire the verbs' meaning. Experimenters may even supply English synonyms for their novel verbs, e.g., break or bounce. Both novel actions and available synonyms demonstrate that subjects fix the meanings for novel verbs in relation to their pre-existing verb lexicon. The same experiments would translate into K'iche' or Mandink as a different verb with a different argument structure. The most significant finding from studies with novel verbs has been the

demonstration that adult speakers fail to constrain argument structure alternations with novel words (Braine et al. 1990; Gropen et al. 1991). Novel verb stimuli cannot be used to study the development of constraints on verb argument structure because experimenters have not succeeded in getting adults to apply grammatical constraints to the argument structures of such verbs.

Spontaneous data provides some information on the range of verbs children will use in inappropriate syntactic contexts, but it is still an uneven sampling across different semantic and syntactic categories of verbs. In an effort to survey children's acquisition of the argument structure for a wide range of verbs we adopted Braine's procedures to 44 verbs. The data we will report come from elicitation studies with 2 groups of normally developing children, and one group of adults. Each group contained 7 subjects. The first group of children ranged in age between 2;6 and 4;0. The second group of children ranged in age between 5;1 and 6;6. All of these children were learning English and had normal scores on an elicited vocabulary test (EOWPVT-Gardner 1990). The 44 verbs we elicited appear in Table 2.

INSERT TABLE 2 ABOUT HERE

The verbs fall into 4 distinct syntactic classes. The lexically alternating verbs (break, open, float, etc.) appear in both transitive and intransitive sentences. In transitive contexts the alternating verbs have an agent as subject and patient as object. In intransitive contexts the patient becomes the subject and the agent is not expressed. The transitive verbs (cut, put, throw) do not participate in the causative alternation. These verbs have to be passivized before they can appear in intransitive contexts, e.g. 'The ball was thrown.' The intransitive verbs (walk, go, dance, etc.) also do not undergo the causative alternation. English speakers must employ a periphrastic construction to use these verbs in 'transitive' contexts, e.g. 'We got the horse to dance.' The last set, the antipassive verbs (climb, eat, leave), are similar to the transitive verbs in

that they do not participate in the causative alternation. They can appear in intransitive contexts ('Mary is eating'), but these result from the omission of the internal argument (e.g., food) rather than from an omission of the external argument (c.f., Ingham 1993/1994).

We assessed the subjects' ability to lexically alternate verbs in the causative alternation, following the procedure described by Braine and his colleagues (1990). We modelled each verb in a sentence and then asked the subjects to use the verb in a different elicitation context. Each subject had eight alternating verbs to alternate in the I → T direction and eleven verbs to alternate in the opposite direction. For example, we presented boil to the subjects in an intransitive context ('Look, the water is boiling') and then elicited its use in a transitive context ('What did I do to the water?'—answer 'You boiled it'). Results from this causative alternation task for the alternating verbs alone are shown in Table 3. English uses a lexical alternation as the predominant form for the causative alternation.

#### INSERT TABLE 3 ABOUT HERE

We found a significant difference between the groups' ability to use the lexical form of the causative alternation (Intransitives  $F(2, 18) = 3.75, p = .05$ ; Transitives  $F(2, 18) = 5.2, p < .05$ ). Subsequent analyses showed that the two to four-year-old children produced significantly fewer lexical alternations in the intransitive to transitive alternation than either the five to six-year-old children or the adults (Newman-Keuls post hoc comparison;  $p < .05$ ). The younger children also produced significantly fewer lexical alternations than adults in the transitive to intransitive direction (Newman-Keuls post hoc comparison;  $p < .05$ ). The older children used the lexical alternation with 72% of the alternating verbs whereas the younger children used the lexical alternation with only 50% of the alternating verbs.

The subjects had a variety of options to choose from if they did not use the lexical form of the causative alternation (Table 4). In the I → T alternation the subjects could use a periphrastic

sentence consisting of the verb make and another verb, e.g. 'You made it stop'. In the T → I alternation subjects could use the passive voice, e.g. 'It was cut'. The younger children were especially prone to produce other types of responses in this task. They would use a different verb (wind for roll or twist for turn), not alternate the verb's transitivity (NA, e.g., they would say 'It boiled' in response to the question 'What did I do to the water?'), or simply refuse to respond.

INSERT TABLE 4 ABOUT HERE

Sixteen (80%) of the older children's non-lexical alternations in the intransitive → transitive direction were periphrastic constructions, while the younger children just produced four periphrastic responses (14% of their nonlexical alternations). This difference is close to significant ( $F(1, 13) = 5.624, p = .0543$ ). The adults subjects were not included in this test since there was no variation in their responses. The use of the passive displays a similar pattern for the T → I responses ( $F(2, 18) = 10.4, p < .01$ ). The younger children produced a significantly smaller proportion of passive sentences than the older subjects (Newman-Keuls post hoc comparison;  $p < .05$ ). The younger group of children used other responses or failed to alternate the verb. The individual subjects' responses underline these group differences. Our 4-year-old was the only member of the 2-4-year-old group who produced both periphrastic and passive sentences, while one other child (3;6) produced all of the other periphrastic constructions. Such results indicate that two to four-year-old English-speaking children do not have full command of the periphrastic and passive constructions the causative alternation requires.

A primary focus of our pilot study was the frequency of overgeneralizations the subjects would produce based on the methodology employed by Braine et al. (1990). Due to the nature of our task, it is only possible to overgeneralize a verb with fixed transitivity. Fixed intransitive verbs require the periphrastic construction to express a causal agent, while fixed transitive verbs can only omit the causal agent in passive constructions. Table 5 shows the number of lexical

overgeneralizations our subjects produced and the verbs that they overgeneralized. Table 6 adds some perspective to the number of overgeneralizations by presenting the number of periphrastic and passive constructions the subjects produced for the nonalternating verbs.

INSERT TABLE 5 ABOUT HERE

INSERT TABLE 6 ABOUT HERE

We reasoned that these three responses (the number of overgeneralizations, periphrastic and passive constructions) constitute the range of relevant responses for the nonalternating verbs. The trials where subjects failed to respond or responded with a different verb would not provide data relevant to determining their knowledge of the target verbs. Table 7 takes this reasoning one step further by presenting the proportion of causative overgeneralizations our subjects produced relative to the number of periphrastic and passive constructions they produced for the nonalternating verbs.

INSERT TABLE 7 ABOUT HERE

Our overgeneralization findings expand observations from the literature on normal language development in many significant respects. This literature suggests that children will overgeneralize the causative alternation in both directions: from intransitive to transitive verbs and from transitive to intransitive verbs. Several researchers have noted that children will overgeneralize more frequently from intransitive to transitive verbs than in the opposite direction (Lord, 1979, Maratsos et al., 1987, Pinker, 1989). Our findings for two of the groups support this observation contrary to the findings from Braine et al. The 5;1-6;6 group produced more overgeneralizations in the opposite direction. Furthermore, we find individual differences between our subjects in the direction of overgeneralization. Only one of our subjects overgeneralized verbs in both directions. The subjects primarily produced overgeneralizations in one direction or the other. This observation accounts at once for the discrepancy between

Bowerman (1974) and Lord (1979). Both investigators may be right in reporting differences between individual children in direction and frequency of causative overgeneralization. Maratsos et al. (1987) report their subjects exhibited stable individual differences in the rates they extended a novel intransitive verb to transitive sentence contexts. Our results thus paint a much richer picture than the existing literature and suggest individual children decide how frequently and in which direction to employ the causative alternation.

We did not find evidence that the semantic class of the verbs exerted any discernable effect on the children's tendency to produce overgeneralizations. A majority of our subjects' overgeneralizations were made with volitional action verbs (sleep, sweep, swim, throw and walk). A volitional action is under the control of its initiator and does not change the physical state of a participant in the action. However, the volitional action verbs also constituted forty-eight percent (12/25) of our non-alternating verb stimuli. Thus, the five overgeneralized volitional verbs make up just forty-two percent (5/12) of the non-alternating volitional action verbs. The children's other causative overgeneralizations make up comparable proportions of their semantic classes (e.g., cut—change of state, 50%; leave—directed motion, 20%). No subjects overgeneralized the expressive action verbs (cry, laugh, roar, sing, talk), but this result may be due to the experimental design. Since we did not elicit several of the classically overgeneralized verbs (come, cry, dance, go, stay), we conclude that our procedure resulted in a conservative estimate of speakers' tendencies to overgeneralize the causative alternation. We need a better understanding of the factors that would induce subjects to overgeneralize these other verbs.

#### 4. Acquisition Theory

The discussion to this point provides the necessary background for evaluating existing

accounts of the acquisition of the causative alternation. We can now review these accounts to evaluate their explanations for the range of verbs that children overgeneralize, the rate and duration of overgeneralization, the types of overgeneralizations that children make, and the means children use to constrain the causative alternation.

#### 4. 1. Bowerman 1974, 1978

Bowerman originally noted that the onset of causative overgeneralizations in her daughters' speech followed the first appearance of periphrastic constructions with make and get at two years. This evidence led her to postulate that children first acquire verbs as incompletely analyzed semantic units. Around 2;0 children begin to analyze verb meaning into distinct semantic components, and realize that the causative alternation adds a component CAUSE to the meaning of the verb that licenses the addition of an external argument—the agent. Bowerman noted that her daughter Christy seldom used fixed transitive verbs in intransitive contexts (1974:148). Thus, her hypothesis accounts for the directionality of the causative overgeneralizations her daughters produced.

Bowerman's original paper on this topic focusses on the onset of causative overgeneralizations and possible explanations for this phenomenon. She neglected the more difficult problem of accounting for the decline in causative overgeneralizations as children grow older. This omission is understandable given the young age of Bowerman's daughters, but current syntactic theory places enormous importance on constraints and their acquisition. Given the theoretical importance of constraints, it is somewhat dismaying to discover that we still lack basic information on the decline in the frequency of causative alternations among school-aged children.

#### 4. 2. Lord 1979

Lord was the first researcher to report a bidirectional set of causative overgeneralizations among her children. She states that she first noticed her children producing novel transitives at about age two and a half, and novel intransitives two or three months later (84). It is impossible to tell from her report, however, how frequently her children overgeneralized the causative alternation in either direction and at what ages. The number of verb types the children overgeneralized appears to be roughly comparable in both directions.

This data led Lord to speculate that the children had constructed a lexical paradigm for the causative alternation that was unbiased in directionality. Applying the paradigm to an intransitive verb would add an agent argument to its verb argument structure. For the verb fall, this would result in the overgeneralization 'I did fall my vitamin.' Applying the paradigm to a transitive verb would remove an agent argument from its argument structure. For the verb eat, this would result in the overgeneralization 'And corn doesn't crunch; it eats!'

While Lord's paradigm theory accounts for the bidirectional nature of the causative overgeneralizations in her data, it does not address the more critical problem of explaining the decline in overgeneralizations with age. That is, it suffers from the same focus as Bowerman's proposal in putting the production of causative overgeneralizations before the acquisition of constraints on the alternation.

#### 4. 3. Pinker 1984

Pinker (1984) also adopted a paradigm construction theory to account for the acquisition of the causative alternation. In the case of the causative alternation, Pinker assumes that the basic paradigm contains two cells as in Figure 2. Pinker used Lexical Functional Grammar (Bresnan 1982) to outline his proposals. The cells in Figure 2 display the syntactic relations on the upper

tier and the corresponding functional relations on the lower tier. A child could apply this paradigm to both intransitive and transitive verbs, so it captures the bidirectional nature of the causative overgeneralizations that Lord documented.

INSERT FIGURE 2 ABOUT HERE

Pinker went on to consider the problem of how children would acquire constraints on the causative alternation in such a model. One proposal he discusses would be that children eventually learn to distinguish conventional or stereotypic from non-conventional types of causation. The development of this distinction would cause children to split the causative cell of the paradigm into two parts—one for stereotypic causation and one for non-stereotypic causation (see Figure 3).

INSERT FIGURE 3 ABOUT HERE

With this more advanced paradigm for the causative alternation, children merely have to determine whether an action is stereotypic.

The main problem with this solution is that Pinker does not provide an explicit description of stereotypic causation. This approach is not demonstrably different from one in which children learn to distinguish between acceptable and unacceptable forms of the causative. An expression that refers to stereotypic causation is acceptable while a causative expression is acceptable because it refers to a stereotypic event of causation. Stereotypy also predicts that children would use a verb in transitive contexts that they **believed** were typical and would not use a verb in contexts that they **believed** were atypical. Languages are far more consistent than individual beliefs, so belief-based accounts of language are not compelling explanations for linguistic regularities. A second problem is that the paradigm account does not offer an explanation for the development of causative overgeneralizations over time. It predicts that children would apply the alternation equally to all of their verbs and likewise constrain the

alternation abruptly once they recognized the role of stereotypy. A final problem is that the paradigm model predicts that children will overgeneralize the causative alternation in both directions. It cannot account for data like Bowerman's. A minor technical correction is also warranted. Figure 4 expands Pinker's model to include nonstereotypic expressions of intransitive actions. This expansion would allow Pinker's model to distinguish between acceptable and unacceptable intransitive verbs.

#### INSERT FIGURE 4 ABOUT HERE

Pinker provides an additional mechanism whereby children could constrain the causative alternation. Following his suggestions for the acquisition of constraints on overregularizing past tense morphology, Pinker suggests that children would have positive evidence in suppletive forms to constrain the causative alternation. A child extending die to transitive contexts ('You died him') would hear other speakers using the word kill to express this meaning. Eventually, the established form should replace the child's innovated form by the uniqueness rule (Clark & Clark 1979; Wexler & Culicover 1980). That is, at some point children must learn to use the words that make up the language of their speech community. As Pinker states (345) 'direct physical causation of death is not expressed as to die X but as to kill X, and other examples of children's use are also ruled out for this reason (e.g., \*sad/sadden, \*sharp/sharpen, \*straight/straighten, \*come/bring, \*go/take, \*fall/drop, \*higher/raise, \*full/fill, \*hot/heat, \*have/give)'.

We think suppletion by an existing form provides a partial solution to the problem of constraining the causative alternation. Roughly ninety percent of children's causative overgeneralizations have lexical suppletions in English (Oetting 1989). Thus, replacement of the overgeneralized form by an existing verb would constrain most of the suspect alternations. However, uniqueness is not a complete solution since it leaves verbs which lack a lexical alternate unexplained. A child would not find a simple lexical form in English to express the

action of disappearing a rabbit or singing a turtle no matter how long they listened. An additional mechanism is called for.

#### 4. 4. Pinker 1989

Pinker (1989) discusses several solutions to the acquisition of constraints on the causative alternation. His chief suggestion is a refinement of his stereotypy-based definition of direct causation. While this constraint is still necessary for the causative alternation to apply, he adds a set of narrow semantic restrictions to further constrain the alternation. Pinker suggests that children acquiring English are sensitive to such narrow semantic distinctions as whether the verb specifies a manner of motion or 'contained motion taking place in a particular manner' (130). Children first acquire the broad range rule of direct causation and then slowly acquire the set of narrow range rules that constrain the alternation appropriately.

Pinker's broad range rule for the causative alternation inherits the defects of its predecessor. Pinker does not provide an explicit theory of direct causation, and so renders the account untestable. His derivation of the directness constraint from the thematic roles patient and theme (85-9) is only convincing to the degree that thematic roles have been substantively defined (cf. Dowty 1991 for discussion). Pinker's narrow range rules are less explicitly defined. They lack independent support beyond the fact that motivated Pinker's original classification—namely their correlation with the causative alternation. Pinker provides no direct evidence of their role in the development of the causative alternation. Bowerman (1988) argues that the narrow range verb classes are unlearnable in that the smaller classes have as many exceptions as members. A child could encounter positive exceptions to a non-alternating subclass and assume that the entire subclass of verbs undergoes the causative alternation. The child would require negative evidence to unlearn such a generalization.

Pinker postulates a host of auxiliary mechanisms in addition to his broad and narrow range rules. The auxiliary mechanisms actually carry the brunt of the work in accounting for the causative alternation. There are 'exceptions' such as walking a batter, burping a baby and bleeding a patient, that Pinker attributes to an 'isolated verb that is learned by positive evidence' (88). There are 'one-shot innovations' that Pinker terms Haigspeak such as What's fussing her? and Can you reach me the book? that Pinker observes are even present in adult speech (317). Pinker appeals to a conservative learning strategy to account for children's acquisition of the language particular narrow range verb classes (317). Pinker suggests that part of children's difficulty can be attributed to the late development of the periphrastic causative (324). Pinker attributes some of the children's errors to 'incorrect lexicosemantic representations' (325). Finally, Pinker rules out adult like slips of the tongue and errors in the lexical retrieval process as explanations of the children's overgeneralizations (333-4).

Certainly reality is often more complex than linguists' simple rule schemas suggest, but this complexity is best understood within a formalized system that explicitly defines elements and their interaction. Some of Pinker's auxiliary mechanisms are performance factors, e.g., the one-shot innovations and conservative learning. Other auxiliary mechanisms bear more directly on the nature of children's linguistic competence, e.g., the hypothesis of incorrect semantic representations. Failing a principled distinction between each of these factors, it is impossible to assert how much of the children's behavior should be attributed to one, some, or all of these factors.

Pinker's hypothesis of conservative learning is particularly inappropriate. An earlier section of his book takes great pains to argue that children readily generalize verb argument structures of novel verbs as adults do when learning a new verb. If children are actually conservative learners then further explanation is unnecessary. We can simply assume that

children gradually constrain verb argument structure by listening to the way other speakers use verbs and imitating them. We agree with Pinker that the evidence against conservative learning is compelling. To cite one example, one of Bowerman's daughters went through a phase in which overgeneralized transitive forms of come and go completely replaced the verbs bring and take (1978). Conservative learning will not explain the establishment of fixed verb argument structures in children's language.

#### 4. 5. Gleitman 1990

Gleitman suggests that children might employ a mechanism she termed syntactic bootstrapping to infer verb meaning from the syntactic contexts in which they appear. Pinker (1994) argues that this process would not allow children to make very fine distinctions in meaning given the wide range of verbs that can appear in transitive or intransitive contexts. We would add further that Gleitman's hypothesis predicts that children would follow a conservative learning strategy and only use verbs in the syntactic contexts they had heard other speakers use. Gleitman's hypothesis also assumes a deterministic semantics that is not supported by experimental research. Gleitman and her coworkers have only worked with children acquiring English, and have only investigated a few, prototypical actions. More extensive investigation is necessary to determine the congruity between the extensions of children's and adults' verb meanings.

#### 4. 6. Wilkins 1993/1994

Wilkins proposes a model for verb argument structure development based on Jackendoff's (1990) model of conceptual structure. Her proposal depends crucially on the assumption that children have access to conceptual structures paired with syntactic structures for lexical learning.

Wilkins states:

CS (conceptual structure, c.p.) is a cognitive construct neither dependent on nor derived from the system of language. As such, it is input to the linguistic components, not something that must be learned in the course of language acquisition (128).

Learning proceeds under Wilkins' assumption when the learner detects a mismatch between conceptual structure and syntactic structure. Wilkins further assumes that: 1. all aspects of conceptual structure must be lexicalized, and 2. the lexicalization of conceptual structure is syntactically minimal. With these learning strategies, Wilkins proposes the following acquisition procedure (131):

- a. Given the input syntactic structure  $ss$ , create a subcategorization frame  $|ss|$ .
- b. Given the input conceptual structure  $cs$ , create a conceptual structure frame  $|cs|$ .
- c. Using  $|ss|$  and  $|cs|$ , assign subscript indices (by use of the correspondence rules).
- d. Create a lexical entry  $LE(x)$  for  $x$ , where  $x$ =an element of  $ss$ .
- e. Using  $LE(x)$ , construct  $csL$  with (input)  $cs$ .
- f. Compare  $csL$  with (input)  $cs$ .
- g. If there is a mismatch, there is a detectable error.

To begin with, it is difficult to understand why such a learning procedure is necessary. By hypothesis, the child has  $|cs|$  and  $|ss|$  available to construct the verb's lexical entry. The child then derives a conceptual structure from the newly created lexical entry and compares it to the original conceptual structure. Since Wilkins assumes the construction process is unproblematic,  $csL$

should always equal cs. Thus, Wilkins' procedure reduces to a trivial example of conservative learning.<sup>6</sup> Wilkins does not provide any examples where her procedures actually result in detectable errors. Instead she is forced to assume that a child has already made an error in constructing a lexical entry to show that such an error would be detectable. Given the perfection of her learning procedure, this is an empty exercise.

Wilkins uses an example of the acquisition of a passivized verb to demonstrate a case where the difference between the csL and cs is not detected. Her example is the sentence 'The ball was thrown.' She assumes that a child hearing the verb throw for the first time in this context would construct a conceptual structure with two arguments and a syntactic structure with only one argument. However, this failure follows from a violation of Wilkins' original assumption that all aspects of conceptual structure must be lexicalized. Wilkins' acquisition procedure dictates that the child would construct a lexical entry for the passive participle thrown rather than the active form throw. Instead of making an error as Wilkins suggests, the child has actually succeeded in constructing the lexical entry for the passive form of the verb throw, and correctly identified its optionally expressed causer with the passive verb form (independently of whether the child recognizes the passive morphology).

Wilkins' learning procedure is most helpful in its explicit reference to a determinant semantics as input. Since we have questioned this assumption in the preceding discussion, we can use Wilkins' procedure to demonstrate where such an assumption causes trouble. Consider the pair of sentences in (17).

17.a. The stick broke.

b. Peter broke the stick.

Wilkins suggests that her learning procedure predicts that children would be unable to settle on a single lexical entry for verbs like break that participate in the English causative alternation (152). Children would switch freely between transitive and intransitive subcategorizations for the verb as they encountered each of these variants. This prediction violates what we take to be the basic assumption in Wilkins' approach. Conservative learners should only construct a single conceptual structure frame for this event. Wilkins' learning procedure is based on the assumption that learners can detect the intrinsic conceptual features of an event, and would therefore construct a single |cs| consistent with the event. Children would then reject as illformed any surface structure that was inconsistent with this |cs| and never acquire the causative alternation.

Following Wilkins' discussion, we might assume that children view these events as conceptually distinct. This time we face the problem of constructing a single lexical entry for two distinct |cs|, |ss| pairs. Wilkins' learning procedure requires a single |cs|, |ss| for each lexical entry otherwise the learner would construct multiple  $cs_L$  from the lexical entry leading to possible mismatches between the cs and  $cs_L$  and rejection of the lexical entry responsible for such mismatches. One solution would be to liberalize Wilkins' procedure by allowing lexical entries to contain ordered pairs of |cs| and |ss|. A child would then construct a  $cs_L$  from the lexical entry with the added constraint that its paired ss be consistent with the syntactic structure of the sentence. This  $cs_L$  should then be consistent with the cs expressed by the sentence.

This addition enables Wilkins' learning procedure to acquire the causative alternation at the cost of explaining how learners retreat from overgeneralizations. Following the procedure for a child overgeneralizing the verb come to transitive sentences results in an ordered pair of |cs|, |ss| in the lexical entry of the verb. The child's overgeneralization of the verb is consistent with one of the ordered pairs in her lexical entry, and so will not lead to a detectable error.

A more fundamental issue Wilkins' procedure raises is what we take to be the concept of

breaking. Wilkins assumes that children have only a single cs for each event, but we know nothing about how finely children distinguish between successive breaking events. Wilkins' procedure allows children to create separate cs for breaking sticks, glasses, bricks, balloons, etc. leading, presumably, to separate lexical entries for each occasion. A further concern is the apparent necessity for children to discern whether the verb refers to an exclusively resultative component of the action as in Mandarin or Garifuna, an inherently caused action as in K'iche' and Mandink, or an action with an optional causal component as in English. Wilkins' does not provide a mechanism for making such conceptual distinctions. This makes it impossible to grant her first assumption that children have immediate access to conceptual structure on the basis of witnessing a breaking event. Breaking events are inherently ambiguous and languages determine whether the causal subevent or the result subevent is lexically basic. Children have to rely upon the linguistic input to determine how to lexicalize events.

Our analysis shows that Wilkins' theory of lexical learning reduces to conservative learning. It predicts that children will not make errors in constructing lexical entries for verbs and contains basic contradictions in its fundamental assumptions. Its main error lies in the assumption that the input provides children with conceptual structures that can be usefully paired with syntactic structures. Wilkins provides no evidence for conceptual structure that is independent of the argument structures she seeks to explain.

## 5. The Generalized Paradigm

A complete solution to the acquisition of the causative alternation has much to account for. The major requirements for a solution include an explanation for developmental trends in the direction of children's overgeneralizations, an explanation for the variation in the degree individual children overgeneralize the alternation, an explanation that is applicable to the full

range of crosslinguistic expressions of causation, and finally, an explanation of how children acquire constraints on the causative alternation in their language. We offer a generalized paradigm explanation for the acquisition of the causative alternation. In this section we discuss the nature of the generalized paradigm and how it can account for each of the main features in the development of the causative alternation.

As we noted earlier a paradigm type explanation provides an immediate explanation for the general finding that children overgeneralize in both directions. The causative paradigm needs to be expanded to include the full range of forms that languages use to express causation. This paradigm appears in Figure 5.

INSERT FIGURE 5 ABOUT HERE

The generalized paradigm assumes that children will discover the available forms of the causative alternation in their language through positive evidence and construct the appropriate subset of the general paradigm. The most significant implication of this hypothesis is that verb argument structure would be independent of verb meaning. Children would not assume that particular events require expression by underlyingly transitive or intransitive verbs. This would be a lexical parameter that children would fix on exposure to positive evidence. Children do not have an innate bias against analyzing laugh as a transitive verb (e.g., K'iche' ts'e) or blush as an unaccusative verb (e.g., Italian arrosiore). The generalized paradigm hypothesis eliminates the need for children to perform microscopic analyses of verb meaning to discover if the verb's semantic representation contains one or another subtle semantic feature. In other words, the generalized paradigm hypothesis does not depend upon the assumption of a determinant semantics (Ellis 1993; Putnam 1989; Quine 1960). We thus eliminate the need to appeal to unsubstantiated semantic representations.

We replace Pinker's semantic dimension with a formal one. However, we maintain the

assumption that novel argument structures are preempted by the conventional forms children find in daily speech. We generalize the preemptions to include elimination by affixal (causative, anticausative, clitics, passive, antipassive, etc.), and periphrastic forms (lexical compounds and complex constructions). The generalized paradigm model offers an immediate explanation for the bulk of causative overgeneralizations in English. Children acquiring English will eventually notice that ideas they express with overgeneralized verbs are conventionally expressed with other words (e.g., come/bring, see/show, etc.). The cases that Lord and Pinker's more restrictive paradigm theories missed now enter into the generalized paradigm hypothesis as generalized cases of suppletion.

We adopt a suggestion from Williams (1994) in treating lexical compounds and periphrastic constructions as suppletive forms within a generalized paradigm structure. At first glance, such syntactic constructions appear to be outside the scope of lexical paradigms, but Williams suggests otherwise. He notes that adjectives have a paradigm that mixes inflectional and syntactic constructions, e.g.,

INSERT FIGURE 6 ABOUT HERE

The lesson Williams draws from such examples is that the lexical entries may contain more syntactic information than the individual part of speech. Significantly, this additional information includes phrasal constructions. We assume that children recognize contexts in which other speakers use phrasal constructions rather than single verbs to label events. This recognition is equivalent to situations in which speakers use a suppletive lexical or morphological form to label events. Children would hear other speakers say make the NP come in some contexts and bring the NP in others. They would use such positive evidence to distinguish the events appropriate to each expression as well as learning that come the NP is not used to label any of these contexts. The range of use for make the NP come and bring the NP would gradually expand

at the expense of the overgeneralized come the NP.

Clark (1987) makes a similar proposal in her discussion of the principle of contrast although she does not fully address the implications of contrast for paradigm construction and the structure of the lexicon. Bowerman (1988:91) finds Clark's proposal lacking in that the phrase make disappear does not have exactly the same meaning as causative disappear (e.g., 'She disappeared the rabbit'). Bowerman assumes that the contrast that exists in English between lexical and periphrastic causatives (e.g., open versus make open) carries over to verbs such as disappear. Thus, children should be reluctant to count the periphrastic make disappear as a suppletion for the lexical causative disappear. The generalized paradigm hypothesis, however, does not require speakers to extend an attribution of conventional causation to all periphrastic constructions. Children would have positive evidence that the periphrastic form conveyed conventional causation for verbs that lack lexical and morphological causative forms.<sup>7</sup>

The generalized paradigm theory has an interesting corollary. We have assumed that children hypothesize that come the NP is a default solution for the expression of an event in which a causer acts on a patient to bring it closer. If a child gradually replaced this default with the expressions make the NP come and bring the NP, there might still be occasions in which come the NP remained as a default. All that would be needed to trigger its use would be an instance that was unique enough to escape the suppletive process. We hypothesize that this process is responsible for the occasional adult innovations that Pinker terms Haigspeak. If the situation arises frequently enough, such innovations may enter the lexicon as marked uses, i.e., uses restricted to highly circumscribe events such as walking a pet, burping a baby or disappearing a prisoner. Indeed, the different acceptabilities of walking a pet vs. walking ??Tony the Tiger or disappearing a prisoner and ??disappearing a table support the generalized paradigm hypothesis to the extent that whole verb phrases rather than individual verbs govern acceptability

judgements.

We see at least two parameters that affect the suppletive processes children use to build lexical paradigms. The first is the default generalization discussed above. The assumption of a default entry in a lexical paradigm is actually a generalization that a child makes on the basis of rather limited evidence. An expression like make the NP come ranges over an infinite number of actors and actions. We assume that an essential part of using such an expression is learning the possible ranges of semantic space the expression refers to. If a child fails to extract a general semantic feature from their initial encounter with the expression, they might resort to tagging the expression with the singular context in which they first encountered the expression. This 'meaning' would result in significant undergeneralization until the child realized that the expression applied to a wider semantic space. Thus, children's default generalizations are limited by the set of expressions they have acquired as well as the structure of their semantic space.

The second parameter to affect the suppletive process is the structure of the child's lexicon. Suppletion requires a linguistic form and a structured semantic space before it can apply. Children would fail to apply suppletion if they lack a suitable lexical or phrasal replacement, or if they failed to recognize an overlap in the semantic space of two or more lexical or phrasal expressions. We assume that the acquisition of a potential suppletive item like bring is not enough to provoke suppletion. Children must also construct a semantic space for bring, and determine where its application overlaps that of come and make the NP come. Since semantic space has an infinite number of dimensions; we assume the suppletion process is never complete. The action of bringing a ball is not identical to bringing an apple, food, a person, technology, a strike, happiness, shame, etc.

We assume that the construction of semantic space is subject to a high degree of individual variation. In terms of the expressions we have been discussing, we assume that

children construct their own individualized semantic spaces for the words come and bring. Some children will generate a large space for come at the expense of bring, while others might initially restrict the semantic space for both come and bring. The first group of children would risk overgeneralizing come to transitive contexts, while the second group might overgeneralize both words. Alternatively, the second group of children might initially restrict both words to a subset of appropriate contexts, but eventually generate a large space for bring. This development would result in the overgeneralization of bring.

We may now offer an explanation for Bowerman's observation on the timing of causative overgeneralizations among her daughters. Remember that she noticed her oldest daughter began overgeneralizing intransitive verbs to transitive contexts shortly after producing her first periphrastic constructions. Bowerman attributed this correlation to the onset of an ability to analyze causal actions into their constituent components, i.e., CAUSE + RESULT. We interpret this observation as evidence that Bowerman's daughter had just begun to realize that the semantic space for come, etc. could be extended, and this extension was first expressed as a periphrastic construction and later by lexical overgeneralizations. Bowerman's hypothesis creates a lexical process that a child could apply to all of her verbs whereas the generalized paradigm hypothesis is restricted by the lexical parameter. A child would construct a generalized paradigm on a verb-by-verb basis as warranted by positive evidence. Thus, only the generalized paradigm hypothesis can reconcile a high degree of individual lexical overgeneralizations with a prolonged increase in the number of different verbs that a child overgeneralizes at any particular time.

There are two other features of causative overgeneralizations that the generalized paradigm hypothesis explains. Some children continue to overgeneralize the causative alternation through puberty. The complexity of generating an appropriately structured semantic space accounts for the length of time children require to restrict verb use. While the task of generating a

semantic space is complex and will continue throughout a lifetime, children are extremely efficient at extracting a general semantic configuration from a few exposures to its context of use. Thus, children appear to use words with their 'correct' meanings in frequently occurring, prototypical contexts. The appropriate test stimuli are required to map the limits of children's semantic space and determine its congruence to adult semantic space.

We conducted a pilot study of the development of semantic space for the verbs break and cut with this question in mind (Pye, Loeb & Pao 1995). We chose these verbs because they have similar semantic features (they describe a change of state), and different syntactic behavior (cut does not undergo the causative alternation). We investigated the cut/break distinction with 16 children learning English and 22 adults. The children were all between 3 and 5 years old. We asked speakers for their intuitions about the meaning of cut and break by asking them to describe a series of event types that range over the actions, instruments and results of breaking and cutting. Our experimental objects included playdoh, peanuts, crackers, paper and dental floss. Our instruments included hands, rulers, scissors, string and a pencil. Finally, our actions included a scissors action with the hand and a cutting action with the ruler and string. A subset of their responses are shown in Table 8.

INSERT TABLE 8 ABOUT HERE

Table 8 shows the percentage of children (the adult percentages appear in parentheses) responding to our paper manipulation stimuli with the verbs break, cut and tear. All of the children and adults used break to label the prototypical action of breaking a toothpick by hand. The results in Table 8 show that the children did not agree with adults about the proper range of uses for break. Many children used break to describe the events using paper. No adults used break for these actions. We were especially surprised to find children labeling the action of

applying scissors to paper as break. These developmental differences are to be expected for the acquisition of complex semantic spaces.

The generalized paradigm hypothesis makes a prediction that the other hypotheses miss. Since lexical, morphological and periphrastic constructions are equally applicable to the expression of causation, we expect to find cases where children overgeneralize morphological and periphrastic constructions to situations an adult would use a lexical form to describe. One of us (Pye 1994) has elicited examples of K'iche' children overgeneralizing the antipassive causative, while our experimental manipulation elicited many cases of children using the periphrastic causative to describe cases of 'direct' causation, e.g., 'You made it roll.'

As so many authors have noted (Nedyalkov & Silnitsky 1973; Shibatani 1976) languages have a strong tendency to express conventional causation lexically. Where two forms exist for expressing causation, the lexical form will be the means of choice for expressing stereotypical acts of causation. This tendency can be accounted for within the generalized paradigm hypothesis by the independent factor of iconicity in language (Haiman 1985; Zipf 1935). That is, common situations are given simple, unmarked forms of expression. Since affixal and periphrastic forms of the causative are more marked than lexical forms they carry an added implication that they refer to marked, nonstereotypic situations.

The generalized paradigm hypothesis offers an immediate explanation for the complex range of expressions languages use to express causation. As we noted in our discussion of the causative alternation, Japanese uses lexical forms to express some stereotypical cases of causation and morphological forms to express others. Some verbs have both forms, allowing a contrast between the two while other verbs lack a lexical or morphological form. The generalized paradigm hypothesis with iconicity would predict that where both forms are available, the lexical form would express stereotypical causation. However, the hypothesis does not predict that

stereotypical causation would always be expressed lexically. Indeed, the generalized paradigm hypothesis allows for the use of periphrastic constructions to express stereotypical causation. The hypothesis explains the variable expression of causation in Japanese as well as the differences between Japanese and English in the range of causative contexts each language expresses lexically.

## 6. Conclusion

Word meaning offers a tempting basis for syntactic generalization. Many parents believe that once children understand a verb's meaning, they will be in a position to use the verb in its appropriate syntactic contexts. We suggest that a serious crosslinguistic examination of verb meaning reveals enormous variation in the basic argument structures languages assign to verbs. This variation is not unlike the variation in lexicalization patterns Talmy (1985) revealed for verbs of motion. Attempts to preserve argument structure uniformity by positing differences in meaning create an insurmountable learnability problem. The conclusion we draw from such variability is that verb argument structure is not a simple reflex of verb meaning.

In the course of language acquisition, children are exposed to much more than a lexical form and a situational context. Spoken language embodies a host of morphological and syntactic constructions that constitute the backdrop for a child's linguistic performance. The generalized paradigm procedure that we outline in this paper, provides a mechanism that learners can use to track the morphological and syntactic information relevant to verb argument structure. This procedure makes reference to details of verb meaning unnecessary, and can be used with any human language. An autonomous syntactic module is still required to explain configurational features of language.

## References

- Baker, C. L. 1979. Syntactic theory and the projection problem. *Linguistic Inquiry* 10.533-581.
- Baker, Mark C. 1988. *Incorporation: A theory of grammatical function changing*. Chicago: Chicago University Press.
- Bowerman, Melissa. 1974. Learning the structure of causative verbs: A study in the relationship of cognitive, semantic and syntactic development. *Papers and Reports in Child Language Development* 8.142-178.
- , 1978. Systematizing semantic knowledge: Changes over time in the child's organization of word meaning. *Child Development* 49.977-987.
- , 1988. The 'No Negative Evidence' Problem: How Do Children Avoid Constructing an Overly General Grammar? *Explaining language universals*, ed. by John A. Hawkins, 73-101. Oxford: Basil Blackwell.
- Braine, Martin D. S. 1971. On two types of models of the internalization of grammars. *The ontogenesis of grammar*, ed. by Dan I. Slobin, 153-186. New York: Academic Press.
- Braine, Martin D. S., Ruth E. Brody, Shalom M. Fisch, Mara J. Weisberger and Monica Blum. 1990. Can children use a verb without exposure to its argument structure? *Journal of Child Language* 17.313-342.
- Bresnan, Joan. 1978. A realistic transformational grammar. *Linguistic theory and psychological reality*, ed. by Morris Halle, Joan Bresnan and George A. Miller, 1-59. Cambridge, MA: MIT Press.
- Bresnan, Joan (ed.) 1982. *The mental representation of grammatical relations*. Cambridge,

MA: MIT Press.

Chomsky, Noam. 1981. Lectures on government and binding. Dordrecht: Foris.

-----, 1993. A minimalist program in linguistic theory. Hale and Keyser (eds.), 1-52. Clark, Eve

V. 1987. The principle of contrast: a constraint on language acquisition. MacWhinney  
(ed.), 1-34.

Clark, Eve V., and Herbert H. Clark. 1979. When nouns surface as verbs. *Language*  
55.767-811.

Disciullo, A. M. and Edwin Williams. 1986. On the definition of word. Cambridge, MA: MIT  
Press.

Dixon, R. M. W. 1979. Ergativity. *Language* 55.59-138.

Dowty, David. 1979. Word meaning and Montague grammar: The semantics of verbs and times  
in generative semantics and in Montague's PTQ. Dordrecht: D. Reidel.

-----, 1991. Thematic proto-roles and argument selection. *Language* 67.547-619.

Ellis, John M. 1993. Language, thought, and logic. Evanston, IL: Northwestern University  
Press.

Fodor, Jerry A. 1970. Three Reasons for not Deriving 'kill' from 'cause to die'. *Linguistic  
Inquiry* 1.429-438.

-----, 1975. The language of thought. New York:

Gardner, M. F. 1990. Expressive one-word picture vocabulary test—revised. Novato, CA:  
Academic Therapy Publications.

Gergely, Gyorgy and Thomas G. Bever. 1986. Related intuitions and the mental representation  
of causative verbs in adults and children. *Cognition* 23.211-277.

Gleitman, Lila. 1990. The structural sources of verb meanings. *Language Acquisition*  
1.3-55.

- Goldberg, Adele E. 1995. *Constructions: A construction grammar approach to argument structure*. Chicago: Chicago University Press.
- Green, Georgia M. 1974. *Semantics and syntactic regularity*. Bloomington, IN: Indiana University Press.
- Grimshaw, Jane. 1990. *Argument structure*. Cambridge, MA: MIT Press.
- Gropen, Jess, Steven Pinker, Michelle Hollander, and Richard Goldberg. 1991. Affectedness and direct objects: The role of lexical semantics in the acquisition of verb argument structure. *Cognition* 41.153-195.
- Haas, W. 1962. The theory of translation. *Philosophy* 37.208-228.
- Haiman, John. 1985. *Natural syntax: Iconicity and erosion*. Cambridge: Cambridge University Press.
- Hale, Ken, and Samuel J. Keyser. 1986. Some transitivity alternations in English. *Lexicon Project Working Papers #7*. Cambridge, MA: MIT Center for Cognitive Science.
- Hale, Kenneth and Samuel Jay Keyser. 1993. On argument structure and the lexical expression of syntactic relations. Hale and Keyser (eds.), 53-109.
- Hale, Kenneth and Samuel Jay Keyser. (eds.) 1993. *The view from building 20*. Cambridge, MA: MIT Press.
- Hall, W.S., Nagy, W.E. & Linn, R. 1984. *Spoken words: Effects of situation and social group on oral word usage and frequency*. Hillsdale, NJ: Erlbaum.
- Haspelmath, Martin. 1994. More on the typology of inchoative/causative verb alternations. *Causatives and transitivity*, ed. by Bernard Comrie. Amsterdam: Benjamins.
- Hopper, Paul J. and Sandra A. Thompson. 1980. Transitivity in grammar and discourse. *Language* 56(2).251-299.
- Ichihashi, Kumiko. 1991. *A study on transitivity alternation in Japanese*. Lawrence, KS: MA

thesis.

Ingham, R. 1993/1994. Input and learnability: Direct-object omissibility in English. *Language Acquisition* 3.95-120.

Jackendoff, Ray. 1983. *Semantics and cognition*. Cambridge, MA: MIT Press.

-----, 1990. *Semantic structures*. Cambridge, MA: MIT Press.

Keyser, Samuel Jay Thomas Roeper. 1984. On the middle and ergative constructions in English. *Linguistic Inquiry* 15.381-416.

Levin, Beth, (ed.) 1985. *Lexical semantics in review*. Lexicon Project Working Papers 1, Center for Cognitive Science, MIT, Cambridge, MA.

Levin, Beth & Rappaport Hovav, M. 1994. The acquisition of the lexicon, A preliminary analysis of causative verbs in English, ed. by Lila Gleitman and Barbara Landau, 35-77. Cambridge, MA: MIT Press.

Li, Charles N. and Sandra A. Thompson. 1981. *Mandarin Chinese: A functional reference grammar*. Berkeley, CA: University of California Press.

Lord, Carol. 1979. 'Don't you fall me down!': Children's generalizations regarding cause and transitivity. *Papers and Reports on Child Language Development* 17.81-89.

Maratsos, M. P., R. Gudeman, P. Gerard-Ngo, and G. DeHart. 1987. A study in novel word learning: the productivity of the causative. *MacWhinney (ed.)*, 89-113.

Marcus, Gary F. 1993. Negative evidence in language acquisition. *Cognition* 46.53-85.

MacWhinney, Brian (ed.) 1987. *Mechanisms of language acquisition*. Hillsdale, NJ: Erlbaum.

McCawley, James D. 1972. Kac and Shibatani on the grammar of killing. *Syntax and semantics I*, ed. by J. Kimball, 139-149. New York: Seminar Press.

Mondloch, James L. 1978. *Basic Quiché grammar*. (Institute for Mesoamerican Studies,

- publication 2. Albany: State University of New York.
- Mondloch, James L. 1981. *Voice in Quiché-Maya*. Albany, NY: SUNY dissertation.
- Nedjalkov, V. P. 1969. *Nekotorye verojatnostnye universalii v glagol'nom slovoobrazovanii*.  
Jazykovye universalii i lingvisticheskaia tipologija, ed. by I. F. Vardul', 106-114.  
Moscow: Nauka.
- Nedjalkov, V. P. and G. G. Silnitsky. 1973. The typology of morphological and lexical  
causatives. *Trends in Soviet theoretical linguistics* ed. by F. Kiefer (Ed.), 1-32. Dordrecht,  
Netherlands: Reidel.
- Oetting, Janna B. 1989. *Exploration of Pinker's grammatically relevant subsystem  
hypothesis*. ms. University of Kansas.
- Pinker, Steven. 1984. *Language learnability and language development*. Cambridge, MA:  
Harvard University Press.
- , 1989. *Learnability and cognition: The acquisition of argument structure*. Cambridge,  
MA: MIT Press.
- , 1994. How could a child use verb syntax to learn verb semantics? The acquisition of  
the lexicon ed. by Lila Gleitman and Barbara Landau, 377-410. Cambridge, MA: MIT  
Press.
- Pye, Clifton. 1994. A cross-linguistic approach to the causative alternation. *Other children,  
other languages* ed. by Yonata Levy, 243-263. Hillsdale, NJ: Erlbaum.
- Pye, Clifton, Diane Frome Loeb, Sean Redmond and Lori Zobel Richardson. 1995. When do  
children acquire verbs? *The proceedings of the twenty-sixth annual child language  
research forum* ed. by Eve V. Clark, 60-70. Stanford: Center for the Study of Language  
and Information.
- Pye, Clifton, Diane Frome Loeb and Yin-Yin Pao. 1996. *The Acquisition of Breaking and*

- Cutting. The proceedings of the twenty-seventh annual child language research forum ed. by Eve V. Clark. Stanford: Center for the Study of Language and Information.
- Shibatani, Masayashi. 1976. Causativization. *Syntax and semantics 5: Japanese generative grammar* ed. by M. Shibatani, 239-294. New York: Academic Press.
- Talmy, Leonard. 1985. Lexicalization patterns: Semantic structure in lexical forms. *Language typology and syntactic description, vol. III: Grammatical categories and the lexicon* ed. by Timothy Shopen, 57-149. Cambridge: Cambridge University Press.
- Wexler, Kenneth and Peter Culicover. 1980. *Formal principles of language acquisition*. Cambridge, MA: MIT Press.
- Wilkins, Wendy K. 1993/1994. Lexical learning by error detection. *Language Acquisition: A Journal of Developmental Linguistics* 3.121-157.
- Williams, Edwin 1994. Remarks on lexical knowledge. *The acquisition of the lexicon* ed. by Lila Gleitman and Barbara Landau, 7-34. Cambridge, MA: MIT Press.
- Zipf, G. K. 1935. *The psycho-biology of language*. Boston: Houghton Mifflin.

## Notes

\* Portions of this paper were presented at the Stanford Child Language Research Forums in 1994 and 1995. We thank the participants of those forums for their comments and suggestions. We would especially like to thank the children, the parents, and the following child care centers for their participation: Children's Learning Center, Hilltop Child Development Center, and Language Acquisition Preschool. We thank Nicole Armstrong, Clara McGonigle, Yin-Yin Pao, Rachel Pratte, Sean Redmond and Lori Zobel Richardson for all their assistance in data collection and analysis. This research was supported by a grant from NIH (1 RO3 DC 01735) awarded to the authors.

<sup>1</sup> We adopt the convention of mentioning words in italics (*run*, *go*) and concepts in capital letters (RUN, GO).

<sup>2</sup> K'iche' employs an ergative cross-reference morphology on the verb. Intransitive verb stems use absolutive markers for the verb subject, while transitive verb stems use absolutive markers for the direct object and ergative markers for the subject. Unlike other Mayan languages, K'iche' does not split its ergative cross-reference system by person, animacy, verb aspect or clause type (c.f. Dixon 1979).

We use the following abbreviations through the rest of the paper: ASP-aspect, 3A-third person singular absolutive cross-reference marker, 3E-third person singular ergative cross-reference marker, CAUSE-causative affix, TV-derived transitive verb affix, NOM-nominative case, ACC-accusative case, PAST-past tense affix, FAM-familiar particle, AP-absolutive antipassive affix.

<sup>3</sup> Definitions of what exactly determines this distinction have undergone a historical divergence. Earlier scholars such as McCawley (1972) and Gergely & Bever (1986) attribute the

distinction to conventional practices and beliefs in a society. More recent commentators such as Pinker (1989) and Grimshaw (1990) discuss the distinction in terms of a perceptual quality. Thus, a fundamental disagreement exists on whether the distinction is based in the social or psychological domain. We will take the position that crosslinguistic variation on this distinction demonstrates the degree to which the distinction is susceptible to social manipulation.

<sup>4</sup> Keyser & Roeper (1984) note an important distinction between intransitive and passive sentences. An intransitive or inchoative expression does not imply an overt agent, while a passive sentence does. This can be brought out by adding a purpose clause to the sentences:

1. a. \* The stick broke to make a point.
- b. The stick was broken to make a point.

Such differences make it necessary to distinguish between the form and function of the alternation. Both the inchoative and passive constructions result in a single verb argument that expresses the logical object in the action.

<sup>5</sup> Levin & Rappaport Hovav (1994:53) claim that Nedjalkov's (1969) crosslinguistic survey suggests that transitive break is morphologically unmarked in most languages while the intransitive use is marked. They acknowledge in a footnote that this pattern does not hold for 9 of the 60 languages in Nedjalkov's survey, and speculate that the causative morpheme in these language might be irregular. My Garifuna data (Table 1) shows that this speculation is incorrect.

<sup>6</sup> Acknowledged by Wilkins on p. 142. She attributes children's lexical overgeneralizations to the operation of productive lexical rules that are outside the scope of her learning procedure and thus, not correctable by it.

<sup>7</sup> Bowerman (1988) goes on to discuss overgeneralizations of verb particle constructions

(e.g., 'Untie it off'). While the generalized paradigm approach does not provide an obvious solution to this puzzle none of the other approaches we have discussed offer a solution either.

## Special Matter

$$[_{\text{Event}} \text{CAUSE}([_{\text{Thing}} ]_i, [_{\text{Event}} \text{GO} ([_{\text{Thing}} \text{LIQUID}]_j, [_{\text{Path}} \text{TO} ([_{\text{Place}} \text{IN} ([_{\text{Thing}} \text{MOUTH OF} ([_{\text{Thing}} ]_i)])))])))]$$

Figure 1. Jakendoff's (1990) Lexical Conceptual Structure (LCS) for drink.

Intransitive	Causative
(Subject)  theme	(Subject, Object)  cause theme

Figure 2. Pinker's basic causative paradigm

Intransitive	Causative	
(Subject)  theme	(Subject, Object)  cause theme	Stereotypic
	-----	Nonstereotypic

Figure 3. Pinker's advanced causative paradigm

Intransitive	Causative	
(Subject)	(Subject, Object)	Stereotypic
theme	cause theme	
-----	-----	Nonstereotypic

Figure 4. Pinker's paradigm expanded

Active	Conventional Causation	
(Subject)	(Subject, Object)	Lexical
theme	cause theme	
Verb	Verb + Affix	Morphological
Verb + Affix	Verb	
Verb	<u>Make</u> + Verb	Periphrastic

Figure 5. The generalized causative paradigm

	Plain	Comparative	Superlative
regular	simple	simpler	simplest
suppletive	good	better	best
syntactic	regular	more regular	most regular

Figure 6. English adjective paradigm

	Alternation Type	Intransitive Form	Transitive Form
English	Lexical	break	break
Spanish	Anticausative	romper-se	romper
Mandarin	Compound	dwàn	nòng dwàn
Thai	Periphrastic	hak	t <sup>h</sup> aam hak
Garifuna	Causative Affix	halagua	halagua-na
Mandink	Anticausative	kati-ta	kati
Korean	Idiosyncratic	bureojida	bureoddeurid
K'iche'	Antipassive	-q'upi-n	-q'upi

Table 1. Causative Alternation Types

Alternation	Elicitation Context	
	Intransitive	Transitive
Alternating Verbs	anger, break, float, fly, fold, move, open, pop, stop, tear, turn	boil, bounce, close, drop, loosen, roll, smash, wind
Intransitive Verbs		come, cry, dance, enter, go, laugh, look, roar, sleep, stay, swim, talk, walk
Transitive Verbs	cut, put, throw	
Antipassive Verbs	eat, follow, sweep, wash	climb, drink, leave, return, sing

Table 2. Verb Selection According to Alternation Class and Elicitation Context.

<u>Age Group</u>	<u>I → T</u>	<u>T → I</u>	<u>Total</u>
2;6-4;0	27/56 = .48	39/77 = .51	66/133 = .5
5;1-6;6	36/56 = .64	60/77 = .78	96/133 = .72
Adults	47/56 = .84	54/77 = .7	101/133 = .76

Table 3. Number and Proportion of Lexical Alternations for Alternating Verbs

Age Group	I → T			T → I		
	<u>Periphrastic</u>	<u>NA</u>	<u>Other</u>	<u>Passive</u>	<u>NA</u>	<u>Other</u>
2;6-4;0	.14	.31	.55	.13	.18	.68
5;1-6;6	.8		.2	.53	.12	.35
Adults	1.0			.87		.13

Table 4. Proportions of Nonlexical Alternations for the Alternating Verbs

<u>Age Group</u>	<u>I → T</u>	<u>T → I</u>
2;6-4;0	6 walk, swim, sleep	1 throw
5;1-6;6	2 walk, leave	4 cut, sweep, throw
Adults	2 swim, walk	

Table 5. Number and Types of Verb Overgeneralizations

<u>Age Group</u>	<u>Periphrastic</u>	<u>Passive</u>	<u>Total</u>
2;6-4;0	27	6	33
5;1-6;6	96	19	115
Adults	114	37	151

Table 6. Periphrastics and Passives for Verbs with Fixed Transitivity

<u>Age Group</u>	<u>I</u>	<u>T</u>	<u>Total</u>
2;6-4;0	.18	.14	.17
5;1-6;6	.02	.17	.05
Adults	.02	0	.01

Table 7. Proportion of Causative Overgeneralizations

<u>instrument</u>	<u>hand</u>	<u>ruler</u>	<u>scissors</u>	<u>string</u>	<u>pencil</u>
break	.56 (-)	.44 (-)	.31 (-)	.37 (-)	.56 (-)
cut	.25 (.27)	.31 (.18)	.69 (1.0)	.31 (.18)	.25 (-)
tear	.19 (.73)	.25 (.82)	- (-)	.31 (.82)	.19 (1.0)

---

Table 8. Percentage of children (adults) responding with break/cut/tear