CHAPTER 13

The Acquisition of the English Causative Alternation

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1. INTRODUCTION

Languages are riddled with partial regularities—patterns that are productive, but not completely so. Such patterns create a challenge for theories of language acquisition: how can children discover the underlying regularities and use them creatively, without at the same time overshooting the bounds of what fluent speakers consider normal and acceptable?

Explaining this process would be straightforward if fluent speakers corrected children when they overgeneralized patterns (and if children paid attention). But it is widely accepted that explicit correction is rare and unsystematic (Baker, 1979; Bowerman, 1988; Braine, 1971; Brown & Hanlon, 1970; Pinker, 1989). Some researchers urge that even if there is little overt correction, there are interaction patterns in adult–child discourse that provide indirect negative evidence—for example, adult reformulations of children's erroneous utterances (e.g., Bohannon & Stanowicz, 1988; Demetras, Post, & Snow, 1986; Hirsh-Pasek, Treiman, & Schneiderman, 1984). But it is controversial whether this kind of evidence is widely available, whether it has the logical power to correct the child, and whether children are in fact even sensitive to it (see Marcus, 1993; Morgan & Travis, 1989; Pinker, 1989: 9ff., for critiques). This state of affairs—often termed the No Negative Evidence problem—has led many researchers to conclude that models of grammar learning cannot depend on learners' receiving information about what is *not* a possible sentence. Children must be able to arrive at the adult state on the basis of positive evidence alone—hearing how other speakers talk about things.

The challenge of explaining how this takes place has attracted much attention. For researchers of a nativist bent, at least part of the solution is sought in inborn grammatical knowledge and mechanisms that block undesirable generalizations from the outset, or enable children to identify and reject incorrect grammatical hypotheses without recourse to negative evidence (e.g., Baker, 1979; Gropen, Pinker, Hollander, & Goldberg, 1991; Pinker, 1989; Randall, 1990). Learning-minded researchers, in contrast, urge that correct generalizations can be built up, and overgeneralizations pruned back where necessary, through general cognitive mechanisms, for example, the effects of type and token frequency on schema induction and on the activation strength and entrenchment of forms (Brooks & Tomasello, 1999; Brooks, Tomasello, Dodson, & Lewis, 1999; Croft, 2001; Croft & Cruse, 2004; Goldberg, 1993, 1995, 2003; MacWhinney, 1987; Tomasello, 2003). Children's overgeneralizations clearly constitute a fertile testing ground for the clash between alternative theories of language acquisition.

Much of the debate has revolved around errors of a particular genre: overgeneralizations of argument structure alternations. An argument structure alternation is a pattern in which a set of verbs systematically appears in two different syntactic frames (Hale & Keyser, 1987; Levin, 1985, 1993; Pinker 1989). English has several important alternations that give rise to errors in children's speech. Three of these—the causative/inchoative alternation (henceforth simply "causative alternation"), dative alternation, and locative alternation—are illustrated in Table 13.1. These alternations are all productive in adult English, and can be applied to novel verbs. But not every verb can undergo a given alternation, even if it seems semantically and syntactically similar to a verb that can. This is evident from examples like (1c-i), (2c-g), and (3d-g) in Table 13.1 from learners of English: these utterances are readily understandable, but they seem strange to fluent adult speakers of English.

In this chapter we evaluate two proposals for how children arrive at an adult understanding of which argument structure frames verbs can appear in: Pinker's (1989) tightly structured nativist model and a looser constructivist scenario based on a cluster of usage-based learning mechanisms. We do this by testing the predictions of the models against a large corpus of spontaneous argument structure errors collected over many years from two learners of English, Bowerman's daughters, C and E (cf. examples in Table 13.1). These children's language development was followed closely, through audio-taping and diary notes, from about 1 to 3 years of age, with continuing attention to certain forms up through the teenage years. C's and E's argument structure errors, as presented in Bowerman (1974, 1982a,1982b, 1988, 1996), have constituted a jumping-off point for much of the discussion in the literature of the No Negative Evidence problem (e.g., Pinker, 1989). Here, we focus on a particular error type—the causativization of an intransitive verb or adjective (as in (1c–g) of Table 13.1). This error type was selected because it was by far the most frequent and persistent in the children's speech.

TABLE 13.1

Three Argument Structure Alternations of English, and Their Overgeneralization in Children's Speech

(1) CAUSATIVE/INCHOATIVE ALTERNATION

a. (i) The chocolate **melted**. (ii) Mom **melted** the chocolate.

b. (i) The ball **rolled** down the hill. (ii) Linda **rolled** the ball down the hill.

Children's errors (c-g: noncausative to causative; h-i: causative to noncausative):

c. C 3;5 How come you had a little troubling **going** it? (M [Mother] couldn't start car.)

d. C 7;5 But he **disappeared** the green one and he **disappeared** the blue one! (Watching magican do tricks with scarves on TV.)

e. C 12;3 Salt **clings** it together. (As C mixes playdough.)

f. E 4;3 Can I **glow** him? (Wants to play with a monster toy that glows after being held under a light.)

g. C 5;0 OK. If you want it to die. E's gonna **die** it. She's gonna make it die. (C's sister E is about to touch a moth.)

h. C 2;11 Bert **knocked down**. (After sees Bert topple over on TV.)

i. C 4;5 But the parts might **lose**. (Concerned about taking a game to school with her.)

(2) LOCATIVE ALTERNATION

a. (i) Harry **loaded** books onto the cart. (ii) Harry **loaded** the cart with books.

b. (i) The cook **sprinkled** powdered sugar onto the cake. (ii) The cook **sprinkled** the cake with powdered sugar.

Children's errors (c-d: require 'with'; e-g: require locative preposition):

c. E 5;0 Can I **fill** some salt into the bear? (=bear-shaped salt shaker.)

d. E 7;11 I'm going to **decorate** them on the edge. (Putting a row of thumbtacks along edge of new bulletin board.)

e. E 4;5 I'm gonna **cover** a screen over me. (Child is pretending to do a magic trick with a blanket.)

f. E 2;11 I **poured** you. [M: you poured me?] Yeah, with water. (Pretending, waving an empty cup near M.)

g. E 4;11 I don't want it [=toast] because I **spilled** it of orange juice. (After spills orange juice on her toast.)

(3) DATIVE ALTERNATION

a. (i) Sarah **gave** some books to the orphanage. (ii) Sarah **gave** the orphanage some books.

b. (i) I **told** the whole story to my parents. (ii) I **told** my parents the whole story.

c. (i) Linda **baked** a cake for John. (ii) Linda **baked** John a cake.

(continued)

TABLE 13.1 *(continued)*

Children's errors:	
d. C 2;6	Don't **say** me that or you'll make me cry.
e. L 7;8	Shall I **whisper** you something?
f. C 3;4	**Button** me the rest. (Most of her pyjama snaps are closed, wants M to fasten the remaining ones.)
g. M 5+	**Choose** me the ones that I can have.

From Bowerman (1974, 1982a,b, 1988, unpublished records). Age in years; months.

2. PINKER: A NATIVIST APPROACH TO LEARNING ARGUMENT STRUCTURE ALTERNATIONS

In an early exploration of the learning puzzle posed by argument structure alternations, Pinker (1984) assumed that errors like those in Table 13.1 mean that English-learning children's initial rules for argument structure alternations are too general; the rules must somehow be cut back. Linguists had noted that argument structure alternations are often subject to specifiable semantic and sometimes morphosyntactic conditions on the verbs to which they apply. For example, to undergo the dative alternation and enter into the double-object construction, an English verb must have a dative argument that refers to a "prospective possessor" of the theme argument (Green, 1974; Mazurkewich & White, 1984; Oehrle, 1976). This means that *Mary baked John a cake/poured John a drink/faxed John a message* are acceptable, because Mary intends for the cake, drink, and message to end up in John's possession, but **Jim washed Susan the dishes/opened Susan the door* are strange because the dishes and door do not change hands as a result of the action. To correct an argument structure alternation rule that is initially too general, proposed Pinker (1984), a child must, over time, annotate the rule with the appropriate conditions on the verbs to which it can apply. When annotation is complete, errors will cease.

This hypothesis captured some important constraints on argument structure alternations, but further work showed that it could not stand as an adequate account of acquisition (Bowerman, 1988; Pinker, 1989). One critical flaw was that for each alternation, there were verbs that seemed to satisfy all the proposed criteria but still did not undergo the alternation. For example, "saying" and "whispering" seem to be perfectly good ways of getting something (information) into someone's possession, and yet—unlike semantically similar verbs such as *tell—say* and *whisper* do not undergo the dative alternation (cf. errors (3d, e) in Table 13.1). How will the child learn this? The No Negative Evidence problem reappears in full force. Further mysteries were why an argument structure rule should have these seemingly arbitrary annotations in the first place, and why children should bother to identify them, given that their initial rule, being overly general, can already parse and interpret any

input it receives. To solve these problems, Pinker (1989) proposed a new and more intricate acquisition theory.

2.1. Argument Structure Alternations as Lexical Rules for Changing Verb Meaning

In the model just discussed, rules for changing a verb's argument structure were seen as having the purely syntactic effect of rearranging the verb's arguments (and, in the case of the causative, also introducing an argument). Following work by Levin and Rappaport (Levin, 1985; Levin & Rappaport, 1986), Pinker now proposed that rules for argument structure alternations are, instead, lexical rules that create a new verb from an old one by changing the verb's *semantic structure*. For example, the rule for dative alternation takes a predicate that means roughly "X cause Y to go to Z" (as in ***give***$_1$ *a book to John*) and converts it into a predicate that means "X cause Z to have Y" (***give***$_2$ *John a book*) (Pinker, 1989: 82).

In this new formulation, the syntactic rearrangement of the arguments does not have to be simply stipulated; it can fall out naturally from the meaning of the verb, through linking rules that map arguments in certain positions in the (compositional) semantic representation of the verb to particular syntactic roles. One such linking rule, according to Pinker (1989; Gropen et al., 1991), states that an entity that is specified to be causally affected is mapped to the grammatical role of direct object. For *give*$_1$ it is the theme argument (i.e., the object given) that is specified to be causally affected (it is the second argument of CAUSE in "X cause **Y** to go to Z"). For *give*$_2$, in contrast, it is the dative argument ("X cause **Z** to have Y").

Because rules for argument structure alternations are, on this new account, basically semantic operations rather than purely syntactic ones, it is not surprising that they are sensitive to the semantic properties of verbs. In particular, the meaning of a verb must be compatible with the semantic change that is brought about by the rule. It is understandable, for instance, why *Wash Susan the dishes* and *Open Susan the door* are ungrammatical—Susan is not caused to "have" the dishes or door as a result of the actions.

The rule for the causative alternation, in Pinker's account, takes a predicate that specifies a "change" (an event of acting or moving in some way) and converts it into a predicate that means "by acting on, cause to change (in the specified way)." (Or vice versa: the rule is bidirectional and can run in either direction.) Linking rules specify that the first argument of CAUSE, the agent, is mapped to the subject role and the second argument, the affected entity, to the object role. Just as for the dative alternation, a number of verbs are immediately rendered outside the scope of the causative rule because they are incompatible with the basic semantic operation the rule brings about. For example, stative intransitives such as *be* and *ache* cannot be causativized because they do not specify a change.

As presented so far, Pinker's revised model of the acquisition of English argument structure alternations has the advantage over his earlier model that it provides a prin-

cipled explanation of major semantic restrictions on which verbs can participate in an alternation. Learning these restrictions would be part and parcel of learning the lexical rules for an alternation in the first place, not conditions to be arbitrarily tacked onto a more general rule. But there is still a critical weakness: just as in the earlier model, there are verbs that satisfy these restrictions and yet do not alternate. For example, why can't *disappear* undergo the causative alternation (as in (1d) of Table 13.1), given that it satisfies the requirement that the verb specify a change?

2.2. Broad-Range Rules and Narrow-Range Rules

To tackle this problem, Pinker (1989) proposed analyzing each rule for alternation into two levels: a *broad-range rule* and one or more *narrow-range rules*, which are semantically more specific versions of the broad-range rule. The broad-range rule provides the *necessary* conditions for a verb to alternate, but does not specify whether or not it actually does alternate. The narrow-range rules, in contrast, provide the *sufficient* conditions.

2.2.1. Broad-Range Rules

A broad-range rule relates two "thematic cores," which are conflations of semantic elements that define a kind of possible verb meaning. Such rules are more formal specifications of the kind of information already described in section 2.1 for the dative and causative alternations; they capture what all the verbs that undergo the alternation have in common. The broad range rules for these two alternations are shown in (1) and (2) (the arrows indicate that the rules are bidirectional):

1. Dative alternation:
   a. X CAUSE [Y GO TO Z] (e.g., *Mary gave a book to John*) ↔
   b. X CAUSE [Z HAVE Y [by means of CAUSing [Y GO TO Z]]] (e.g., *Mary gave John a book*)

2. Causative alternation:
   a. Y <+dynamic> event: ACT/GO (e.g., *The ball rolls*) ↔
   b. X ACT on Y, thereby CAUSing Y ACT/GO (e.g., *John rolled the ball*)

The broad-range rule for an alternation insures that no verb can participate in the alternation unless it can be represented in terms of both thematic cores, and the rule specifies what the new verb would mean if the rule were applied. This rule provides an initial semantic filter that excludes a large number of verbs from the alternation. For example, the specification <+dynamic> in the thematic core of (2a) captures the generalization that the caused situation must be an *event* (i.e., a predicate built around ACT or GO); put differently, the causative alternation cannot be applied to in-

transitive verbs with BE or HAVE in their semantic representation (e.g., *be*, *exist*, *stay*, *wait*, *have*) (Pinker, 1989: 223). The thematic core of (2b), the transitive causative, has in its main clause "X ACT on Y." This core is responsible for the reading of "direct" or "unmediated" causation associated with lexical causatives: "direct," proposes Pinker (1989), is the default interpretation of "ACT on".

2.2.2. Narrow-Range Rules

Some verbs meet the specifications of a broad-range rule, but still do not alternate. For example, the intransitive English verbs *go*, *fall*, and *disappear* are <+dynamic>, as the broad-range rule for the causative alternation requires, but they do not have a morphologically identical transitive, causative counterpart. Drawing on work by Laughren, Levin, and Rappaport (1986), Pinker proposed that each broad-range rule is paired with one or more *narrow-range rules*: from the candidate alternators admitted by the broad-range rule, the narrow range rules provide a more delicate filter by picking out semantically coherent subclasses of verbs that *do* in fact alternate.

For the causative alternation, there are narrow-range rules that pick out two important classes of verbs that alternate, as shown in (3) (Pinker, 1989: 130; Levin & Rappaport Hovav, 1995: 93). Classes of verbs that lack a narrow-range rule and so do *not* alternate are shown in (4).

3. *Classes with narrow-range rules for the causative alternation (alternators)*

   a. Verbs of EXTERNALLY-CAUSED CHANGE OF PHYSICAL STATE: *melt, open, break, shrink, shatter…*

   b. Verbs of MOTION TAKING PLACE IN A PARTICULAR MANNER: *slide, skid, float, roll, bounce…*

4. *Classes without a narrow-range rule for the causative alternation (nonalternators)*

   a. Verbs of MOTION IN A LEXICALLY SPECIFIED DIRECTION: *go, come, rise, fall, exit, ascend, leave, arrive…*

   b. Verbs of COMING INTO OR GOING OUT OF EXISTENCE: *die, appear, disappear, expire, vanish …*

   c. Most verbs of EMISSION OF LIGHTS, SOUNDS, SUBSTANCES, AND SMELLS: *glow, glisten, sparkle, blaze, shriek, buzz, bubble, leak, ooze, smell…*

   d. Verbs of INTERNALLY-CAUSED STATE CHANGE: *bloom, blossom, decay, blush, wax, wane…*

   e. Verbs of VOLITIONALLY OR INTERNALLY-CAUSED ACTIONS: *jump, walk, talk, climb, drink, sing…*) (apparent exceptions like *gallop/walk/jump a horse* belong to a different alternation, according to Levin & Rappaport Hovav, 1995)

   f. Verbs of PSYCHOLOGICAL ACTIVITY: *think, hope, wish, hesitate, refrain from…*

   g. Most verbs of EMOTIONAL EXPRESSION: *smile, cry, laugh, frown, blink…*

For any particular alternation, it is not possible to predict, a priori, which verb classes sanctioned by the broad-range rule have an associated narrow-range rule. For example, it would be possible for English to causativize verbs of "motion in a lexically specified direction" or verbs of "coming into or going out of existence"; English simply lacks narrow-range rules for these classes. But Pinker (1989: 133) points outs that several of the noncausativizing verb classes shown earlier—particularly (4c–g)—probably do not causativize for a principled reason: because they specify *internally-caused events* and so resist the "directness" interpretation required by the broad-range rule (see Levin & Rappaport Hovav, 1995, on the distinction between internally- and externally-caused events). In other words, these verbs are not causativizable for reasons that are central to the semantic structure of the causative rule itself, not simply because they lack an associated narrow-range rule. But whether a verb specifies an internally-caused event is often not obvious, and in ambiguous cases—for example, especially classes (4c) and (4d)—different languages may take different stances (Pinker, 1989: 302).

2.3. Learning

In Pinker's (1989) account of language acquisition, children approach the task with inborn knowledge of the primitive semantic elements out of which verb meanings are composed (e.g., CAUSE, GO, BE, ACT), as well as of the linking rules associated with them. This knowledge insures that if a child represents the meaning of a verb correctly, she will know how to link its arguments. But even if learners can formulate their broad-range alternation rules correctly, they must still determine which narrow-range rules are associated with them. If there is not some water-tight procedure for identifying these rules accurately from the very beginning, the No Negative Evidence problem reasserts itself in full force: the child's rules will be too general, and it is unclear how she can discover the exceptions to them.

To solve this problem, Pinker proposes that children develop the broad-range rule and the narrow-range rules for a particular alternation in tandem. This insures that there is never a time when a broad-range rule operates unconstrained by one or more narrow-range rules. Children formulate the broad-range rule through a top-down process of abstraction over verbs that have been observed to display the alternation. Simultaneously, they formulate narrow-range rules through a conservative bottom-up process in which the privilege of alternating generalizes, but only out to the boundary of each semantic class for which an instance of an alternating verb has been encountered. (What constitutes a relevant semantic class is highly constrained by innate mechanisms; see Pinker, 1989: 273–280, on this key feature of his model.) The crucial claim of Pinker's model is, then, that the child's rules are *correctly constrained* from the start, so there is no need to explain how retreat can take place in the absence of negative evidence.

But if the child's grammar develops so accurately, why do errors like those in Table 13.1 occur? Pinker (1989: 292ff., 350) offers two explanations:

5. Causes of children's argument structure errors:

   a. *One-shot innovations*. By hypothesis, speakers of all ages sometimes use broad-range rules creatively on-line to produce forms that are not licensed by any of the narrow-range rules associated with them. This may occur in children more often than in adults for several reasons; for example, children may innovate to extend their communicative resources when they don't yet know a more appropriate verb, or cannot access it at the moment. One-shot innovations are not actually licensed by the speaker's grammar, so they don't require any specific unlearning. (See Braine & Brooks, 1995, for a similar proposal.)
   b. *Erroneous verb meanings*. Some argument structure errors arise, Pinker hypothesizes, because children have associated a verb with an incorrect meaning. If a child's semantic representation for a verb is wrong, the appropriate application of linking rules to this representation might result in errors from the adult point of view. For example, suppose a child associates the verb *fill* (roughly "cause X [e.g., a cup] to become full [of Y, e.g., water]") with a meaning more similar to that of *pour* ("cause Y to move in a certain way"). In this case the "affected object" linking rule will assign Y, as the affected object, to the role of direct object, resulting in errors like (2c) in Table 13.1 ("fill Y into X"). Repeatedly observing the situations to which adults apply the verb—for example, hearing *fill* for events where there is "becoming full" but no "pouring"—will lead the child to reanalyze the verb's meaning (e.g., which argument is taken to be the "affected" one), and errors will automatically cease.

Crucially, both of these explanations for errors are compatible with Pinker's claim that the child's rules for argument structure alternations are basically correct from the beginning.

2.4. Evaluating Pinker's Model

Pinker's model is explicit, coherent, and based on a well-developed theory of lexico-semantic structure. There is much to admire about it. But is its account of the acquisition of argument structure alternations correct?

2.4.1. Innate Linking

The success of the theory depends on the accuracy of many interacting assumptions, some of them highly controversial. For example, the theory requires knowledge of linking rules to be innate. This is because correct linking must follow automatically from meaning: as long as children have represented the meaning of a verb correctly, they must be able to link its arguments correctly. There is by now a good deal of literature debating whether children in fact show evidence of innate knowledge of linking, and it is fair to say that there is as yet little consensus on this. (See section 2.1 of chapter 1, this volume, for an overview of this literature, with references.)

2.4.2. Narrow-Range Rules

The theory also requires children to be sensitive to syntactically relevant semantic subclasses of verbs from the beginning, because they must generate narrow-range rules for these from the ground up, never generalizing too far. Initial explicit tests of the hypothesis proved negative: there was no evidence for this sensitivity (Braine & Brooks, 1995; Pye & Loeb, 1995; see also Ingham, 1992).

In a more recent experiment, Brooks and Tomasello (1999) did find evidence for sensitivity to two semantic classes of verbs relevant for the causative alternation. These researchers taught children (age 2;6, 4;6, and 6-7) a novel verb in either an intransitive or a transitive, causative frame, and then tried to induce them to use it in the other, as yet unattested frame. Children were more willing to use the verb in the unattested frame if its apparent meaning was something like "spin" than if it was something like "ascend." Recall that "motion taking place in a particular manner" (such as spinning) is a narrow-range class for the causative alternation (cf. (3b) above), whereas "motion in a lexically specified direction" (such as ascending) is not (4a). Strikingly, though, this result was found only in children over 4;6 years old. Children of 2;6 years used both kinds of novel verbs in the unattested frame with equal probability. This outcome is incompatible with Pinker's claim that children's rules for argument structure alternations are appropriately constrained *from the beginning*. It suggests instead—as Brooks and Tomasello indeed argue—that the needed semantic constraints are discovered only gradually over time.

In the present study, we find remarkably little evidence that children are constrained by the narrow-range semantic categories that are relevant for the causative alternation, either early *or* late in development. We come back to this issue presently.

2.4.3. Accounting for Errors

An aspect of Pinker's theory that has so far received little attention is whether children's argument structure errors, such as those shown in Table 13.1, can really be "explained away," as the theory requires, either as one-shot innovations licensed by the broad-range rule or as casualties of incorrect verb meanings. How well does this claim hold up against the novel lexical causatives produced by our two language learners, C and E?

Proliferation of Errors. Novel causatives followed a very similar course in the children's speech: they appeared around age 2, flourished—especially for C—between about 3 and 5, and then continued on at a lower level until about age 12, after which they essentially disappeared (total number of recorded errors: C 225 tokens, 79 types; E 92 tokens, 54 types). The children made many errors with verbs from all the noncausativizable narrow-range semantic classes listed earlier in (4). Their errors are summarized in the Appendix, broken down by semantic class.[1]

The very quantity, variety, and persistence of these novel causatives over a long period of time seems at odds with Pinker's theory; such a profusion of errors does not really square with the view that the children's grammars were perfectly adult-like except for one-shot innovations and erroneous verb meanings. The presence of multiple errors in the "externally-caused change of physical state" class is also troubling. This class is *supposed* to causativize (see (3a) earlier), so how can the child determine that intransitive verbs like *overflow* do not? (cf. *You're gonna* ***overflow*** *the spoon with medicine*, C 6;7. See also Braine & Brooks, 1995, for a more general discussion of negative exceptions to Pinker's causativizable subclasses, i.e., verbs that do not causativize even though they supposedly fall into a causativizable narrow-range class.)[2]

Incorrect Verb Meanings? Pinker hints that at least some of children's novel causatives are caused by incorrect verb meanings (1989: 325), but he makes no concrete suggestions about this; most of his evidence for this source of errors revolves around a different alternation, the locative (see section 1.1 of chapter 1, this volume). It is indeed not clear what could be wrong with the meaning of most of the words shown in the Appendix that would make them susceptible to causativization. Especially resistant to this interpretation are novel lexical causatives created from highly frequent verbs like *come, go, disappear*, and *stay*. These errors persisted over a period of many years even though the children used their intransitive base forms in an entirely adult-like way.

One-shot innovations? This puts the burden of explanation for novel causatives on Pinker's "one-shot innovation" hypothesis, which posits that many of children's errors reflect the creative online use of the broad-range rule, perhaps especially under communicative pressure when the child doesn't know or can't remember a better verb.

The persistence of many of the errors argues against this explanation (as Pinker, 1989: 325, also recognizes). For example, C causativized *stay* (e.g., *stay the door open*) at least 43 times between the ages of 2;4 and 10;4, long after she knew—and usually used—the more appropriate verbs *keep* and *leave*. She causativized *go* at least 28 times between the ages of 2;8 and 7;11, long after she knew verbs like *send* and *take*. Often the children did not even begin to causativize a verb erroneously until well after an appropriate counterpart for it was already well established in their speech (e.g., causative *come* vs. *bring*). Even so, the novel form was sometimes powerful enough to temporarily almost supplant the correct form (Bowerman, 1974).

Also problematic for the "one-shot innovation" hypothesis is that many of the children's errors fall outside the scope of the broad-range rule that is supposed to constrain them. Recall that Pinker's strategy for solving the learnability problem associated with argument structure alternations is to insure that the child never generalizes too broadly to begin with, and so has nothing to repair later. With this goal

in mind, Pinker formulates the broad-range rule for the causative alternation (cf. (2), shown earlier) as restrictively as the facts of adult English will allow: First, *the caused event must be* <+*dynamic*> (i.e., the verb must have ACT or GO in its semantic representation); second, the causing event must involve an ACT whereby an *agent impinges on a patient*; and third, this act must bring about the caused event *directly.*

C and E violated all three constraints repeatedly, as illustrated in Table 13.2. They causativized <-dynamic> verbs that lack ACT or GO in their representation (Table 13.2, examples a–f); they causativized when the causing situation cannot be conceptualized as an "act" on a patient by any stretch of the imagination, not even a

TABLE 13.2

Violations of Pinker's (1989) Broad-Range Rule for Causativization

1. Caused event: Counter to the broad-range rule, in many errors the caused situation is not a <+dynamic> event (i.e., the underlying predicate does not contain GO or ACT), but instead is static, e.g., with BE, STAY, or HAVE:

a. C 5;5 I meant to **be** it like this. (=have it be. Showing with her hand how she had intended an unsuccessful styrofoam Christmas tree to turn out.)

b. C 4;5 (C making drawings to bind as a book; upset with a poor picture.) This one is yukky! **Be** it for a picture. (=let/have be [only] a picture) (M: Hmm?) C: **Be** it for a picture, I don't need a book.

c. E 7;11 I was used to turning it [TV] on a channel and **being** it on a channel. (= keeping it, letting it continue to be …)

d. C 2;11 Maybe they had a cold and the cold **stayed** them awake. (=kept.)

e. E 6;7 Now I'm going to **have** you a lesson. (=give.)

f. E 5;3 This is **aching** my legs. (As climbs stairs.)

2. Causing event: sometimes there's no "act", not even a metaphorical "impingement" of an actor on a patient: e.g., (a)-(d) above, and:

g. C 3;1 Is this to **climb** her up? (=enable her to climb up. C looking at picture of a hippo at the bottom of a ramp leading into a truck, pointing to the ramp.)

3. Violations of the "directness" constraint on lexical causatives (according to Pinker, directness is an automatic consequence of the fact that in the broad-range rule, the causee is a patient):

h. E 3;3 Will you **climb** me up there and hold me? (Wants help climbing a pole.)

i. C 10;5 (C doing a trick; explains that the magician must first make everyone feel a marble hidden under a scarf:) First you have it, and you **feel** it to everybody. (=make/ have everybody feel it.)

j. C 4;3 Andrea, I want to **watch** you this book! (Trying to get a friend to look at a book she is holding.)

k. C 3;3 (C has drawn a puzzle.) M: Do you think Daddy can guess that one? C: I'm gonna **guess** it to him! (=have him guess it. Runs off to find F.)

l. E 3;2 Everybody makes me cry. (F: I didn't make you cry.) Yes, you did, you just **cried** me.

purely metaphorical impingement (examples a–d, f, g); and they causativized when the causation was clearly indirect; that is, when a physically or psychologically active animate causee mediated between the agent's act and the resulting event (examples h–l) (see also Bowerman, 1982a: 46–47).[3]

Causatives with truly animate causees, such as (h)–(l) in Table 13.2, were relatively infrequent; most errors with verbs of volitional or semivolitional events, like *climb, walk, swim, eat,* and *cry*, involved dolls and other toys that could not really carry out the action independently. Noting this, Pinker (1989: 302ff.) argues that this shows that children *are* sensitive to the "directness" constraint of the broad-range rule for causativization. If they were not, he suggests, they should produce many more errors with volitional or semivolitional verbs than they do. After all, "opportunities for producing such errors are rampant: parents forcing, threatening, inducing, preventing, or allowing children to do things, and children enticing or badgering their parents or siblings to do things, have to be among the most common events involving some notion of causation that children are likely to think about or comment on" (Pinker, 1989: 302).

But Pinker's argument is valid only if children actually do talk frequently about the causation of volitional or semivolitional events. If they seldom do, even using periphrastic causatives (e.g., *She made me sing*), then the relatively low numbers of novel lexical causatives (e.g., *She sang me*) of this semantic category would reflect only the low number of opportunities to make such errors—that is, children's relative conversational neglect of the causation of (semi)volitional actions. It would tell us nothing about children's sensitivity to "directness" in lexical causatives.

To explore this issue, we calculated, for three semantic classes of noncausativizable verbs, the total number of opportunities to make an error: that is, the sum obtained by adding together the number of novel lexical causatives (e.g., *You just cried me*) and the number of periphrastic causatives with verbs of the same semantic class (e.g., *Everyone makes me cry*—cf. Table 13.2, example l). The classes were: (a) verbs of VOLITIONAL AND SEMIVOLITIONAL EVENTS, a composite of verbs of "volitionally or internally-caused actions," "psychological activity," and "emotional expression," for example, *crawl, guess, giggle*, cf. class 7 in the Appendix (we included in the calculation *only* utterances referring to events with a truly animate, active causee, i.e., not a doll or other inanimate); (b) verbs of MOTION IN A

TABLE 13.3

Proportion of Novel Lexical Causatives out of All Causatives (Novel Lexical Plus Periphrastic) Belonging to Three Semantic Classes in C's and E's Speech

	C		*E*	
1. VOLITIONAL AND SEMIVOLITIONAL EVENTS	70%	(14/20)	55%	(6/11)
2. MOTION IN A LEXICALLY SPECIFIED DIRECTION	74%	(45/61)	76%	(26/34)
3. COMING INTO/GOING OUT OF EXISTENCE	58%	(14/24)	63%	(5/8)

LEXICALLY SPECIFIED DIRECTION, such as *go, fall, rise*—class 2 in the Appendix; and (c) verbs of COMING INTO OR GOING OUT OF EXISTENCE, such as *disappear, die*—class 3 in the Appendix.

If Pinker's argument is correct, the proportion of novel lexical causatives to all opportunities to produce a novel lexical causatives should be significantly *lower* for verbs of VOLITIONAL AND SEMIVOLITIONAL EVENTS, which seriously violate Pinker's "directness" constraint, than for verbs of MOTION IN A LEXICALLY SPECIFIED DIRECTION and verbs of COMING INTO OR GOING OUT OF EXISTENCE, which do not.[4] The proportions are shown in Table 13.3.

This table shows that the children talked relatively infrequently about the causation of volitional and semi-volitional actions, but when they did, they used novel lexical causatives no less often (C) or only slightly less often (E) than when they talked about events that do not violate "directness." Differences among the three proportions were not significant (one-way analysis of variance [ANOVA] for the child C, $F(2, 102) = .096$, $p = .39$; for the child E, $F(2, 50) = 1.05$; $p = .36$). Consistent with this finding, children in an elicited production study (Pye & Loeb, 1995) were just as willing to causativize English volitional action verbs as state-change verbs and verbs of motion in a lexically specified direction. Contrary to Pinker, then, children's rule for the causative alternation is by no means restricted to events involving "direct" causation.

To summarize, Pinker's explanation cannot account adequately for the error data from C and E. The children causativized prolifically for many years across a broad range of verbs (see Appendix), respecting neither the distinction between causativizable and noncausativizable narrow-range verb classes nor between verbs that fall inside or outside of the scope of Pinker's broad-range rule for causativization. For learners, causativizing an intransitive predicate seems to require little more than that the predicate describe a situation that can be conceptualized as being "caused" (Bowerman, 1974, 1982a; see also Gergely & Bever, 1986, for the same conclusion based on Bowerman's data). But if this is true, then explaining how and why children eventually stop producing novel causatives does, after all, require—counter to Pinker's (1989) nativist model and in accord with usage-based assumptions—explaining how they *retreat* from a causativizing operation that is overly general.

3. A USAGE-BASED SOLUTION TO THE ACQUISITION OF THE CAUSATIVE ALTERNATION

In the last decade there has been a surge of interest in constructivist, usage-based models of language and language acquisition. These explain the representation of language structures not by reference to highly abstract, perhaps innate grammatical constructs and principles, but by invoking properties of the use of utterances in communication (e.g., type and token frequency of word forms and constructions, competition among forms), in interaction with the mental processes involved in

representing such properties (e.g., activation, schema formation, entrenchment, decay) (Barlow & Kemmer, 2001; Bybee & Hopper, 2001; Croft & Cruse, 2004; Goldberg, 1995; Langacker, 1987, chapter 10; MacWhinney, 1987; Regier, 1996; Tomasello, 1998/2002, 2003). This framework is attractive to researchers who find it more plausible that grammar is acquired through general cognitive mechanisms than through innate knowledge of language-specific categories and principles.

3.1. Usage-Based Mechanisms for Grammar Induction

Within this general framework, several mechanisms have been singled out as critical to explaining why children stop making argument structure overgeneralizations: preemption, the induction of semantic categories, and the entrenchment of verbs in particular syntactic frames.

3.1.1. Preemption

For some of children's argument structure errors, adult speech provides a conventional verb that expresses the same meaning as the child's form. For example, the child's causative use of *die* in (1g) of Table 13.1 (*E's gonna **die** it* [a moth]) is perfectly matched by the adult word *kill* (*E's gonna **kill** it*). The relationship between *kill* and causativized *die* is loosely analogous to the relationship between irregular inflectional forms and their regularized counterparts in child speech, for example, *ran* and *runned, feet* and *foots*. Following this analogy, we will say for convenience that *kill* is "suppletive" for causativized *die*, just as *ran* is suppletive for *runned*, although for reasons mentioned by Pinker (1989: 293) this label is not quite accurate; we come back to this in section 4. Other "suppletive" causatives include *bring* for *come* (e.g., *I **came** it closer* so it won't fall—pulling bowl on counter toward herself), *keep* for *stay* (*Mommy, can you **stay** this open?*—having trouble with refrigerator door), *drop* for *fall* (*I'm just gonna **fall** this on her*—dropping piece of paper on her sister), and *remind* for *remember* (*Will you please **remember** me what I came in for?*) (Bowerman, 1982a).

In virtually every theory of language acquisition, it is assumed that the consistent clash between a child's error and the conventional adult form for this meaning will eventually bring the child into line with adult speech; that is, the adult form comes to *preempt* the child's erroneous form (e.g., Clark, 1987; MacWhinney, 1987; Pinker, 1984; Pye & Loeb, 1995). Pinker (1989:293–294) also assigns an important role to lexical preemption, arguing that once forms like *kill* and *bring* have been strengthened enough, there will be no need for the child to make one-shot innovations (e.g., causativized *die* and *come*) to plug the gaps associated with their absence.

Direct preemption of one word by another cannot be the whole solution to the problem, because by no means all of children's erroneous lexical causatives are matched by a conventional lexical causative in adult speech. For instance, there is no lexical causative in English that means what the child's causativized form of *dis-*

appear means (cf. (1d) in Table 13.1). For verbs like *disappear*, it has been suggested that the child's erroneous lexical causative form is preempted by the corresponding periphrastic causative, for example, *make disappear* (e.g., Clark, 1987; MacWhinney, 1987). The logical case for extending the notion of preemption to periphrastic causatives is weaker than for forms like *kill*, because lexical and periphrastic causatives are, as constructions, systematically associated with different meanings (Bowerman, 1988). But a child might notice when adults do not use the verb the child has predicted, especially if they use a more marked construction, for example, *make disappear* instead of causativized *disappear* (Goldberg, 1995; see also Regier & Gahl, 2004). Brooks and Tomasello (1999) found some evidence for this process in children older than 4;6: When children were taught a novel verb in an intransitive frame (e.g., *it's tamming*, see section 2.4.2), they were less likely to use it as a lexical causative (*he's tamming it*) if they had been exposed to a periphrastic causative alternative (*he's making it tam*) than if they had not.

3.1.2. Induction of the Relevant Semantic Subclasses of Verbs

In his initial proposal for how argument structure alternations are learned, Pinker (1984) suggested that children home in only gradually on the semantic categories of verbs relevant for a particular alternation. In his later model, Pinker (1989) discarded this hypothesis as both implausible and unfeasible, opting instead to capture some of the relevant semantic constraints as inherent properties of the (broad-range) rule itself, while postulating that others fall out automatically from how the rule generalizes—that is, only to other verbs in the same semantic class as verbs that have been observed to alternate (see section 2.3).

In more recent research, the notion that semantic schemas can be learned gradually through induction has staged a strong comeback (e.g., Brooks & Tomasello, 1999; Goldberg, 1993, 1995). The hypothesis is supported by the success of recent connectionist simulations of category induction (see Regier, 1996; Schütze, 1994; Ping & MacWhinney, 1996, for studies relevant to word meaning and to verb syntax and morphology). It is also consistent with growing interest in construction grammar (e.g., Croft, 2001; Goldberg, 1995, 2003; Tomasello, 2003) and network-style theoretical approaches to morphology (Bybee 1985)—frameworks that stress input-driven learning.

3.1.3. Entrenchment

The idea behind "entrenchment" in the domain of argument structure is straightforward: repeated experience with a verb that is always heard in the same syntactic frame (e.g., as an intransitive) strengthens the association between verb and frame to the point where the correct frame consistently wins out over the incorrect frame generated by the child's too-broad alternation schema (Braine, 1971; Braine & Brooks, 1995; MacWhinney, 1987). Entrenchment and preemption often go together; for ex-

ample, every encounter with a periphrastic causative like *make disappear* simultaneously both exemplifies the verb *disappear* in an intransitive frame (yet again) and offers an alternative to causativized *disappear.* There is some experimental evidence for entrenchment in the domain of learning argument structure alternations. In the face of adult questions aimed at eliciting overgeneralizations of fixed-transitivity verbs, young learners of English were less likely to overgeneralize early-learned (hence presumably more entrenched) verbs than later-learned verbs; for example, they were less likely to produce *I comed it* than *I arrived it* (Brooks et al., 1999).

3.2. A USAGE-BASED MODEL FOR ACQUISITION OF THE CAUSATIVE ALTERNATION

3.2.1. The Model

Let us draw on the mechanisms just discussed to construct and test aspects of a straightforward usage-based scenario for how children master the causative alternation. The model runs as follows (we give the prediction first, and then, where needed, the reasoning behind the prediction):

Step 1. First, individual verbs are learned with (a subset of) their correct argument structures (transitive, intransitive, or both). (This step is documented in Bowerman, 1974, 1982a, and Tomasello, 1992, 2003.)

Step 2. Next, the lexical causative is (over)generalized across a wide range of forms and semantic classes. (The child has observed a high enough type frequency of low enough token frequency forms that alternate to merit building a schema for the alternation. This schema—which varies in strength [i.e., productivity] across children [Maratsos et al., 1987]—is broader than Pinker's [1989] broad-range rule for the causative alternation, because it also generates lexical causatives for indirect causation [as in Table 13.2].)

Step 3. Errors abate or cease with verbs that have high-frequency lexical causative counterparts (e.g., *kill* for causativized *die*). (Frequency in the input strengthens the entrenchment of these forms at the expense of their child-generated competitors, resulting in preemption. The removal of the preempted forms from the abstract schema for causativization also "bleeds" (weakens) the schema's overall strength.)

Step 4. Semantic subclasses of causativizable verbs begin to develop (i.e., Pinker's [1989] narrow-range classes), and fewer and fewer errors occur outside these classes. (The input has begun to more densely populate narrowly semantically specified areas of semantic space. Within those areas, lower-level subschemas become increasingly entrenched, and this—like preemption—bleeds

the more abstract schema.) Somewhere around this time, less frequent suppletive causatives also become entrenched, for example, *remind* comes to replace causative *remember.*

Step 5. The last errors to fade out are causativizations of noncausativizable predicates that are in the right semantic ballpark and have no suppletive counterparts (e.g., *disappear, small*). (These should be the last to go because the main mechanisms working against them are the overall weakening of the abstract schema [steps 3 and 4] and the strengthening of the association between the verb and its intransitive frame through repeated exposure [entrenchment]. Preemption by periphrastic causatives [*make disappear*] may also contribute to the demise of errors with these forms, but this type of preemption should not be as powerful as preemption by a suppletive causative counterpart [e.g., *kill* for causativized *die*, as in Step 2], because the competition between error and candidate preemptor is less direct.)

3.2.2. Testing the Model

Is it indeed true—as virtually everyone has supposed—that errors fade out earlier for verbs with suppletive causative counterparts than for verbs without them (Step 3)? And do errors abate earlier for verbs that are semantically distant from the core classes of causativizable verbs than for those that are semantically closer (Step 4)? We tested these two predictions against our corpora of novel lexical causatives, collected longitudinally from C and E over a period of more than a decade.

Suppletion. To analyze the role of suppletion, we divided each year of the child's life between age 2 and 12 years into three 4-month periods, and calculated for each period the number of tokens of novel causatives formed from predicates (verbs and adjectives) that do, versus do not, have straightforward suppletive counterparts.[5] The frequencies of errors with verbs of these two kinds are shown in Figures 13.1 and 13.2. If the existence of a suppletive lexical causative works preemptively against a child's tendency to erroneously causativize an intransitive verb, the line representing errors with predicates that have suppletive counterparts should decline more rapidly than the line representing predicates that do not. This was roughly true for E (although in fact she simply made fewer errors overall on verbs with suppletives), but not at all for C: for this child, forms with and without suppletive counterparts declined in parallel.

Semantic Classes. To examine the role of semantic class, we plotted for each child the frequency of novel causatives of various classes during each of several successive time periods (Figures 13.3 and 13.4). A point on the *x* axis (time line) such as "3;0" means errors produced between ages 2;6 and 3;6. The errors are assigned to five different semantic classes, as follows (see also legend in Figure 13.4):

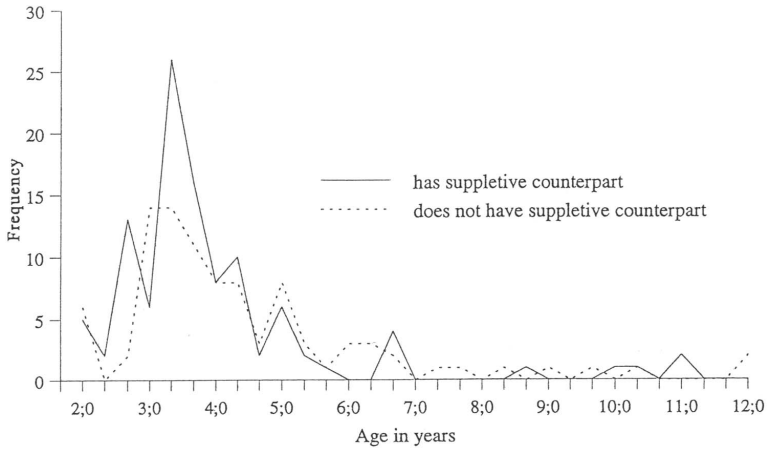

FIGURE 13.1. Frequency (in tokens) over time of novel lexical causatives with and without suppletive counterparts in C's speech.

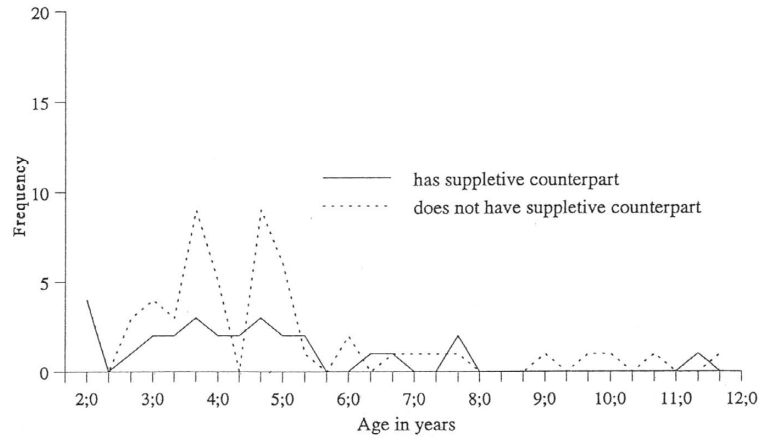

FIGURE 13.2. Frequency (in tokens) over time of novel lexical causatives with and without suppletive counterparts in E's speech.

- The first three bars at each time period represent predicate classes (verbs and adjectives) that are *semantically close* to the core causativizable verb classes. The first bar in fact represents idiosyncratically noncausativizable members of the two core causativizable classes: EXTERNALLY-CAUSED CHANGE OF PHYSICAL STATE (e.g., *overflow*, *bigger*) and MOTION TAKING PLACE IN A PARTICULAR MANNER (e.g., *slip* [in the sense of 'make someone slip', not 'slip your shoes on']) (collapsed together in the Appendix as class 1, where

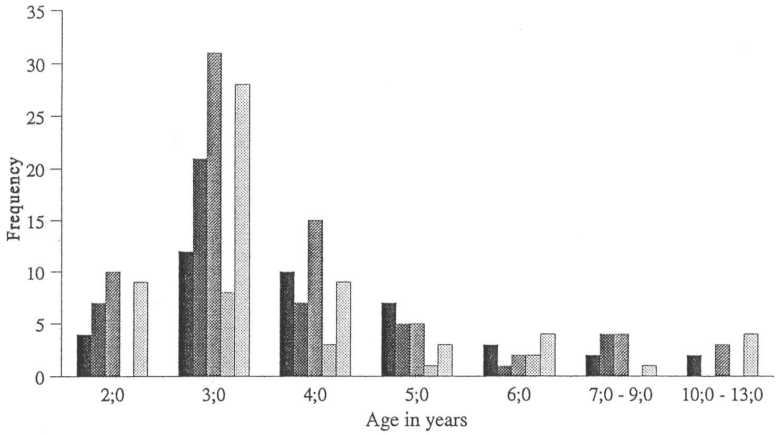

FIGURE 13.3. Frequency in tokens over time of novel lexical causatives in different semantic classes in C's speech.

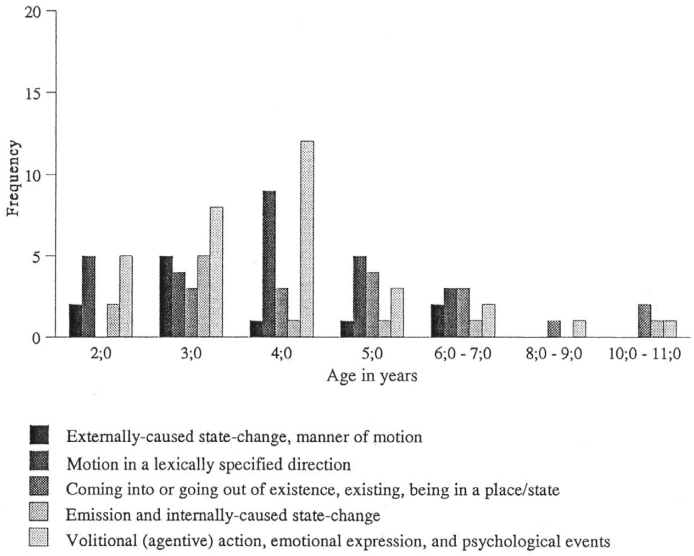

FIGURE 13.4. Frequency (in tokens) over time of novel lexical causatives in different semantic classes in E's speech.

the reader can see which predicates are counted). The second and third bars represent verbs that are not causativizable, but are similar to core causativizable verbs in that they are unaccusative (Levin & Rappaport Hovav, 1995) and involve external causation: verbs of MOTION IN A LEXICALLY SPECIFIED DIRECTION (e.g., *go*, *fall*, *rise*—class 2 in the Appendix) and verbs of COM-

ING INTO OR GOING OUT OF EXISTENCE and of EXISTING OR BEING IN A PLACE/STATE (e.g., *disappear*, *die*—class 3 in the Appendix, and *be*, *stay*—class 4, collapsed together and shown as a single bar).

- The last two bars at each time period represent verbs that are *semantically distant* from the core classes because they involve internal causation (see Levin & Rappaport Hovav, 1995; Pinker, 1989): verbs of EMISSION of light, fluid, sound, etc. (e.g., *glow*, *sweat*, *squeak*) and of INTERNALLY-CAUSED STATE CHANGE (e.g., *bloom*, *grow* [feet], *stick* [=make adhere](classes 5 and 6 in the Appendix, collapsed together) and verbs of VOLITIONAL ACTION, EMOTIONAL EXPRESSION, and PSYCHOLOGICAL EVENTS (e.g., *ride*, *laugh*, *remember*) (class 7). (For this last bar, the frequencies encompass utterances with both truly animate causees and "pretend" animate causees like dolls and stuffed animals; see section 2.4.3.)

If the induction of semantic categories is important in children's retreat from causative overgeneralizations, the last two bars (semantically distant from core causativizable classes) should decline faster than the first three bars (semantically close). But this pattern is not found. Verbs of EMISSION and INTERNALLY-CAUSED STATE CHANGE (fourth bar), never very frequent to begin with, do tend to abate early. But errors with verbs of VOLITIONAL ACTION, PSYCHOLOGICAL EVENTS, and EMOTIONAL EXPRESSION (fifth bar)—internally-caused events that violate the presumed semantic constraints most egregiously—hold their own remarkably well over time against the first three classes, and fade out at the same time, about age 12. In this data set, then, there is no evidence for the hypothesized role of semantic class induction in the decline and disappearance of causative errors.

4. DISCUSSION

In this study we have focused on the causative alternation to evaluate two proposals for how children master argument structure alternations: Pinker's nativist proposal and our own usage-based proposal. In our longitudinal spontaneous speech data from two learners of English, there is remarkably little support for either proposal.

The predictions of Pinker's model were violated repeatedly: the children respected neither the broad-range rule nor the narrow-range rules hypothesized for the causative, and their errors cannot easily be dismissed as one-shot innovations or due to faulty verb meanings. Both Pinker and constructivist theorists posit an important role for lexical preemption, with proposals often extending this mechanism to less precise competitors to children's errors, such as periphrastic causatives. But the effect of lexical preemption is visible only very mildly in the data from one of our two children (E, Figure 13.2), and not at all in the data from the other (C, Figure 13.1).

Finally, both Pinker and constructivists stress the role of semantically defined subclasses of predicates, although their predictions differ on when these effects

should appear: for Pinker, the relevant subclasses should constrain children's generalizations from the very beginning, whereas for constructivists the classes are induced gradually over time. Under either scenario, there is little evidence in our data for sensitivity to semantic classes. In particular, the children causativized verbs expressing animate, internally-caused events (severe violators of semantic constraints on the causative alternation) just as robustly as unaccusative verbs expressing externally-caused events (far less severe violators). Errors of both types continued over a period of many years, declined in parallel, and faded out entirely at about the same time.

Why do these widely invoked mechanisms play so little role in our data? With respect to preemption, we can think of two potential explanations. First, hearing the adult counterpart to a child's causative overgeneralization (e.g., *kill* for causative *die*) might act not only to weaken the child's form by repeatedly displaying an alternative way to express the same meaning, but also, ironically, to *strengthen* it by reinforcing the semantic niche it occupies. Thus, whenever the child understands an instance of *kill* in the input to mean what she herself would mean when she uses *die* causatively, she is reminded that the verb *die* indeed has a transitive lexical causative counterpart. If she remembers this, but forgets the specific form *kill*, she may be more likely to use *die* causatively.

Overgeneralizations that lack suppletive counterparts, such as causative *disappear*, are not weakened by lexical preemption, but neither are they strengthened by evidence for the existence of a lexical causative with the same meaning. If the two hypothesized influences of lexical preemption—one eroding the tendency to use a verb causatively and the other promoting it—are approximately in balance, the net effect would be little overall difference in the rate at which children causativize verbs that are, versus are not, matched by adult lexical counterparts.

A second factor that could detract from the effectiveness of lexical preemption in the domain of causatives is that few pairings between a child's erroneous form and a competing adult form constitute perfect one-to-one matches from the semantic point of view. (This is one reason why it is not really accurate to speak of "suppletion" in this domain.) In some cases, a child's causative error has several possible adult counterparts, each with a different nuance. For example, causativized *stay* corresponds sometimes to *keep* ("Mommy, can you *stay* this [a door] open?") and sometimes to *leave* ("[she] won't *stay* things where I want them to be" [angry at meddling sister]). Causativized *fall* corresponds to both *drop* ("I'm just gonna *fall* this on her") and *knock* ("you *fell* me down"). Causativized *go* corresponds to *take* ("*go* me to the bathroom"), *put* ("*go* it over there"), *send* ("Do you have anything else you'd like to *go* to China?"), and a variety of manner verbs (see note 5). In other cases several different child errors may correspond to a single adult form. For example, *give* is the most natural rendering of causative uses of both *have* ("will you *have* me a lesson?") and *take* ("we *took* him a bath yesterday"; cf. "take a bath").

Given this complex, many-to-many semantic mapping, it cannot be easy for children to work out which competing adult form is the one needed on a particular occasion. Using the intransitive form causatively is safe and accurate, because the resulting transitive verb will convey exactly the same information as the intransitive, plus "cause," and nothing more.

Turning now to semantic class, how can we explain our failure to find that children become sensitive, at least over time, to a verb's semantic class membership, such that that their errors are increasingly restricted to verbs with the right kinds of meanings?

This mechanism, although widely presupposed to be important in the recovery from argument structure errors, has received little empirical investigation. The best evidence for it comes from Brooks and Tomasello's (1999) novel-verb experiment (see section 2.4.2). These authors found that after age 4;6 children were more likely to causativize a new verb that had been modeled only intransitively if it seemed to refer to an event of spinning (manner of motion: a causativizable class) than if it referred to an event of upward motion (motion in a lexically specified direction: noncausativizable). The authors take this as evidence for the gradual induction of the relevant semantic classes, but the findings are limited (only two verbs) and other interpretations are equally plausible.

One major concern is that there was no test of whether the children understood the meanings of the novel verbs as intended. The authors infer that they did, because when the children talked about the actions, they often referred to them with real English verbs of the right semantic class, for example, *spin* or *swing* (manner of motion) versus *go* or *come* (motion in a lexically specified direction). But this defense introduces its own source of doubt: to the extent that the children equated the novel verbs with real verbs of English, their tendency to use them causatively or not may have been influenced not, as intended, by the novel verbs' abstract semantic class membership, but by the syntax, already at least partially learned, of these specific real verbs.

Finally, there is a complete confounding in the experiment, as the authors also recognize, between semantic class and directness of causation. For the "manner of motion" event the agent pushed on an object hanging on a rope, making it spin (direct), whereas for the "motion in a lexically specified direction" event the agent did not touch the patient, but pulled on a rope attached to a container it was in, thereby causing it to move up a ramp (indirect). Because using a verb causatively is often possible and preferred for events of direct causation, but impossible or dispreferred for events of indirect causation (McCawley, 1978; Pinker, 1989; see also section 2.2.1), children's greater willingness to causativize the "spin"-type verb than the "go up"-type verb may have been influenced by sensitivity to this constructional distinction rather than by the semantic-class membership of the verbs.

In sum, experimental evidence is weak that children's recovery from causative overgeneralizations has anything to do with semantic class induction. To our knowledge, our study is the first to test this hypothesized recovery mechanism against a longitudinal corpus, and our failure to find support for the hypothesis in children's real-life spontaneous speech is sobering. Of course, it does not mean that speakers never identify the implicit semantic categories associated with verbs that can be causativized, but it does suggest that recovery from causative overgeneralization can and does proceed without this mechanism.

When lexical preemption and semantic class induction fall by the wayside, the main mechanism we are left with is *entrenchment*: repeatedly hearing verbs like *fall*, *disappear*, and *go* only in intransitive syntactic frames, until the association between verb and frame becomes so strong that it consistently prevails in the child's production. This mechanism played a relatively modest role in our proposed usage-based model of the acquisition of the causative alternation, serving primarily to clean up stragglers left over after preemption and semantic category induction have done their job (see Step 5 earlier). But our findings suggest that it should be treated with new respect (see also Braine & Brooks, 1995, and Brooks et al., 1999): after all, it may turn out to be the most powerful force available to counteract children's causative overgeneralizations.

ACKNOWLEDGMENTS

We are grateful to Cynthia Fisher and Adele Goldberg for incisive comments in their role as discussants.

NOTES

[1]The children also sometimes intransitivized transitive causative verbs, as is shown in 1h–i of Table 13.1 (see Bowerman, 1982a, for discussion). However, there were far fewer of these errors than of lexical causatives derived from intransitive verbs or adjectives (see also Brooks & Tomasello, 1999, who could elicit far fewer of them in an experimental setting).

[2]Most of the errors in this category are derived from adjectives rather than intransitive verbs (see Appendix). Since adjectives are <-dynamic>, they do not directly qualify for causativization under the broad-range rule (though they can sometimes be formed from deadjectival intransitives, as in *The clothes dried/Betty dried the clothes* or *The milk warmed slowly/Mom warmed the milk slowly.* (See Levin & Rappaport Hovac, 1995: 95–96, for more on the causativization of adjectives.) In any event, Pinker gives no account of how children determine which adjectives can be used to express a caused state change and which cannot.

[3]Examples e and i–k in Table 13.2 illustrate still another way in which the children often violated the broad-range rule for the causative: the causativized verb is transitive, and already has an agent or experiencer subject argument (see Bowerman, 1982a).

[4]Novel lexical causatives, being errors, were more likely to be noticed and noted down than periphrasic causatives. This means that the proportion of novel lexical causatives to all causatives of each semantic class is probably higher in this corpus than in the children's "real life" speech. But it is the *relative* value of the proportions in the three verb classes that is of interest, not the absolute value, and there is no reason to think that the sampling bias in favor of novel lexical causatives over periphrastic causatives affects the three classes differentially.

[5]Causativized forms considered to have a suppletive counterpart included: *die*, *dead* (*kill*), *come* (*bring*, *take* [e.g., for "come me over there"]), *stay* (*keep*, *leave*), *fall* (*drop*, *knock down*), *go* (*take*, *put*, *send*), *eat* (*feed*), *full* (*fill*), *remember* (*remind*), *learn* (*teach*), *higher, rise*, *go up* (*raise*), *go down* (*lower*), *round* (*rotate*, *turn*), *have* (*get*, *take* [*a bath/nap*], *give*), *be* (*put*, *make*, *keep*), *hot* (*heat*), *happy up* (*cheer up*), *broken* (*break*), *sharp* (*sharpen*), *flat* (*flatten*), *straight* (*straighten*), *tight* (*tighten*), *stable* (*stabilize*) (see Bowerman, 1982a, Table 1, for errors with these predicates). Excluded from the calculation are causative uses of *go* and *come* where adults would use a manner-of-motion or state-change verb (e.g., "you go [=*push*] it in" [of a chair at the table]; "go [=*pull*] it up to the cloth" [of a diaper around the rubber ankles of a doll with cloth torso]; "go [=*turn*] on the bathtub". Here the adult form adds so much information that is missing from the child's simple *go* that it seems inappropriate to speak even loosely of "suppletion".

APPENDIX: VERBS AND ADJECTIVES USED BY C AND E AS NOVEL LEXICAL CAUSATIVES

1. EXTERNALLY-CAUSED STATE CHANGE/ MANNER OF MOTION

C **(37 errors, age 2;0–10;3)** full (6), flat, dirty, stuck [= make clogged], unstuck [= make unclogged] (2), sharp, straight, unstraight, stable, round (5), yellow, stick [= make stuck, jammed], fasten [= make go fast] (2), bigger, smaller, smallen, largen, longen, sour, colder, separate (adjective pronunciation), face, overflow (2), slip [= make someone slip] (2)

E **(11 errors, age 2;3–7;8)** tight, untight, broken, full (2), round (2), bumpy, hot, smallen, largen

2. MOTION IN A LEXICALLY SPECIFIED DIRECTION

C **(45 errors, age 2;0–9;8)** go (28), come (7), fall (5), rise, cross (3), higher

E **(26 errors, age 1;10–7;8)** go (12), come (4), fall (7), cross (2), higher

3. COMING INTO OR GOING OUT OF EXISTENCE

C **(13 errors, age 2;8–12;4)** peek out, spell [make letters on a spelling toy spell "X"], die (2), disappear (6), vanish (2), lose turn

E **(6 errors, age 3;7–11;11)** spell [cf. above], dead, disappear (2), subside (2)

4. EXISTING, BEING IN A PLACE OR STATE

C (59 errors, age 2;1–11;3) be (9), have (5), stay (43), take too long, lie around

E (8 errors, age 3;7–11;7) be (2), stay (3), have, wait, lie around

5. EMISSION

C (10 errors, age 3;0–6;7) bleed, sweat (3), sing [of music box] (2), squeak, squeaky, whistle (2)

E (9 errors, age 2;11–10;2) bleed (2), water [eyes], sing [of musical instruments] (2), talk [of music box], glow, bubble, leak

6. INTERNALLY-CAUSED STATE CHANGE OR SITUATION
(cf. Levin & Rappaport, 1995: 90ff.)

C (5 errors, age 3;6–12;3) bloom (2), grow [feet], cling together, soak in

E (1 error, age 3;8) stick [= make adhere]

7. VOLITIONAL (AGENTIVE) ACTION, EMOTIONAL EXPRESSION, AND PSYCHOLOGICAL EVENT

C (57 errors, age 2;3–11;3) climb, crawl, jump (8), skate, ride (3), walk, drink (2), eat (3), guess, laugh, learn, play [= make act a part], remember (4), watch, feel, touch (2), turn a somersault (3), do a trick, take a bath, take little bites, take a ride (3), take a quiet time, take a walk, get [= cause to receive] (2), lie down (3), sit (3), itch, feel better (4)

E (32 errors, age 1;11–10;11) ride, swim, climb, stagger, cry (3), drink, giggle, talk (4), walk, watch, take a ride, take a walk (2), lag, bow down, sit down, perform, remember, recognize, learn, itch, ache (2), sore, happy, comfy

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