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Jess Gropen; Steven Pinker; Michelle Hollander; Richard Goldberg; Ronald Wilson

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THE LEARNABILITY AND ACQUISITION OF THE DATIVE ALTERNATION IN ENGLISH

JESS GROPEN

STEVEN PINKER

MICHELLE HOLLANDER

Massachusetts Institute of Technology

RICHARD GOLDBERG

RONALD WILSON

University of Maryland

Digital Equipment Corporation

The dative alternation poses a learnability paradox: when children hear *give money to him* and *give him money*, they could formulate a rule deriving the double object from the prepositional form, but the rule would allow overgeneralization from *donate money to him* to **donate him money*. Children are not corrected for speaking ungrammatically, so how do they avoid overgeneralizing? The 'conservatism' hypothesis proposes that children do not generalize at all; the 'criteria' hypothesis holds that children learn to constrain their rule to apply to monosyllabic verbs denoting possession changes. In a questionnaire study, adults rated double-object forms with novel verbs as sounding better if they met these criteria. In an analysis of speech transcripts, children were found to produce ungrammatical double-object sentences (though not very frequently). In two experiments children were taught novel motion verbs; they extended them to double-object structures, and did so more often for monosyllabic than for polysyllabic verbs and more often to denote a possession transfer than motion to a location. However, children also had a bias to use each verb in the construction they heard it in. Thus children are not invariably conservative but show conservative tendencies, and their generalizations are influenced by morphophonological and semantic criteria. We propose that speakers acquire a dative rule that operates on two levels: a broad-range rule defines the possibility of a verb meaning 'cause to move' to be changed into one meaning 'cause to have', and narrow-range rules license such extensions to be made for subclasses of semantically and morphologically similar verbs.*

1. INTRODUCTION. In a classic article, 'Syntactic Theory and the Projection Problem', C. L. Baker (1979) pointed out a number of learnability paradoxes that stem from the fact that children have no systematic access to information about which strings of words are not sentences in the language to be learned. The absence of such 'negative evidence' has been documented by Brown & Hanlon (1970), who showed that children are neither corrected nor miscomprehended more often when they speak ungrammatically. Though parents' tendencies to repeat and expand their children's utterances appear to have a small probabilistic relationship to whether such utterances are well-formed (Hirsh-Pasek et al. 1984, Demetras et al. 1986, Penner 1987, Bohannon & Stanowicz 1988), such feedback is noisy, inconsistent from parent to parent and from one period of development to another, and nondiagnostic as to the kind of error

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the child has made (syntactic, phonological, pragmatic, etc.). Thus it seems unlikely that children could make use of such information (see Gordon 1989, Pinker 1989, Grimshaw & Pinker 1989, Morgan & Travis 1989), and there is anecdotal evidence that they ignore it (e.g. Braine 1971, McNeill 1966, Maratsos 1986).

Baker's paradoxes arise when input sentences inspire the child to make generalizations that define a larger language than the one spoken by the community. Because of the lack of negative evidence, the world can never tell the child that he or she is wrong (see also Braine 1971). Baker pointed out that the dative alternation in English is problematical in this way. Many verbs permit both the prepositional construction, as in 1a, and the double-object construction, as in 1b; some allow only the prepositional form (2). If a child had the ability to coin a productive rule generating a double-object dative form corresponding to every prepositional dative form, surely the evidence in 1 would impel him or her to do so. But this would lead to errors for verbs like those in 2. The problem is: how does the child avoid, or unlearn, such mistakes, in the absence of negative evidence indicating that the forms are ungrammatical? Another way of putting it is this: why isn't the ungrammaticality of sentences such as those in 2b obliterated by a single generation of children?

- (1) a. John gave a gift to Mary.
Hal told a story to Sue.
Alice baked a cake for David.
Tim built a house for Spot.
- b. John gave Mary a gift.
 Hal told Sue a story.
 Alice baked David a cake.
 Tim built Spot a house.
- (2) a. John whispered a secret to Sue.
 I donated a book to the library.
 Max washed the car for Kate.
 Mom buttoned the coat for Tom.
- b. *John whispered Sue a secret.
 *I donated the library a book.
 *Max washed Kate the car.
 *Mom buttoned Tom the coat.

The dative alternation has served as the paradigm case of this kind of learnability problem, and considerable attention has been devoted to it during the past decade (see, e.g., Bowerman 1983, 1987a; Clark 1987; Fodor 1985; Fodor & Crain 1987; MacWhinney 1987; Mazurkewich & White 1984; Pinker 1982, 1984, 1989; Randall 1987; Roeper 1981; White 1987).

The paradox arises from the combination of three assumptions: productivity, no negative evidence, and arbitrariness. If children were not productive but CONSERVATIVE, sticking to the forms they heard in the input, they would never overgeneralize because they would never generalize to begin with. If children had access to negative evidence, any overgeneral rule could be weeded out

when a parent corrected or otherwise reacted specially to a sentence generated by that rule. And if the verbs that allowed a rule to apply did not constitute an arbitrary list, but differed according to some criterion from those verbs that blocked the rule, the child could apply the rule where it is mandated but not where it would lead to ungrammaticality. To resolve the paradox, one of these three assumptions must be shown to be false.

Hirsh-Pasek et al. 1984, Demetras et al. 1986, and Bohannon & Stanowicz 1988 suggest that it is the assumption of no negative evidence that should be weakened, based on their observations of mother-child interactions. However, even interpreting these findings in the most charitable possible light (and they are problematical for a variety of reasons; see Pinker 1989), it is virtually certain that they will not solve the problem at hand. Many of the nondativizable verbs are low in frequency and are unlikely to have been uttered and reacted to in the lifetime of every adult who finds them ungrammatical (e.g. **transport him the package*, **explicate him the theory*, **designate her a partner*). Worse, the small statistical contingency between parental behavior and well-formedness dwindles rapidly after the age of two and disappears long before children's grammatical errors cease (Hirsh-Pasek et al. 1984, Penner 1987, Morgan & Travis 1989). So for subtle negative evidence to solve Baker's problem, every person must have uttered every undativizable verb in double-object sentences enough times to detect the parental feedback signal above the noise (i.e. the many repetitions and expansions that do not reflect grammaticality)—all by the age of three.

Baker himself suggested rejecting the first assumption, that learners can formulate a productive dative rule. Let us assume that the ability of a verb to enter into the prepositional or double-object construction is recorded in a part of its lexical entry called its ARGUMENT STRUCTURE (also called SUBCATEGORIZATION FRAME). Baker suggested that children add a double-object argument structure to the lexical entry for a verb in their mental dictionaries only if they hear the verb used in a double-object sentence in the parental input. Fodor 1985 argues for a similar position: she suggests that the generalization that many verbs appear in both double-object and prepositional forms is captured in a nonproductive lexical 'redundancy' rule (Jackendoff 1975). Such a rule might be used to store lexical entries in memory more compactly, or perhaps to dictate what a form would have to look like if it really existed, but not to generate forms that had not been heard in the input. According to this 'strict conservatism' hypothesis, children would not overgeneralize the dative to exceptional verbs like *donate* or *whisper*, because the child would never hear such double-object forms in the input and the child does not generalize the dative at all.

The third way out of the paradox involves weakening the assumption of arbitrariness. According to this hypothesis, the learner makes use of a productive rule, but one that is constrained to operate only on certain subclasses of verbs, delineated by some independent criteria, so that the dativizability of a verb in the language can be predicted in advance. The possible criteria could be drawn from any of the syntactic, semantic, or phonological properties of

the verb. Syntactic factors are stressed by Randall 1987 and Grimshaw 1989. Randall suggests that dativizable verbs must specify that both their objects are obligatory arguments, whereas nondativizable verbs specify only the theme as an obligatory argument. For example, *John donated a book* is grammatical, but **John gave a book* is not. If all of a predicate's obligatory arguments must precede any of its optional arguments, the nondativizability of *donate* would follow. However, the facts of English do not support this generalization. Many verbs with optional *to*-objects dativize (e.g. *Bill wrote (me) a letter*; *Amy asked (him) a question*; *John threw (her) the ball*; *Robert mailed (us) a letter*; *Jill brought (them) some flowers*), and some verbs with obligatory *to*-objects do not (e.g. *She entrusted her child to the daycare center*/**She entrusted her child*/**She entrusted the daycare center her child*; *He credited the money to my account*/**He credited the money*/**He credited my account the money*).

Grimshaw 1989 makes the related but more subtle proposal that the *to*-phrases appearing with dativizable verbs can be arguments of those verbs, whereas those appearing with nondativizable verbs must be adjuncts. Naturally, only the arguments of verbs can be affected by dativization (*John told the joke to death*/**John told death the joke*). Unfortunately, when independent tests of the argument/adjunct distinction (e.g. those suggested by Bresnan 1982; Dowty 1982, and Gazdar et al. 1985) are applied to the *to*-phrases of various verbs, the tests do not distinguish the dativizable from the nondativizable ones (Pinker 1989). For example, in both *John threw the box to Mary* and *John pulled the box to Mary*, the phrase *to Mary* is optional, it has a referent that need not be presupposed when the phrase is omitted, and it contains a meaningful preposition. Thus the *to*-phrase would appear to be an adjunct and neither verb should dativize—but *throw* does, and *pull* does not. Conversely, the *to*-phrases of both *award* and *credit* do pass the tests for argumenthood, but *award* dativizes, and *credit* does not. Of course, if such independent tests are bypassed, and we simply use the fact of dativizability to support a stipulation that one version of *throw* has a *to*-phrase argument but no version of *pull* does, we are begging the question of how the child tells the difference between such verbs short of hearing them in double-object forms (which would reduce to strict conservatism).

Pinker 1984 and Mazurkewich & White 1984 proposed that children come to rely on semantic and morphological or phonological criteria. Mazurkewich & White, citing Green 1974, Oehrle 1976, and Stowell 1981, propose two constraints on the alternation. One is morphological: double-object verbs must belong to the native-stem class rather than to the Latinate class. Consider the prepositional and double-object forms in 3:

- (3) a. John told/reported the news to Bill.
 John told/*reported Bill the news.
 b. Kate showed/demonstrated the technique to Alan.
 Kate showed/*demonstrated Alan the technique.
 c. Debbie built/constructed a cradle for Ezra.
 Debbie built/*constructed Ezra a cradle.

- d. Max got/obtained a ticket for Alice.
 Max got/*obtained Alice a ticket.

Children, of course, are insensitive to the etymology of their words—whether they are of Latin or native (e.g. Anglo-Saxon) origin. However, the distinction between Latinate and native vocabulary can be recast in morphological or phonological terms. Latinate stems could be those formed by combinations of a finite list of designated meaningless morphemes such as *per-*, *con-*, *-mit-*, *-sume*, and so on (Aronoff 1976). Alternatively, the native class could be defined in phonological terms, with its verbs being monosyllabic or polysyllabic with initial stress—a disjunction that corresponds to the natural class defined by words consisting of a single metrical foot (Grimshaw 1985, Grimshaw & Prince 1986). Defining the native class phonologically would be consistent with the fact that most verbs of native origin are either monosyllabic or bisyllabic with initial stress, and that many verbs of Latinate origin which behave like native stems with respect to dativizability—*Promise her anything*; *Offer him a cigarette*—are pronounced with initial stress (Green 1974, Stowell 1981). In any case, the division of the lexicon into these two classes, roughly corresponding to origin, appears to be useful in accounting for a wide variety of morphological processes, not just the dative (see, e.g., Chomsky and Halle 1968, Aronoff 1976).

Mazurkewich & White, citing Oehrle 1976, Green 1974, Goldsmith 1980, and Stowell 1981, also propose a semantic criterion for dativizable verbs: the referent of the first (indirect) object must be the prospective possessor of the referent of the second object. More specifically, the first object of double-object verbs must be a possessor and goal in the case of *to*-datives, or a possessor and beneficiary in the case of *for*-datives. Thus, *John gave Mary a car* is acceptable, but **John washed Mary a car* is not—presumably because Mary is asserted to be only the beneficiary, but not the possessor of the car, as the result of the action. In the same way, we can rule out double-object forms of *cut*, *stir*, *brush*, *solve*, *prove*, and so on. Verbs of communication (e.g. *tell/teach/read/write him something*) fit into the hypothesis under the assumption that they are mentally represented as metaphoric extensions involving the notion of ideas being possessed and transferred. Besides sequestering some of the verbs which never alternate, the semantic constraint also accounts for the unacceptability of certain readings of ambiguous double-object forms. An example from Bresnan 1978 is the following contrast:

- (4) I sent a package to the boarder/the border.
 I sent the boarder/*the border a package.

In this case, the double-object form with *the border* as the first object is unacceptable, presumably because a location is inanimate and hence incapable of possessing something.

Let us call this the ‘criteria-governed productivity’ hypothesis. Pinker 1984 offers an explicit proposal of how morphophonological and semantic constraints could be learned: the child would note the morphophonological and semantic differences between the verbs that have been heard in both prepo-

sitional and double-object forms and the verbs that have been heard in the prepositional form only. The criteria that differentiate them would then be appended to the rule, constraining its application in the future. Before succeeding at finding the criteria, children would overregularize the alternation of the dative to verbs heard only in the prepositional form, regardless of their specific morphophonological or semantic properties. Thereafter, the child should productively use dativization, but only for the appropriate classes of verbs.

What is the evidence for these solutions to Baker's paradox? Strict conservatism predicts that neither children nor adults should use a verb in the double-object form unless he or she has heard it used in that form. Criteria-governed productivity predicts that both children and adults should be productive—children quite broadly so, adults only within the morphophonologically and semantically delineated classes. In this paper, we test these predictions while documenting the major features of children's acquisition and use of the dative constructions. In addition, we point out problems with all the accounts proposed to date, and offer an alternative.

Currently, the evidence is inconclusive. On the one hand, there is evidence that the conservatism hypothesis is too strong. Adults seem to be willing to use or accept a great number of verbs in the double-object form, including many that are unlikely to have been heard in that form, for example, *Pierre flipped/slapped/kicked/tossed/poked/banged/threw/shot/slipped/tapped him the puck*. In addition, Wasow 1981 notes that when new verbs enter the language, they sound quite natural in the double-object form. He notes, for example, that *I satellited a message to him* can be paraphrased quite naturally as *I satellited him a message*. Similarly, *Please xerox me a copy*, *Fax him this document*, and *She bitnetted me the latest version* are common in the late 1980s though they must have been created quite recently. As for children, there exist counterexamples to the prediction that children avoid double-object forms they haven't heard their parents use. Some examples are listed in Table 1.

In addition, Mazurkewich & White gathered evidence that children may accept datives which are ungrammatical in adult speech because the sentences violate the morphophonological constraint (examples in spontaneous speech are fairly rare, probably because Latinate verbs are learned late). Mazurkewich & White elicited acceptability judgments on dative sentences from three groups of children, aged nine, twelve, and sixteen. They found that these groups of children respectively judged 46.7%, 33%, and 11% of the ungrammatical double-object sentences violating the morphophonological constraint to be acceptable.

On the other hand, Fodor (1985) has argued that the arguments against conservatism and in favor of criteria-governed productivity are inconclusive. Besides questioning whether adults possess rules generating double-object forms productively, as opposed to treating such novel forms as innovations in the language, Fodor suggests that the reported instances of overgeneralization in children's spontaneous speech are probably rare (e.g. compared to obvious overgeneralizations like *eated*); the reports include little information about

- From Mazurkewich & White 1984:
 (2;3) I'll brush him his hair.
 (5;2) Pick me up all these things.
 (6;0) Mummy, open Hadwen the door.
- From Bowerman 1978, 1983, 1987a:
 Christy (3;1) I said her no.
 Christy (3;3) You put me just bread and butter.
 Christy (3;4) Put Eva the yukky one first.
 Christy (3;6) Don't say me that or you'll make me cry.
 Christy (3;4) Button me the rest.
 Christy (3;9) I do what my horsie says me to do.
 Eva (2;4) Then put her some more.
 Eva (2;4) How come you're putting me that kind of juice?
- From Eve Clark (personal communication, 1987):
 Damon (8;0) Mattia demonstrated me that yesterday.
- From Susan Pinker (personal communication, 1986):
 Eva (2;0) Pass me some more horsies.

TABLE 1. Examples of productive double-object forms in children's spontaneous speech.

sample size, and there is therefore no way of estimating the relevant baselines. Fodor also points out possible methodological problems in the experimental work by Mazurkewich & White 1984. Children's increasing tendency to judge ungrammatical sentences as being unacceptable may reflect their adoption of a more stringent criterion for indicating acceptability, rather than any change in their grammar such as learning a morphophonological constraint.

Other objections can be raised to the conclusions that White (1987) has drawn based on a study of 3–5-year-old children. She found that the children were capable of acting out and imitating double-object sentences, including many that would be ungrammatical to adults, though they did this more successfully for grammatical than ungrammatical sentences. She uses these results as evidence for early overgeneralization and for a developing sensitivity to the differences between dativizable and nondativizable verbs. However, neither comprehension nor imitation tasks provide proper tests of the conservatism hypothesis: adults can easily imitate or act out sentences like *I washed him his car* that they perceive to be ungrammatical, so children's ability to do so is uninformative. There were also serious problems with White's materials. The sentences were semantically nonreversible (e.g. *Tie the teddy the shoelace*), enabling children to act them out properly by relying on individual word meanings and event probabilities even if they ignored their syntax. Furthermore, the distinction between ungrammatical and grammatical test sentences was almost perfectly confounded with whether the direct object (i.e. the patient) was preceded by the definite or the indefinite article; the indefinite article is generally more felicitous in the double-object form and thus this factor, rather than the choice of verb, could have caused the differences in children's comprehension and imitation data.

In summary, a major problem in resolving Baker's paradox is the lack of conclusive evidence on the following three critical issues. First, to what extent do children generalize verbs to the double-object construction? Second, are

the proposed constraints on the dativizability of verbs in the adult lexicon psychologically real? Third, do children come to respect constraints on dativizability and, if so, which ones and when? In this paper we use two converging sources of data to answer these questions. First, we conduct an analysis of computer-based transcripts of children's spontaneous speech in naturalistic settings, in an effort to characterize the onset, frequency, and character of children's use of dative constructions. Second, we run experiments in which we expose children and adults to novel verbs in one dative construction and then test their willingness to use the verbs in the other construction. This allows one to see whether and when productive extensions of verbs to dative constructions are made; by varying the semantics and morphophonology of the novel verbs, we test whether children and adults are sensitive to the hypothesized constraints. The advantage of using these two measures is that they make up for each other's deficiencies: samples of errors in spontaneous speech may be unrepresentative of children in general, and the types of verbs used, the prior parental input, and the opportunities for using each construction are uncontrolled. Experimental procedures do not share these problems, but could put children in an artificial situation in which task demands may influence their behavior in unnatural ways. However, when the two techniques yield the same conclusion, one can be more confident that the conclusion is warranted.

2. STUDY 1. In this study of dative constructions in the spontaneous speech of five children, we seek to answer six questions. The first two concern basic descriptive issues and are a prerequisite to understanding the acquisition of the English dative in general. First, when do the prepositional and double-object constructions emerge in children's speech? Many grammarians have characterized the English double-object construction as highly 'marked' or unusual with respect to Universal Grammar, because of the presence of an NP that is neither adjacent to the verb nor cued morphologically by a case-marking affix or preposition (e.g. Stowell 1981). Therefore, some have predicted that the double-object form should be difficult for children to acquire (e.g. Ritchie 1985, Mazurkewich 1984). Furthermore, some have tied the marked nature of the double-object form to the constraints on it: if the form is acquired only grudgingly, it would not be surprising if it is restricted to certain special kinds of verbs. The supposed markedness of the double-object form has also been invoked in studies of the acquisition of the dative by adult learners of English as a second language (e.g. Mazurkewich 1984). However, the evidence that children have difficulty with the double-object form is equivocal. Children do have more difficulty COMPREHENDING double-object dative sentences than prepositional dative sentences in act-out tasks (e.g. Cook 1976, Osgood & Zehler 1981, Roeper et al. 1981), but this may have nothing to do with their grammar of dative constructions. As mentioned, what is difficult to understand is not the same as what is felt to be ill-formed: some ungrammatical datives are easy to understand (e.g. **He donated the museum a painting*), whereas some grammatical datives are relatively difficult to understand (e.g. *The giraffe sent the hippopotamus the elephant*), presumably because sequences of unmarked NPs

are difficult to parse in general (Frazier & Fodor 1978). Therefore we cannot use comprehension difficulty in children as evidence that their rule systems treat the double-object form as difficult or special. A second important general descriptive question is: what kinds of verbs are used in these constructions? This is relevant to determining whether children use verbs fairly indiscriminately in the dative constructions or restrict them to certain semantically-delineated classes that could play a role in criteria for dativizability.

The other questions are more directly addressed to Baker's paradox. The third question is: do children use the double-object dative construction with verbs that they could not have heard their parents use in such constructions? If so, it would speak against a strong conservatism hypothesis in which children restrict themselves to the verb-argument structure combinations that they have witnessed in the input. Fourth, what kinds of errors are they? Specifically, do they violate the constraints proposed for the adult dative? Fifth, how common are these productive errors? Sixth, since the morphophonological constraint on the dative alternation is obviously English-specific, it must be learned from parental speech, and we can ask what kind of evidence for the constraint is present in that speech.

2.1. SUBJECTS. The speech of five children and their caretakers was analyzed. Three of them, Adam, Eve, and Sarah, were observed by Brown (1973) and his students. Adam's speech was recorded in 55 two-hour samples taken every 2–4 weeks between the ages of 2;3 and 5;2. Eve's speech was recorded in 20 two-hour samples taken every 2–3 weeks between the ages of 1;6 and 2;3. Sarah's speech was recorded in 139 one-hour samples taken at intervals ranging from 2–19 days between the ages of 2;3 and 5;1. The other two children, Ross and Mark, had their speech recorded by their father, Brian MacWhinney. Their speech was recorded in 62 samples of varying sizes at varying intervals between the ages of 2;7 and 6;6 for Ross, and between 1;5 and 4;7 for Mark. All the transcripts were in the form of computer text files and were provided by the ChiLDES project (MacWhinney & Snow 1985).

2.2. PROCEDURE. The searches were performed on a Microvax II computer running the Unix operating system. Using 'grep', a Unix program that finds matches of a given regular expression, we separated the speech of children from those of the adults present; because the program processes lines, not utterances, portions of utterances wrapping around to a second line were omitted. Since most utterances were short, we believe that few dative constructions were omitted from the analysis because of this limitation. We excluded utterances for which the transcription was questionable, or in which portions of the sentence were garbled. Utterances which were immediately repeated were counted only once. Context was used for disambiguation when necessary, for example to distinguish double-object datives from possessive forms in which the possessive marker may have been omitted (e.g. *Get Daddy shoe*), or to distinguish separately the static-possessional sense of *get* or *got* from the 'obtaining' sense (e.g. *We got no clothes for her*, where *got* can be interpreted as

have). An utterance was counted as a double-object dative if it contained a verb followed by two noun phrases; an utterance was counted as a prepositional dative if it included a verb, followed by a noun phrase, followed by a prepositional phrase headed by *to* or *for*. Utterances in the order specific to prepositional phrases but lacking a preposition (e.g. *Give book Frazier*) were omitted; there were no more than four of these utterances. We also excluded a number of utterances that fit this schema but that clearly belonged to a different grammatical construction, such as cases where the *to*-phrase was a clear adjunct (e.g. *She wore the dress to the party*), an argument of a verb of attachment (e.g. *He tied it to the post*), idioms (e.g. *Don't do that to me*), and temporal and purposive uses of *for* (e.g. *She made soup for dinner*, *Save it for a while*).

Examples of dative utterances of both forms were classified by speaker, age, and the semantic class of the verbs they contained. Eleven classes of verbs participating in dative constructions (see Green 1974, Pinker 1989) were considered: (1) giving (e.g. *give*, *sell*, *hand*; idiomatic expressions with *give*—e.g. *give him a spanking/headache*—were tabulated separately); (2) type of communication (e.g. *tell*, *show*, *read*); (3) creation (e.g. *make*, *draw*, *cook*, *build*); (4) obtaining (e.g. *get*, *buy*, *find*); (5) accompanied motion in a direction (*bring*, *take*); (6) sending (e.g. *send*, *ship*, *mail*); (7) ballistic motion (e.g. *throw*, *kick*, *toss*); (8) manner of accompanied motion (e.g. *push*, *carry*, *pull*); (9) other communication, including *say* and the 'manner of speaking' verbs (e.g. *shout*, *whisper*, *mutter*); (10) future having (e.g. *promise*, *assign*, *offer*); (11) other benefactive (prepositional datives with *for* whose verbs do not fall into classes 3 or 4). The verbs in all of these classes except 11 are compatible with the notion of causing a change in possession. Note, though, that, contrary to the hypotheses of Mazurkewich & White 1984 and Pinker 1984, the verbs in classes 8 (**pull me the wagon*) and 9 (**say me something*; **shout me something*) do not dativize; the significance of this fact will be made clear in the General Discussion (§6).

2.3. RESULTS AND DISCUSSION. Tables 2 through 6 summarize the use of dative forms in the spontaneous speech of each of the five children. In each table we list the verbs that a child used within each class in order of appearance in his or her transcripts, how many times they were used, and the age range in which they were used, broken down into double-object and prepositional forms. Dashes indicate that the construction is ungrammatical with the particular class of verbs.

2.3.1. EMERGENCE OF THE DATIVE CONSTRUCTIONS. Both double-object and prepositional datives were plentiful in the children's speech. The age of onset varied from 1;8 for Eve to 3;3 for Mark. Mean length of utterance (MLU) norms are available for the Brown children (Brown 1973); the dative forms emerge at an MLU of 2.00 for Adam, 2.00 for Eve, and 2.35 for Sarah, suggesting that onset is better correlated with MLU than with chronological age.

The data clearly show that neither version of the dative consistently emerges first, contrary to the widespread assumption that the prepositional dative should

| | DOUBLE-OBJECT | PREPOSITIONAL |
|------------------------------|--------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| GIVING | give (59) 2;3-5;2 (idiom: (6) 2;9-4;4) hand (1) 2;6 pay (4) 4;7 | give (14) 2;8-5;2 |
| TYPE OF COMMUNICATION | show (11) 3;0-4;5 tell (4) 3;0-5;2 sing (1) 3;0 read (1) 4;2 ask (1) 5;2 | show (7) 2;11-5;2 read (3) 3;2-4;2 |
| CREATION | draw (1) 3;4 make (4) 3;5-4;11 | make (10) 3;0-5;2 cook (1) 3;2 build (1) 4;0 drill (3) 4;2 |
| OBTAINING | get (15) 2;4-4;4 buy (8) 3;3-5;2 | get (5) 3;2-4;7 leave (3) 3;8-4;11 buy (2) 4;0 |
| DIRECTED ACCOMPANIED MOTION | bring (2) 3;1-3;11 | take (5) 3;1-3;8 (inanimate goal) |
| SENDING | | send (4) 3;3-4;7 (animate goal (2) 3;3-4;7) (inanimate goal (2) 4;7) |
| BALLISTIC MOTION | | throw (3) 3;0-3;4 |
| MANNER OF ACCOMPANIED MOTION | — | drive (1) 4;4 (inanimate goal) |
| OTHER BENEFACTIVE | — | tear (1) 2;7 turn (1) 3;2 keep (3) 3;3-4;4 set (1) 3;3 open (2) 3;4 burn (1) 3;5 put (1) 3;8 do (3) 4;2-4;7 tie (2) 4;7-4;11 hold (1) 4;7 fix (2) 4;8 blow (1) 4;9 bring (1) 4;9 |

TABLE 2. Number and age range of grammatical dative constructions with different verbs in the spontaneous speech of Adam.

precede the double-object form. The first double-object forms of any alternating verbs appear before the first prepositional forms for Adam and Eve; they appear in the opposite order for Mark, and appear within a month of one another for Sarah and Ross. The same pattern occurs when we look at individual verbs. Of the 28 cases where a child used a verb in both forms, the double-object version came first 16 times, the prepositional object version came first 9 times, and both appeared simultaneously 3 times (each child showed one acquisition order for some verbs, another for other verbs). Furthermore, 22 potentially alternating verbs were used only in the double-object form, and 24 were used only in the prepositional form. Early double-object forms showed the use of syntactically composed structures, not stereotyped routines or amalgams. In

| | DOUBLE-OBJECT | PREPOSITIONAL |
|------------------------------|-----------------------------------|----------------------------------------------------------------------------------------|
| GIVING | give (4) 1;9-1;10 | give (1) 2;2 |
| TYPE OF COMMUNICATION | read (1) 1;8 show (2) 1;9-1;10 | read (2) 2;0-2;2 |
| CREATION | | make (4) 2;2-2;3 |
| OBTAINING | get (2) 2;0-2;2 | get (3) 2;0-2;2 buy (1) 2;0 find (1) 2;2 |
| DIRECTED ACCOMPANIED MOTION | bring (2) 1;10-1;11 | take (1) 2;1 (inanimate goal) bring (1) 2;3 |
| MANNER OF ACCOMPANIED MOTION | — | push (1) 2;2 |
| OTHER COMMUNICATION | — | say (1) 2;2 |
| OTHER BENEFACTIVE | — | read (7) 1;11-2;2 do (3) 1;11-2;2 fix (1) 1;11 hold (1) 1;11 spell (1) 2;0 |

TABLE 3. Number and age range of grammatical dative constructions with different verbs in the spontaneous speech of Eve.

| | DOUBLE-OBJECT | PREPOSITIONAL |
|-----------------------------|----------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| GIVING | give (29) 2;11-5;1 (idiom: (6) 2;11-5;0) | give (6) 3;3-5;1 |
| TYPE OF COMMUNICATION | lend (3) 4;4 tell (2) 3;1-4;7 show (6) 3;4-4;6 read (2) 3;8-5;1 teach (1) 4;4 ask (1) 4;7 | show (2) 3;8 read (1) 5;1 |
| CREATION | make (2) 4;1-4;8 pour (1) 2;11 | make (2) 3;0-3;8 |
| OBTAINING | get (12) 3;1-4;11 buy (6) 3;10-5;1 | buy (3) 3;1-3;5 get (3) 3;7-4;11 save (1) 4;3 leave (1) 4;9 take (1) 3;5 (inanimate goal) |
| DIRECTED ACCOMPANIED MOTION | bring (2) 3;8-4;1 | throw (1) 3;5 say (2) 3;9-4;6 bring (2) 3;5-4;9 put (1) 3;6 stick (1) 4;1 cut (1) 4;1 move (1) 4;3 push (1) 4;4 wrap (1) 4;5 do (2) 4;8 hold (1) 4;8 |
| BALLISTIC MOTION | | |
| OTHER COMMUNICATION | — | |
| OTHER BENEFACTIVE | — | |

TABLE 4. Number and age range of grammatical dative constructions with different verbs in the spontaneous speech of Sarah.

| | DOUBLE-OBJECT | PREPOSITIONAL |
|------------------------------|-------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| GIVING | give (69) 2;7-6;6 (idiom: (11) 3;4-6;6) | give (26) 2;11-6;6 sell (1) 5;0 |
| TYPE OF COMMUNICATION | tell (27) 3;4-6;6 show (14) 3;4-6;4 read (3) 3;5-5;7 teach (2) 3;6-3;11 ask (1) 5;7 | read (5) 2;10-5;2 sing (2) 3;1-4;0 tell (3) 3;4-4;8 teach (1) 4;5 show (1) 5;0 |
| CREATION | make (1) 3;4 draw (3) 3;6-3;8 | make (5) 2;8-6;0 |
| OBTAINING | buy (7) 2;11-5;6 get (29) 3;1-6;0 find (1) 3;5 | buy (14) 2;8-4;7 save (5) 2;11-4;1 get (15) 3;9-5;6 |
| DIRECTED ACCOMPANIED MOTION | bring (3) 3;0-3;4 | take (21) 2;7-6;1 (inanimate goal (20) 2;7-6;1) (animate goal (1) 3;6) bring (4) 3;0-3;8 (animate goal (3) 3;0-3;8) (inanimate goal (1) 3;8) |
| SENDING | | send (4) 3;8-5;5 |
| BALLISTIC MOTION | | throw (3) 3;3-3;5 (animate goal (2) 3;3) (inanimate goal (1) 3;5) |
| MANNER OF ACCOMPANIED MOTION | — | drive (1) 3;4 (inanimate goal) |
| OTHER COMMUNICATION | — | say (3) 3;1-5;6 |
| FUTURE HAVING | promise (1) 6;3 | |
| OTHER BENEFACTIVE | — | fix (1) 2;11 cut (1) 3;0 put (2) 3;3-5;4 open (1) 3;4 read (1) 3;4 turn (1) 3;8 do (4) 3;10-5;10 take (2) 3;10-4;7 tie (1) 4;3 hold (1) 4;5 bring (1) 4;10 wash (1) 6;0 |

TABLE 5. Number and age range of grammatical dative constructions with different verbs in the spontaneous speech of Ross.

particular, these forms did not necessarily contain cliticized pronouns (e.g. *gimme*) or even pronouns in postverbal position. For example, Adam produced *Give doggie paper* at 2;3, Ross produced *I give big tiger a bracelet* at 2;7, and Eve produced *Show Fraser horsie* at 1;9. These results are also consistent with those of Bowerman (1987b), who recorded the very first appearances of dative forms in her far more extensive diary data. She reports that the prepositional and double-object forms of *give*, *buy*, and *bring* appeared within a month of each other in the speech of her daughter Christy, very close to her second birthday.

| | DOUBLE-OBJECT | PREPOSITIONAL |
|------------------------------|--------------------------------------------------------|------------------------------------------------------------------|
| GIVING | give (10) 3;8-4;7 (idiom: (2) 4;5-4;6) | give (5) 3;5-4;5 |
| TYPE OF COMMUNICATION | tell (11) 3;8-4;7 teach (1) 3;8 show (5) 3;9-4;7 | read (2) 3;10 show (1) 4;0 tell (1) 4;5 sing (1) 4;7 |
| OBTAINING | get (4) 3;9-4;6 | save (1) 4;0 |
| CREATION | pour (1) 3;8 | |
| DIRECTED ACCOMPANIED MOTION | take (1) 3;7 bring (1) 4;4 | take (1) 3;11 (inanimate goal) |
| MANNER OF ACCOMPANIED MOTION | — | wing (1) 2;11 (used like 'fly' or 'drive'; inanimate goal) |
| OTHER COMMUNICATION | — | say (1) 4;1 |
| OTHER BENEFACTIVE | — | open (2) 3;5-4;1 |

TABLE 6. Number and age range of grammatical dative constructions with different verbs in the spontaneous speech of Mark.

2.3.2. KINDS OF VERBS USED IN THE DATIVE CONSTRUCTIONS. Most of the children's double-object dative sentences contained verbs in the classes 'giving', 'type of communication', 'obtaining', 'accompanied motion in a direction', and 'creation'. Verbs of 'future having' were represented only by one instance of *promise* in the speech of Ross; verbs of 'ballistic motion' were never used in the double-object form, and were rarely used in the prepositional form. There were also few usages of prepositional forms with verbs of manner of accompanied motion or manner of speaking. However, undativizable *for*-benefactives were fairly common in the speech of all the children but Mark.

2.3.3. PRODUCTIVE USAGES. All the children but Sarah uttered double-object dative sentences containing verbs that they could not have heard in double-object sentences in adult speech. The 22 productive sentences we found (involving 8 different verbs) are listed in Table 7 (we are not counting Adam's *get me* as a productive form because it is common in colloquial American speech). Two of these verbs would have been grammatical if they had been used in different senses: *write*, which Eve used as a synonym of *draw*, is acceptable in *Write* (i.e. send) *me a letter*, and *fix* can be used in *Fix* (i.e. make) *me a drink*. However, Eve was clearly using the double-object sentences with *write* in a benefactive sense corresponding to the preposition *for*, not *to*, and in the same session she actually uttered sentences like *Write a lady for me* four times. Adam never said or heard the food-creation sense of *fix* in any of the transcripts. Therefore it is unlikely that these double-object sentences are caused by the child transferring the privileges of homophonous verbs heard in the double-object form. The sources of the errors are discussed in detail below; for now it suffices to note that the existence of these forms replicates the reports of Bowerman 1983 and Mazurkewich & White 1984, and refutes the strongest version of the conservatism hypothesis according to which children invariably stick to the combinations of individual verbs and dative argument structures attested in adult speech.

- Adam (4;1) (putting colored rubber bands on a board)
 I gon' put each ... all of the rubber bands on dere?
 (Ursula: You can put them in all different directions.)
 I got me another one. I gon' put me ... I gon' put me all dese rubber bands on.
- Adam (4;11) You finished me lots of rings.
- Adam (5;2) Mommy, fix me my tiger.
 Ursula, fix me a tiger.
 Ursula, fix me a tiger.
- Eve (2;3) (But) I go write you a lady now.
 I go write you something
 I go write you train.
 I writing you something.
 You (please) write me lady. You (please) write me lady.
 You can write me a lady on that page.
 Writing you someping.
 Write me another one right here.
 You please write me snowman.
 When Fraser come back he goin' to write me another snowman.
- Ross (2;8) Jay said me no.
- Ross (3;3) Don't say me that. (asking adult not to tell him to put on his socks)
- Ross (3;3) You ate me my cracker.
- Mark (3;8) So don't please ... keep me a favor. (asking brother not to throw up on a ride)
- Mark (4;0) Ross is gonna break into the TV and is gonna spend us money.
 (Father: What is he gonna do, Mark?)
 Spend us money. (I.e. to fix it = cost us money, cause us to spend money.)

TABLE 7. Double-object datives with nondativizable verbs in the spontaneous speech of the five children.

2.3.4. KINDS OF VIOLATIONS. The sentences in Table 7 are ungrammatical in adult speech for a variety of reasons. Counting repeated use of a verb within a session as a single example, we have nine examples in the table. Of these nine, two could be due to the substitution of a verb for a semantically similar verb: Eve used *write* as a synonym of *draw*, and Mark used *keep* in place of *do* in the idiom *do me a favor*. These are similar to Bowerman's children using *put* in double-object forms when *give* would be called for (see Table 1). However, Eve used *write* in the prepositional form four times in that session, but never used *draw* in a double-object form in any of the transcripts, so it is likely that she derived the errors using something like the dative rule. Another two forms involved the verb *say* (also reported in Bowerman 1983), which is nondativizable, in contrast to other verbs of communication like *tell* and *ask*, for reasons covered in §6 (see also Pinker 1989). Of the remaining examples, three from Adam involved a benefactive relation (two would have been fully well-formed if the prepositional form with *for* had been used instead; the third would be grammatical, though oddly redundant, with a *for*-phrase; it is similar to colloquial reflexive benefactives such as *He was going to chew himself a hole through the fence* or Adam's own *I got me another one*; see Pinker 1989). Double-object benefactive errors were also reported by Bowerman and Mazurkewich & White (Table 1). Finally, two examples from the MacWhinney boys show a complementary 'malefactive' relation, in which the referent of the postverbal NP suffers rather than benefits as the result of the action. Both

of these utterances also involve a loss of possession and are in some ways similar to the verbs of 'future not having' discussed by Green 1974 and Pinker 1989 that appear only in the double-object form in adult speech (*That remark cost you your job! *cost your job to you*; also *bet, charge, spare, begrudge, envy, etc.*).

It is hard to determine with certainty whether the children used the dative rule to derive these sentences from prepositional forms, or some other productive mechanism. For the examples containing *finish, fix, write, and say*, the corresponding prepositional forms would have been appropriate in context and they are a plausible source. The benefactive/malefactive examples with *put, eat, and spend* do not have natural prepositional counterparts, but it is possible that a rule deriving them directly from their transitive versions by inserting the malefactive argument (similar to an 'applicative' rule) was used. A direct verb-for-verb substitution is the most likely source of the example with *keep a favor* and cannot be ruled out absolutely for the examples with *write* and *say*. Therefore at least some of the double-object errors, and perhaps most of them, reflect the productive application of a rule deriving them from other argument structures. (Note also that the fact that some of the errors may be due to word substitutions does not rob them of interest regarding the acquisition of argument structure; it is interesting that, when stems and meanings part company in children's speech, argument structures such as the double object go with the meanings. See Pinker 1989.)

Though children do not exactly obey the constraints that govern dativizability in adult English, it is interesting that their errors are nonetheless quite circumscribed. We find verb substitutions, uses of *say*, and benefactive/malefactives, but not examples of any of the kinds of possible overextensions of a dative rule shown in 5. (Bowerman 1982b reports that children's errors with locative forms such as *fill water into the glass* are also quite circumscribed.)

- (5) a. Amy took the road to Chicago./*Amy took Chicago the road.
 b. Mommy found the top to the jar./*Mommy found the jar the top.
 c. Custer fought the Indians to the last man./*Custer fought the last man the Indians.
 d. Betty threw the box to the tree./*Betty threw the tree the box.
 e. Jimmy drove the car to Chicago./*Jimmy drove Chicago the car.
 f. Sally brought roses to the cemetery./*Sally brought the cemetery roses.
 g. Alex put a gun to his head./*Alex put his head a gun.
 h. Sheila finally put pencil to paper./*Sheila finally put paper pencil.
 i. They blew the building to smithereens./*They blew smithereens the building.
 j. Hildy wiped the case for her typewriter./*Hildy wiped her typewriter the case.
 k. Babs took a trip for fun./*Babs took fun a trip.
 l. Jane planted the trees for six hours./*Jane planted six hours the trees.
 m. Bill bought a car for \$6000./*Bill bought \$6000 a car.

- n. Mommy punished Tex for bad behavior./ *Mommy punished bad behavior Tex.
- o. John set the VCR for Channel 6./ *John set Channel 6 the VCR.

2.3.5. FREQUENCY OF AND TIMING OF PRODUCTIVE USAGES. The onset of errors invariably followed nonproductive, grammatical usages of one or both kinds of dative forms. Adam's first recorded overgeneralization of the double-object form occurred at the age of 4;1, but he used grammatical double-object forms beginning at 2;3 and prepositional forms beginning at 2;8. Eve's use of *write* in double-object constructions at 2;3 followed correct uses of double-object forms beginning at 1;8 and prepositional forms beginning at 2;0. We found no productive double-object forms from Sarah by age 5;1, though many conventional datives of each type were produced by then. The two stages are not clearly demarcated for Ross and Mark, though each boy used some grammatical dative forms before the first appearance of a recognizably productive form. Ross incorrectly used *say* in the double-object form at 2;8; his preceding transcripts show *give* (2;7) being used in the double-object form, and *buy* (2;8) being used in the prepositional form. Mark's overextensions of the dative occurred at 3;8 and 4;0; before that he had used the double-object form of *take* at 3;7 and *pour* at 3;8, and the prepositional dative form of *give* at 3;5. The general pattern of conservative, grammatical usages preceding productive, ungrammatical usages, sometimes for extended periods of time, also characterizes overextensions of the causative and the locative alternations (Bowerman 1982a, b), and is probably seen even more clearly in continuous diary data than in our biweekly or monthly samples.

Though errors with the double-object form can be found, they are quite rare both in absolute terms and relative to grammatical usages. The 22 errors we found came from a database of the following size: 22,303 utterances from Adam, 9,482 from Eve, 26,913 from Sarah, 19,591 from Ross, and 8,043 from Mark. Obviously, many of these sentences were from stages in which utterance lengths were too short to support double-object sentences, or were in contexts where potentially dativizable verbs were not called for, but a rate of one double-object form in every 3,924 sentences (.0003) gives one an idea of how rare these errors are (note that the double-object form in general is a common construction in casual speech).

Furthermore, the vast majority of the children's double-object forms were grammatical usages with a few common verbs in forms that were also used in the double-object form by their parents. In Table 8, we see that the productive

| | UNGRAMMATICAL: | | GRAMMATICAL: | | GRAMMATICAL TYPES ALSO USED BY ADULTS |
|-------|----------------|-------|--------------|-------|------------------------------------------|
| | TOKENS | TYPES | TOKENS | TYPES | |
| ADAM | 5 | 3 | 118 | 13 | 11 |
| EVE | 11 | 1 | 11 | 5 | 5 |
| SARAH | 0 | 0 | 73 | 12 | 10 |
| ROSS | 3 | 2 | 172 | 13 | 11 |
| MARK | 3 | 2 | 36 | 8 | 7 |

TABLE 8. Productive versus conservative double-object datives in children's spontaneous speech.

(ungrammatical) double-object forms were a small fraction of the number of grammatical double-object forms that could have been picked up from parental speech. In fact, virtually all of the children's grammatical double-object forms actually did appear in that form in adults' speech in their transcripts, as the last column shows (and others undoubtedly appeared in their speech outside the recording sessions). Usage of the prepositional forms of dativizable verbs in these children's speech also closely mirrored the adult input: 79% of the dativizable verbs (types) appearing in the prepositional form in each child's speech also appeared in the prepositional form in the speech of adults in that child's transcripts.

Thus, on the average, about 95% of the children's double-object sentences (tokens) and about 86% of the verbs (types) they use in double-object sentences could have been based on argument structures acquired conservatively from adult speech. This is by no means an obvious result: given that children are prone to using double-object forms to express benefactive relations, the pool of possible double-object forms includes any transitive verb in their vocabulary.

2.3.6. MORPHOPHONOLOGY OF VERBS IN DATIVE CONSTRUCTIONS. No child used a verb with Latinate prosodic properties in either double-object or prepositional forms. In fact, *promise* and *finish*, which are etymologically Latinate but prosodically native, were the only polysyllabic verbs used in either construction. Interestingly, Latinate forms were also rare in the adults' speech. The only verb with Latinate prosody used in either construction was *explain*, used once each by the adults playing with Adam and Sarah. (Three other verbs were Latinate but had the native stress-initial prosodic pattern—*measure*, *package*, and *finish*, used once apiece in benefactive *for*-datives.) Of course, there is no constraint forcing prepositional datives to have verbs that are native in adult English. It seems that native verbs just happen to be the ones parents use when talking to their children, presumably because they are more basic and of higher frequency.

2.4. SUMMARY OF STUDY 1. Grammatical double-object and prepositional dative forms appear around the second year in children's spontaneous speech in five main classes of verbs, with neither construction systematically preceding the other. Later, most children utter productive, ungrammatical double-object forms as well. These forms are ungrammatical because of verb substitutions, use of the verb *say*, or expressions of benefactive/malefactive relations, but they do not represent an indiscriminate transformation of sentences with *to* or *for* to the double-object form. Productive usages, though, are rare both in absolute terms and relative to grammatical forms, which could have been picked up from adult input. Latinate verbs are rare in both constructions in the speech of both children and parents.

3. EXPERIMENT 1. This experiment tests whether the hypothesized constraints of semantics (i.e. prospective possession) and morphophonology (specifically, monosyllabicity) are psychologically real for the adult. The alternative is that the so-called constraints are nothing more than nonrandom patterns in

lists of lexical items caused by historical processes. According to Visser 1963, in Old English the order 'V NP-dat NP-acc' was more common than the order 'V NP-acc NP-dat'. In Middle English the case markers eroded, resulting in a 'V NP_{goal} NP_{theme}' verb phrase similar to the double-object construction of contemporary English. Very few verbs appeared in the prepositional form 'V to NP NP' in early Middle English. But in the 14th and 15th centuries many new verbs entered the language as borrowings from French, which marked the goal phrase with the preposition *à*. When these verbs were assimilated into English, the French argument structure was translated, and thus the preposition *to* (the translation of *à*) was used to mark the goal argument. Native verbs were then allowed to take this argument structure as well, presumably via the application of a dative rule operating in what we now think of as the 'backwards' order, from the double-object form to the prepositional form. Thus the verbs that take the double-object form are the ones that were already in the language when that form came into being, and the verbs that fail to take that form came into the language more recently from French (and Latin), accompanied by a French-like argument structure.

Of course, if the constraints aren't real for adults, then they cannot account for how the child avoids or recovers from overgeneralizations of the dative. We tested adults' sensitivity to the constraints by presenting them with various kinds of novel verbs in the prepositional dative form, and asking them to rate the acceptability of double-object sentences containing these verbs.

3.1. SUBJECTS. Sixty-four native speakers of English, aged 17 to 41 years, participated without payment. Thirty-one were undergraduates at MIT, enrolled in an introductory psychology course; the remaining 33 were students at the Colorado State University School of Veterinary Medicine.

3.2. MATERIALS. We gave each subject a questionnaire consisting of two pages of instructions followed by eight pages of test material. Each page of test material contained a short paragraph followed by a block of eleven sentences to be rated. Each paragraph contained a novel verb in a prepositional dative sentence whose meaning was related to that of a novel noun. For example:

John, the star player of the Boston Whalers, was eager to begin the match against the New York Maulers. He knew that he would be facing their champion—Ben—also adept at using the pell. And sure enough, at a critical point in the game, John summoned all of his strength and pelled the disc to Ben.

Three factors were varied orthogonally across the eight verbs: whether the verbs were monosyllabic (*norp*, *pell*, *moop*, *tonk*) or polysyllabic (*calimode*, *repetrine*, *orgulate*, *dorfinize*); whether the verbs specified a change of possession (as in the example above) or mere transportation or benefaction; and whether they used the preposition *to* or *for*. Appendix 1 contains the eight paragraphs used.

Following each paragraph on the same page was a list of eleven sentences and rating scales. Two of the sentences were datives—a double-object and a prepositional form. The remaining nine sentences were distractor items: one

simple transitive sentence (lacking an indirect object), five passive sentences (three with the theme passivized and two with the goal passivized), and imperative versions of prepositional, double-object and simple transitive forms. Appendix 2 shows an example.

3.3. INSTRUCTIONS. We asked subjects to rate the acceptability of sentences by giving a 'gut feeling as to how good or bad they sound', not by reasoning about right or wrong answers. A seven-point rating scale was provided, ranging from -3 , 'completely odd', through 0 , 'you don't know', to 3 , 'perfectly natural'. We illustrated the use of the scale by providing sample ratings for sets of sentences containing the verbs *give* and *say*, which were shown with scores of 3 and -3 . Note that the unacceptability of *say* in the double-object form is not related to the semantic or morphophonological constraint, ensuring that the example sentence did not exemplify the constraint we were testing for.

3.4. DESIGN. We employed a factorial design with the within-subject factors of Semantics (possessive vs. nonpossessive), Phonology (monosyllabic vs. polysyllabic), Preposition (*to* vs. *for*), and Construction (prepositional vs. double-object). Pairing of stems and stories was counterbalanced so that, across subjects, every stem occurred in each story an equal number of times. Furthermore, each pair of paragraphs with a given Preposition and of a given Semantic type was combined with a given pair of stems (a monosyllabic and a polysyllabic one) an equal number of times across the experiment. We used the same nouns across all of the sentences in each list of test sentences for a verb, and these nouns differed from those used in any of the paragraphs in the entire questionnaire. The order of sentences within lists of test sentences and the order of the paragraphs were randomized separately for each subject.

3.5. RESULTS AND DISCUSSION. In Table 9 we present the means for the sixteen conditions. A 4-factor within-subjects Analysis of Variance reveals that subjects rated the prepositional forms as being significantly more acceptable than the double-object forms (mean ratings of 2.72 versus -0.92 ; $F(1, 63) = 706.80$, $p < .001$), presumably because subjects had actually read the verbs in the prepositional forms in the paragraph. In addition, the effect of Verb Semantics was highly significant ($F(1, 63) = 194.29$, $p < .001$), showing that subjects rated possessive verbs as being more acceptable than nonpossessive verbs (mean ratings of 1.40 versus 0.41). These main effects are best interpreted in light of a significant two-way interaction between Construction and Verb Semantics, $F(1, 63) = 191.31$, $p < .001$, reflecting the fact that subjects, when judging prepositional forms, did not care whether the verbs involved possession or not; however, when judging double-object forms, subjects deemed verbs that did not involve possession worse than those that did involve possession. This interaction is exactly what the criteria-governed productivity theory predicts, since the putative constraint is held to apply only to the double-object form—and, indeed, a planned comparison of nonpossessive (-1.94) and possessive (0.11) double-object sentences revealed a significant difference, $F(1, 63) = 247.02$, $p < .001$.

| <i>TO-DATIVES</i> | | | |
|---------------------------------------------|------------|---------------|-------|
| PREPOSITIONAL FORMS | | | |
| | Possessive | Nonpossessive | Mean |
| Monosyllabic | 2.73 | 2.83 | 2.78 |
| Polysyllabic | 2.62 | 2.69 | 2.66 |
| Mean | 2.68 | 2.76 | 2.72 |
| DOUBLE-OBJECT FORMS | | | |
| | Possessive | Nonpossessive | Mean |
| Monosyllabic | 0.69 | -2.27 | -0.79 |
| Polysyllabic | -0.23 | -2.33 | -1.28 |
| Mean | 0.23 | -2.30 | -1.04 |
| <i>FOR-DATIVES</i> | | | |
| PREPOSITIONAL FORMS | | | |
| | Possessive | Nonpossessive | Mean |
| Monosyllabic | 2.62 | 2.72 | 2.67 |
| Polysyllabic | 2.75 | 2.83 | 2.79 |
| Mean | 2.69 | 2.77 | 2.73 |
| DOUBLE-OBJECT FORMS | | | |
| | Possessive | Nonpossessive | Mean |
| Monosyllabic | -0.02 | -1.50 | -0.76 |
| Polysyllabic | 0.00 | -1.67 | -0.84 |
| Mean | -0.01 | -1.59 | -0.80 |
| COMBINED <i>TO-</i> AND <i>FOR-</i> DATIVES | | | |
| PREPOSITIONAL FORMS | | | |
| | Possessive | Nonpossessive | Mean |
| Monosyllabic | 2.68 | 2.77 | 2.73 |
| Polysyllabic | 2.69 | 2.76 | 2.72 |
| Mean | 2.68 | 2.77 | 2.72 |
| DOUBLE-OBJECT FORMS | | | |
| | Possessive | Nonpossessive | Mean |
| Monosyllabic | 0.34 | -1.88 | -0.77 |
| Polysyllabic | -0.12 | -2.00 | -1.06 |
| Mean | 0.11 | -1.94 | -0.92 |

TABLE 9. Experiment 1: Mean acceptability ratings for dative forms with different novel verbs.

There was a significant interaction between Preposition and Phonology, $F(1, 63) = 4.11, p < .05$; this interaction reflects the fact that subjects judged monosyllabic verbs as sounding better than polysyllabic verbs when the verbs appeared with the preposition *to* (1.00 versus 0.69), but they showed no preference when the verbs appeared with the preposition *for* (0.96 versus 0.98). Concentrating on those conditions for which the putative criteria are relevant (double-object version of possessive verbs), we can confirm that phonology does have a significant effect for verbs taking *to*: the difference between the ratings for possessive double-object *to*-datives that are monosyllabic (0.69) and those that are polysyllabic (-0.23) is statistically significant: $F(1, 63) = 8.07, p < .01$.

Datives with *to* and with *for* differed in another way, shown in the two-way interaction between Preposition and Semantics, $F(1, 63) = 6.39, p < .02$, and the three-way interaction involving Preposition, Semantics, and Construction, $F(1, 63) = 6.58, p < .02$. These interactions reflect the fact that, whereas all

the prepositional constructions were judged equally acceptable, regardless of condition, for the double-object constructions the difference in acceptability between possessive and nonpossessive sentences is somewhat greater for *to*-datives than it is for *for*-datives. For the *for*-datives, nonetheless, the difference in acceptability between possessive (mean = -0.01) and nonpossessive (mean = -1.59) sentences is statistically significant, $F(1, 63) = 50.43, p < .001$.

Note that the morphophonological constraint applies to the process generating double-object constructions per se, and not just a general preference for short simple verbs across the board. We have shown that the asymmetry disappears when subjects were rating the prepositional forms, though this result is less than conclusive because the prepositional form was the one actually used in the paragraph introducing the verb, resulting in a ceiling effect. But the same conclusion is supported by the results of the ratings of the distractor sentences: differences between monosyllabic and polysyllabic verbs did not affect ratings at all for simple transitive sentences such as *Fred pelled/calimoded a ball* (2.32 versus 2.36).

Subjects showed a sensitivity to the morphophonological constraint only for one of the four verbs presented, the one in which the verb had a transfer of possession as part of its inherent meaning (a hypothetical form of property transfer; see Appendix 1, Paragraph 2), with means of 0.81 versus -0.72, $F(1, 62) = 8.39, p < .01$. The other *to*-dative verb meaning, like both *for*-dative verb meanings, was judged as sounding equally good with both kinds of stems: 0.56 versus 0.25. All three of these phonology-insensitive verbs were denominals conflating possession with the use of some instrument whose name contributed the verb stem: caused motion in a sport using a specific instrument, creation using a specific instrument (a kind of machine), and obtaining using a kind of currency. The possible significance of this limitation will be considered in §6.

In sum, subjects judged double-object sentences which involved a change of possession as being significantly more acceptable than those which did not; and for one verb which inherently involved a change of possession and which took the preposition *to*, subjects judged the sentence with monosyllabic verbs as being significantly more acceptable than that with polysyllabic verbs. Therefore both the semantic and morphophonological constraints on dativizability in English are psychologically real for adult speakers. This establishes the necessary precondition for the hypothesis that adults, when faced with the option of using a verb in the double-object construction for the first time, use these criteria in making their decision, thereby avoiding overgeneration to the extent that the criteria accurately describe the distribution of dativization in the language.

4. EXPERIMENT 2. In Study 1 we found that children occasionally overgeneralize the dative alternation in their spontaneous speech. However, the overgeneralizations were rare and were not made at all by one of the five children. We also found that they obey the morphophonological constraint in a trivial sense: children avoid Latinate-sounding verbs altogether, both in dou-

ble-object and in prepositional-object forms. We do not know, however, whether the children would discriminate between Latinate- and native-sounding verbs in the double-object form if they had the former in their vocabulary. Furthermore, the status of the semantic constraint is unclear for children. They occasionally use the double-object form for pure benefactive, non-possession-change constructions, but that is the only violation we find among the many that are formally possible. Only experimental interventions can shed light on these issues. In the next two experiments we teach children verbs with specific semantic and morphophonological properties in an effort to get converging evidence about how and when children generalize the dative alternation.

An experiment reported in Wilson et al. 1981 served as a pilot for this experiment. In that study, children were taught four verbs that involve the movement of objects and hence can be extended to denote a transfer of possession. Each of the verbs was taught solely in the prepositional form or solely in the double-object form. The question was: would children productively generalize to the form that they had not heard the verb in? Given that children cannot easily be induced to offer judgments of grammaticality, and that comprehension and imitation abilities are not relevant, the study sought to determine whether children were likely to produce double-object sentences with novel verbs. A problem arises: even if children's grammars render them able to do so, they cannot be forced to utter a verb in a specific construction. However, it is possible to exploit pragmatic factors that influence the choice between the two dative constructions in adult speech. When the identity of the theme (i.e. the transferred object) is the current topic of attention and the identity of the goal (i.e. the recipient) is the new and informative piece of information, the prepositional dative is more felicitous (6a); when it is the goal that is currently the topic and the theme that is to be learned about, the double-object dative is more appropriate (6b; see Erteschik-Shir 1979). (In general, 'given' material is better when placed early in the sentence and 'new' material is better at the end.) In 6, '?' indicates a pragmatically suboptimal response (when uttered in neutral intonation).

- (6) a. What did John do with the letter?
 He mailed the letter to Mary.
 ?He mailed Mary the letter.
- b. What did John do to Mary?
 He mailed Mary the letter.
 ?He mailed the letter to Mary.

Wilson et al. tried to use this technique to elicit double-object forms from children. Sixteen 4–6-year-old children were taught nonsense words referring to novel actions, each involving transfer of an object to a recipient using a novel instrument such as a Lazy Susan or a toy clothesline. The experimenter modeled each verb by manipulating three animal toys, showing one sending the second to the third while uttering, for example, 'Look, the lion is dooping the bear to the seal' (if the prepositional form was being modeled), or 'Look, the lion is dooping the seal the bear' (if the double-object form was being

modeled). In the production test the experimenter again acted out a transfer with three new toy animals, and the child was asked to answer questions concerning the event—one focusing on the recipient, intended to elicit a double-object construction (e.g., ‘What did the elephant do with the mouse?’, with the desired answer ‘He dooped the mouse the bird’), and one focusing on the theme, intended to elicit a prepositional-object form (e.g., ‘What did the elephant do with the bird?’, with the desired answer ‘He dooped the bird to the mouse’).

It was found that prepositional forms were uttered most of the time in all conditions, especially in response to the query designed to elicit them, but double-object forms were virtually never uttered, even when the double-object form had been modeled by the experimenter. In fact, even the verb *give*, which was included as a control, was rarely used in a double-object sentence. Thus the technique simply failed to elicit double-object forms of any kind, productive or not. One possible reason is that children did not interpret the actions as examples of a kind of giving, but simply as a kind of motion. Unlike English, many languages do not allow verbs meaning ‘cause an object to move in some manner’ to be extended to mean in addition ‘give an object to someone by causing it to move in some manner’ (Talmy 1985, Levin 1985, Pinker 1989). Children learning English may have to learn that such extended usages of motion verbs (such as *throw*, *toss*, *kick*, and *flip*) exist in the language, and the subjects in Wilson et al.’s study may not have learned that by the time they were tested. If so, and if children reserve the double-object form for changes of possession or benefactive/malefactive relations, they would not readily use other verbs (such as motion verbs) in the double-object construction; in fact, Study 1 showed that children through the age of 6 do not use verbs like *throw* in the double-object form in spontaneous speech, though they use a variety of other kinds of verbs in that form. In fact, they only rarely (11 times) used verbs of manner of motion even in prepositional forms with *to*. (These forms are all moderately rare in parental speech as well: 6 tokens, all prepositional, were recorded from the five sets of adults.)

Given the extreme difficulties in eliciting any double-object forms with verbs of causation of motion in the pilot study reported in Wilson et al. 1981, even with existing verbs like *give*, our goal in our second experiment was to do everything possible to elicit such forms. If children can be motivated to utter any double-object forms with novel verbs, we can then see whether they will do so productively, that is, in cases where the experimenter uses the novel verb only in the prepositional form, never in the double-object form. If they do use such forms productively, it would weaken the strict conservatism hypothesis. Furthermore, if productive usages are elicited, we would be able to see whether they conform to the morphophonological constraint on the double-object dative, a moot question in the Wilson et al. experiment.

4.1. SUBJECTS. Sixteen children participated, all native speakers of American English attending a private school in Cambridge, Massachusetts. Fifteen were between the ages of 6;3 and 8;6, and one was 5;0. The mean age of the 16 children was 7;4 years.

4.2. MATERIALS. Four verb meanings were created, consisting of the causation of the transfer of an object (e.g. a ball) from an operator (i.e. the experimenter or the child) to a recipient (e.g. a toy mouse) using a particular instrument. For example, one of the instruments consisted of a wire strung between two platforms at different heights, with a basket suspended from the wire; the experimenter could put the ball in the basket and slide the basket from the higher platform to the lower platform, where the mouse was positioned. The other instruments consisted of an oddly shaped scoop; a paddle attached to base and side boards, allowing an object to be ricocheted from one position to another; and an enclosed box with removable endplates, allowing an object to slide through as if in a tunnel. The toys used in the experiment were a ball, a boat, an airplane, a car, a wheel, a cupcake, a mouse, a lion, a bear, a bull, a raccoon, a lamb, a turtle, and an elephant.

Corresponding to the four novel actions were four stems, two monosyllabic and two trisyllabic: *moop*, *keat*, *orgulate*, and *calimode*. The combination of meanings and stems into verbs was counterbalanced across children.

4.3. PROCEDURE. Children were tested individually in a separate room at the school. Each child's session was split into four blocks, one for each novel verb, with each block consisting of a teaching phase and an elicited production task involving that verb. At the beginning of each session, the experimenter introduced all of the toys (except the instruments) to the child. The experimenter began each block by introducing the novel stem (e.g., 'Can you say "moop" ?') as well as the recipient to be used (e.g., 'This is an action with a mouse'). The teaching itself consisted of the experimenter uttering the appropriate double-object sentence (e.g., 'I'm mooping the mouse a ball') or prepositional sentence (e.g., 'I'm mooping the ball to the mouse') while performing the corresponding action. The experimenter then repeated the modeling of the form, but with a different transferred object ('I'm mooping the mouse a car' or 'I'm mooping the car to the mouse', respectively).

To elicit double-object forms, the experimenter first performed the appropriate action while asking about the recipient (e.g., 'Can you tell me what I'm doing with the mouse?'). The experimenter then repeated this kind of action and question, but with a different transferred object. To elicit prepositional forms, the experimenter first performed an action while asking about the object transferred (e.g., 'Here's a ball ... can you tell me what I'm doing with the ball?'). Again, the experimenter provided another action involving a different object and elicited a response using the same kind of question. The queries contained the preposition *with* rather than *to*, so as to avoid any superficial resemblance between the query and a prepositional response. (Although the use of *with* in goal-topic queries may have caused some confusion—because the object of *with* is often interpreted as an instrument or moving entity—in practice this did not prevent children from uttering appropriate dative sentences.)

For each verb we also administered a comprehension task in which the child was asked to act out both prepositional and double-object datives. Since both forms were actually uttered by the experimenter, the comprehension task had

to follow the production task for each verb; otherwise the child would have been exposed to the verbs in both constructions and we could not have tested for productive generalizations. In all cases animal toys were used in the comprehension task for recipient and transferred object alike, in order to prevent the child from always choosing an animate toy as the recipient. In acting out a response the child always had the entire pool of toys and gadgets in front of him or her. Each sentence type was given twice, with a new pair of animals named in the second question.

At the end of each session the experimenter gave the production and comprehension tasks once more, using the verb *give* as a control for the efficacy of the methods.

4.4. PRIMING THE PRODUCTION OF DOUBLE-OBJECT FORMS. In light of the difficulty Wilson et al. (1981) had in eliciting double-object forms, we adopted several measures to encourage children to produce them here. The choice of the same recipient in all the production tests, and the constant use of the particular combinations of definite and indefinite articles shown in the examples discussed above, helped make the double-object form a natural response in context. Other manipulations exploit a phenomenon similar to the 'syntactic priming' that has been documented in adults by Bock 1986: when a person is induced to utter a sentence using a particular syntactic construction, it increases the likelihood that he or she will use that construction again in the near future when describing events spontaneously.

First, as a means of making accessible to the child some natural uses of double-object sentences in connection with acts of physical transfer, the experimenter began each child's session by attempting to elicit a double-object form of the verb *pass* (specifically, by having the child utter the sentence that he or she uses in requesting the salt shaker at the dinner table). The experimenter modeled the verb in the double-object form (e.g., 'Pass me the salt') in those cases where the child failed to do so. Furthermore, the experimenter then produced, and asked the child to produce, a double-object form of *pass* (e.g., 'Pass the turtle a cupcake') while performing the corresponding action with a few of the available toys, chosen at random. Second, double-object forms were always taught in the first two blocks, which can be considered as 'priming blocks'. In these cases, the double-object form was modeled not only during the teaching phase of the block, but also during the production testing phase as feedback to the child in those cases where he or she did not utter a double-object form in response to the recipient-topic query. Specifically, if the child responded to the recipient-topic query with something other than a double-object form, the experimenter said, e.g., 'Another way of saying that is "I'm mooping the mouse a ball"'. This made the third and fourth blocks the genuine 'experimental blocks', in which the double-object form was never modeled. Some additional priming, however, was encouraged during these two experimental blocks in those cases where a double-object form was not given in response to the recipient-topic query. Specifically, the experimenter would first ask, 'Do you remember another way of saying that?'; if this prompt elicited

no response, the experimenter would then ask, 'Do you remember the other way of saying that?'. Responses to these follow-up queries were not counted as data; they were only intended to encourage the production of double-object forms in subsequent questions.

4.5. SCORING. In the production test for the experimental blocks, we scored responses to either of the initial queries, before the priming feedback questions were given, as 'double-object forms', 'prepositional forms', or 'incorrect'. A response was counted as a correct double-object form if it included the verb followed by an unambiguous specification (given the context) of the recipient (e.g. *the mouse* or *him*), followed by an unambiguous specification of the transferred object (e.g. *a ball* or *it*). A prepositional response was counted as correct if it included the verb followed by an unambiguous specification of the transferred object (e.g. *a ball* or *it*), followed by an unambiguous specification of the recipient in a *to*-phrase (e.g. *to the mouse* or *to him*). In several instances a child would utter both the double-object and the prepositional form in response to a single query; only the first utterance was scored. Other kinds of responses were scored as incorrect. In the comprehension test, we scored responses to either sentence as 'correct', 'reversed' (where transferred object/theme and recipient/goal were reversed), or 'other'.

4.6. DESIGN. The production test involved a factorial design with the within-subject factors of Construction Modeled (prepositional vs. double-object), Phonology (monosyllabic vs. polysyllabic), Elicitation Query (goal-topic, designed to elicit double-object forms, vs. theme-topic, designed to elicit prepositional forms), and Repetition (first query, in the absence of prior priming feedback, vs. second query, subsequent to possible feedback provided on the basis of the response to the first query). The two dependent variables were the proportion of queries to which children responded with double-object forms and with prepositional forms, respectively. For the comprehension test the within-subject factors were Construction Modeled, Phonology, Sentence Type (double-object vs. prepositional), and Repetition (first sentence vs. second).

Order of teaching of the different verbs and pairing of phonetic forms with meanings were counterbalanced across children. The order in which queries were given in the production task was determined by a desire to minimize the number of switches between the types of construction elicited: in the first two trials, in which double-object forms were modeled and primed, goal-topic queries preceded theme-topic queries; in the experimental trials, theme-topic queries preceded goal-topic queries.

In sum, the experimental procedure was as follows:

Priming with double-object form:

- Model verb in a double-object sentence (twice)
- Elicited production task with goal-topic query (twice)
- Elicited production task with theme-topic query (twice)
- Comprehension task with prepositional dative sentence (twice)
- Comprehension task with double-object sentence (twice)

Testing for productive use of double-object form:

- Model verb in a prepositional dative sentence (twice)
- Elicited production task with theme-topic query (twice)
- Elicited production task with goal-topic query (twice)
- Comprehension task with double-object sentence (twice)
- Comprehension task with prepositional dative sentence (twice)

The toys used as recipients and transferred objects were counterbalanced across children. In addition, the animal toys used in the comprehension test were counterbalanced across children so that, for a given pair of animals named in the query, each animal was the recipient as often as it was the transferred object, and each animal was used only once per comprehension test.

4.7. RESULTS AND DISCUSSION. Results are summarized in Tables 10 and 11. In general, we succeeded in eliciting double-object forms: the children produced the double-object form of *give* in response to 70% of the queries, and 14 children (out of 16) produced at least one double-object form. The children were also able to interpret correctly 100% of the double-object forms with the verb *give* in the comprehension task. The proportion of double-object forms produced was lower for novel verbs modeled in the double-object forms (54%), but still much greater than zero. So we can now ask whether the children also produced double-object forms with verbs they had heard only in the prepositional form. The answer is that they did: when asked a question for which such a double-object form was the most felicitous answer, children produced the double-object form 44% of the time, with 11 out of 16 children uttering such

| DOUBLE-OBJECT FORM MODELED | | | |
|--------------------------------------------------|--------------|--------------|------|
| GOAL-TOPIC QUERY (ELICITING DOUBLE-OBJECT FORM) | | | |
| | Monosyllabic | Polysyllabic | Mean |
| First Repetition | 0.56 | 0.19 | 0.38 |
| Second Repetition | 0.62 | 0.62 | 0.62 |
| Mean Correct: | 0.59 | 0.41 | 0.50 |
| THEME-TOPIC QUERY (ELICITING PREPOSITIONAL FORM) | | | |
| | Monosyllabic | Polysyllabic | Mean |
| First Repetition | 0.50 | 0.69 | 0.59 |
| Second Repetition | 0.56 | 0.56 | 0.56 |
| Mean Correct: | 0.53 | 0.62 | 0.58 |
| PREPOSITIONAL FORM MODELED | | | |
| GOAL-TOPIC QUERY (ELICITING DOUBLE-OBJECT FORM) | | | |
| | Monosyllabic | Polysyllabic | Mean |
| First Repetition | 0.44 | 0.38 | 0.41 |
| Second Repetition | 0.56 | 0.38 | 0.47 |
| Mean Correct: | 0.50 | 0.38 | 0.44 |
| THEME-TOPIC QUERY (ELICITING PREPOSITIONAL FORM) | | | |
| | Monosyllabic | Polysyllabic | Mean |
| First Repetition | 0.19 | 0.12 | 0.16 |
| Second Repetition | 0.19 | 0.19 | 0.19 |
| Mean Correct: | 0.19 | 0.16 | 0.17 |

TABLE 10. Experiment 2: Proportion of trials in which children produced double-object sentences.

| DOUBLE-OBJECT FORM MODELED | | | |
|--------------------------------------------------|--------------|--------------|------|
| GOAL-TOPIC QUERY (ELICITING DOUBLE-OBJECT FORM) | | | |
| | Monosyllabic | Polysyllabic | Mean |
| First Repetition | 0.44 | 0.62 | 0.53 |
| Second Repetition | 0.38 | 0.38 | 0.38 |
| Mean Correct: | 0.41 | 0.50 | 0.45 |
| THEME-TOPIC QUERY (ELICITING PREPOSITIONAL FORM) | | | |
| | Monosyllabic | Polysyllabic | Mean |
| First Repetition | 0.50 | 0.31 | 0.41 |
| Second Repetition | 0.44 | 0.44 | 0.44 |
| Mean Correct: | 0.47 | 0.38 | 0.42 |
| PREPOSITIONAL FORM MODELED | | | |
| GOAL-TOPIC QUERY (ELICITING DOUBLE-OBJECT FORM) | | | |
| | Monosyllabic | Polysyllabic | Mean |
| First Repetition | 0.56 | 0.62 | 0.59 |
| Second Repetition | 0.44 | 0.56 | 0.50 |
| Mean Correct: | 0.50 | 0.59 | 0.55 |
| THEME-TOPIC QUERY (ELICITING PREPOSITIONAL FORM) | | | |
| | Monosyllabic | Polysyllabic | Mean |
| First Repetition | 0.81 | 0.88 | 0.84 |
| Second Repetition | 0.81 | 0.81 | 0.81 |
| Mean Correct: | 0.81 | 0.84 | 0.83 |

TABLE 11. Experiment 2: Proportion of trials in which children produced prepositional dative sentences.

a form at least once. This is a bit less than the proportion of times that we successfully elicited double-object forms when the verb had actually been taught in that construction (50%), and even the familiar verb *give* was only uttered in the double-object form on 72% of the trials in which we elicited it. The frequent production of productive double-object forms occurred not only on the second goal-topic query, following feedback to the first query, but also on the child's first encounter with such questions, at a rate of 41%.

Children were also found to be sensitive to the morphophonological constraint. When double-object forms were elicited by goal-topic questions, children produced them 54.7% of the time for monosyllabic verbs and 39.1% of the time for polysyllabic verbs (collapsing over Construction Modeled and Repetition in Table 10), which is statistically significant in a planned comparison, $F(1, 15) = 4.75, p < .05$. This difference can still be seen when we confine our attention to the first repetition (pre-feedback) of the goal-topic questions: 50% versus 28%, $F(1, 15) = 3.85, p < .07$. Sensitivity to the constraint can be seen both in the cases where the verb had actually been taught in the double-object form and in cases in which it had to be derived from the prepositional form, suggesting that the monosyllabicity constraint acts like a filter on children's double-object forms in general, not just as a filter on the output of a rule generating such forms productively.

Table 10 summarizes the proportion of trials in which children provided double-object forms. An Analysis of Variance reveals a main effect for Construction Modeled, indicating that more double-object forms were elicited when double-object forms were modeled (mean = 0.54) than when prepositional

forms were modeled (mean = 0.30, $F(1, 15) = 6.93$, $p < .02$). This reflects a tendency toward conservatism (also documented in Wilson et al. 1981 and in Pinker et al. 1987), showing that there is a benefit in having a construction modeled (or a cost to deriving it productively) for a given verb. A main effect for the Repetition factor indicated that more double-object forms were elicited in response to the second query (mean = 0.46) than in response to the first query (mean = 0.38, $F(1, 15) = 4.75$, $p < .05$), presumably a consequence of the priming feedback.

An interaction between Construction Modeled and Query, $F(1, 15) = 8.14$, $p < .02$, shows that children were sensitive to the pragmatics of the queries. Specifically, the different kinds of queries had an effect on the frequency of double-object utterances when the prepositional form had been taught and double-object utterances were thus productive (44% for goal-topic questions versus 17.2% for theme-topic questions, $F(1, 15) = 5.77$, $p < .05$), though not when they were nonproductive, i.e. taught (50% versus 57.8%). It appears that the salience of the construction in which the verb was taught overshadowed any pragmatic effects of what was focused in the query. Another two-way interaction, between Phonology and Query, $F(1, 15) = 7.94$, $p < .02$, reflects the fact that children's preference for uttering monosyllabic verbs over polysyllabic verbs in double-object sentences, noted earlier, occurred only when we tried to elicit double-object forms with goal-topic queries; when theme-topic queries were given, children's production of monosyllabic double-object forms dropped to the level of their polysyllabic forms. Finally, there was a significant four-way interaction (Construction Modeled \times Phonology \times Query \times Repetition; $F(1, 15) = 5.40$, $p < .05$).

Table 11 summarizes the proportion of trials in which children produced prepositional dative forms in the same conditions. An Analysis of Variance yields a significant main effect for Construction Modeled, indicating that more prepositional forms were elicited when prepositional forms had been modeled (mean = 0.69) than when double-object forms had been modeled (mean = 0.44, $F(1, 15) = 8.00$, $p < .02$), again revealing children's preference for using verbs in the constructions in which they were taught. There was also a significant two-way interaction between Construction Modeled and Query, $F(1, 15) = 5.60$, $p < .05$, reflecting the fact that more prepositional forms were elicited by the theme-topic query than by the goal-topic query, but only when a prepositional form was modeled (.83 versus .55, $F(1, 15) = 6.36$, $p < .025$), not when a double-object form had been modeled. Note that this is the same kind of interaction that we observed in the production of double-object forms: the different kinds of queries had their anticipated effects only in the last half of the experiment, in which prepositional forms were taught and in which the priming feedback was at a minimum.

In the comprehension task, children were able to act out 86% of the double-object sentences correctly and 95% of the prepositional sentences correctly. Comprehension was good across the board; we found no significant effects in the Analysis of Variance on the proportion of sentences correctly acted out.

In sum, we have succeeded in designing a situation in which children use

the double-object form spontaneously for acts of physical motion, and have discovered that, when they do, they do so for verbs they have never previously heard in the double-object form as well as for verbs that they have heard in that form. This supports the claim that children can be productive in their use of double-object constructions, contrary to the strict conservatism hypothesis. Furthermore, children are (to some extent) sensitive to the morphophonological constraint proposed by Mazurkewich & White 1984, buttressing the claim that learners can be productive in the absence of negative evidence by virtue of respecting constraints on the permissible bounds of productive extension in the language. However, as in Study 1, the productivity we observed occurred against a background of relative conservatism, whereby children generally preferred to stick with the argument structures they heard a verb used in.

5. EXPERIMENT 3. In this experiment we try to observe children using double-object forms in more natural circumstances than those used in Experiment 2; specifically, we avoid the somewhat contrived procedure of explicitly calling to the child's attention the existence of alternative constructions. Instead, we use three methods of making the double-object construction available. First, we eliminate the competing influence of the prepositional form by not using it when teaching the verbs and by not eliciting it. Second, we focus the role of the recipient/goal in a more salient and natural way, by using as the recipient a single toy or, in some conditions, the child himself or herself. Children tend to utter many dative forms with *me* as the recipient, and presumably the child appreciates that an object physically moved over to an entity can be construed as being possessed by that entity if that entity happens to be himself or herself. Third, we strengthen the salience of the double-object form in general by having the child imitate double-object forms (with existing verbs) a number of times before the experimental procedure.

A second goal is to ensure that the manipulations used in Experiment 2 and here do not simply coerce the child into using a metalinguistic game-playing strategy in which he or she would reproduce arbitrary, newly-taught word sequences. We believe that this danger is remote: children's production of double-object sentences in Experiment 2 was sensitive to stem phonology, and the feedback we provided would only undermine such effects because, of the two verbs modeled in the training trials, one was always polysyllabic and the other monosyllabic. But in any case, a more direct test ruling out this potential artifact is desirable. The following reasoning was used. If children's utterances in these experiments do not reflect their linguistic competence, but instead result wholly or substantially from a metalinguistic strategy, we should be able to induce children to utter almost any construction roughly consistent with the grammatical patterns of the language. Accordingly, we primed children with two different forms—the double-object construction, as before, and a distractor form that could be, but is not, an English construction used to communicate transfers of possession. We predict that when children are given equal access to both forms, they should be influenced by the double-object primes but not by the distractor primes in describing events about transfers of possession,

assuming that the priming technique works by making an appropriate existing form more available, rather than by teaching arbitrary strings.

We also implement a rough test of the semantic constraint by systematically varying the animacy of the recipient used in modeling and in testing. Only animate beings can possess something, as can be seen in the contrast *John sent his brother/ *Chicago a package*. Furthermore, the child might construe himself or herself as an even more salient possible possessor, and perhaps even more double-object sentences with the child as postverbal NP would be produced.

5.1. SUBJECTS. Thirty-two children, all native speakers of English, participated. The children fell into two age groups, 16 between the ages of 5;8 and 7;6 (mean 6;11) and 16 between the ages of 7;6 and 8;11 (mean 8;3). Subjects came from a summer day camp at MIT and several day care centers in Cambridge and Somerville, some working-class and some middle-class.

5.2. MATERIALS. Four actions were created, identical to those used in Experiment 2. Corresponding to the four novel actions were four stems, two monosyllabic and two trisyllabic: *norp*, *keat*, *orgulate*, and *calimode*. The combining of actions and stems into verbs was counterbalanced across children. The recipients/goals in this experiment were of three types: the child, one of six possible toy animals (which presumably could be treated by the child as possible possessors), or an inanimate object (a book, a matted 9" × 11" picture, a blackboard eraser, a record, a large candle, or a hand-held mirror). The transferred objects were a ball, a miniature wheel, a whistle, a crayon, a spoon, and a marble.

Besides the double-object form, children were primed with what we will call the *OF-OBJECT FORM* (e.g. *I norped the mouse of a ball*). We chose the preposition *of* because it is fairly neutral semantically, as in the phrase *proud of John*, where its presence serves the purely syntactic function of allowing an adjective to have an NP argument.

5.3. PROCEDURE. The procedure differed from that of Experiment 2 in three ways. First, the preliminary priming/modeling (formerly, of the double-object form of *pass*) was extended to include six double-object sentences instead of two, and the *of*-object pseudoconstruction was modeled for the child in equal numbers. Second, the novel verbs themselves were never modeled in the double-object, *of*-object, or prepositional forms, either in teaching or in feedback. In fact, feedback of any sort was eliminated. Third, there was no comprehension task.

Children were tested individually. Each child's session was split into four blocks, with each trial consisting of a modeling phase and an elicited production task with one of the novel verbs. At the beginning of each session, the experimenter introduced all of the toys (except the instruments of transfer, such as the scoop) to the child. Then the experimenter would transfer a ball from himself to the mouse and simultaneously ask the child, 'Can you tell me, using the word "send" (or "move"), what I'm doing with the mouse?' Regardless of what the child said, the experimenter modeled the form, using the double-object

construction of *send* (*I'm sending the mouse a ball*) or the *of*-object construction for *move* (*I'm moving the mouse of a ball*), and had the child repeat the sentence once. The twelve priming sentences were presented to the subject in alternate groups of three consecutive sentences involving the same construction. For eight of the twelve primes (the first four double-object and *of*-object sentences), the recipient was the child. The recipients in the remaining primes were one animate recipient and one inanimate recipient in each of the two constructions (with order counterbalanced across children). Thus, although the child was exposed to each type of recipient (in direct object position) before the testing began, we emphasized the child's role as recipient.

After this preliminary phase, we taught and tested each of four novel verbs. The experimenter began each block by introducing the novel phonetic form (e.g., 'Can you say "norp"?'). The teaching itself consisted of the experimenter uttering the verb in the syntactically neutral gerund construction ('This is norping') while performing a novel action with the child as recipient. This was repeated.

In the elicited production task the experimenter first drew the child's attention to the intended recipient, by saying 'Are you ready?' when the child was the intended recipient, or 'We'll put the bear here' when a toy was the intended recipient. Then he acted out the verb meaning while asking the child, e.g., 'Can you tell me, using the word "norp", what I'm doing with you?' Note that the double-object and *of*-object responses are equally acceptable answers on pragmatic grounds because each form keeps the same order of arguments, with the 'new' information at the end. All the sentences contained definite noun phrases for the goal argument. In each trial the experimenter posed six goal-topic queries, two consecutive questions for each type of recipient (child, animate, and inanimate; or child, inanimate, and animate, the two orders used with different verbs for each child). The two questions of each type differed in terms of the transferred theme object that was used in the action accompanying the query. The child's first response was recorded, and no feedback was provided.

At the end of each session the experimenter elicited sentences with the verb *give*, using the same procedures.

5.4. SCORING. We scored responses to the queries as 'double-object forms', '*of*-object forms', or 'other'. The criteria were the same as in Experiment 2, extended so that they also defined 'correct' *of*-object responses. In responding to the child-recipient query, e.g., 'Can you tell me, using the word "norp", what I'm doing with you?', several of the children said, for instance, *I'm norping you a ball* instead of *You're norping me a ball*. These responses, in which the children apparently took the perspective of the experimenter, were scored as correct if they otherwise met the criteria.

5.5. DESIGN. The factorial design had the within-subject factors Recipient (child vs. animate vs. inanimate), Phonology (monosyllabic vs. polysyllabic), and Repetition (first vs. second), and the between-subjects factor Age (5;8-7;6 vs. 7;7-8;11). The two dependent variables were the proportion of queries

to which children responded with the double-object form and with the *of*-object form, respectively. The pairing of stems, actions, animate recipients, inanimate recipients, transferred objects, and trial order was counterbalanced across children (within age group). In addition, animate recipients preceded inanimate recipients in testing trials (within child) as often as the converse.

5.6. RESULTS AND DISCUSSION. We succeeded once again in eliciting double-object forms in general: the children produced the double-object form of *give* in response to 78% of the queries (cf. 70% in Experiment 2), and 29 children (out of 32) produced at least one double-object form. More interestingly, children produced unmodeled double-object forms in response to 41% of the queries, with 24 out of 32 children producing at least one double-object form. In contrast, only one child produced *of*-object forms with *give*, and only 4 produced *of*-object forms with the novel verbs, doing so in response to only 4% of the total queries. These findings suggest that the double-object forms uttered in these experiments reflect prior linguistic knowledge and are not the result of ad hoc learning of category sequences in response to experimental demand characteristics. Further support for the interpretation that children were tapping their grammar of double-object constructions comes from the animacy manipulation, where we found that children, as predicted, produced more double-object sentences if the recipient was a possible possessor than if it was an inanimate location (to be discussed below).

It might be objected that the difference between the production of double-object and *of*-object forms is due solely to the avoidance of the *of*-object form because of a conflict between the pseudoconstruction we taught and an existing 'privative' or 'abstrument' meaning (i.e. removing content from a container, as in *John emptied the can of garbage*). However, evidence from spontaneous speech shows that children, at least up to the age of 6;6, are probably not familiar with the genuine privative *of*-object form. In a search of the computer transcripts of the five children in Study 1, we found NO utterances of such *of*-object forms spoken by children or adults. Rather, *of* was used and heard in a heterogeneous set of more or less semantically neutral forms by all five of the children, such as *take one of them*, *see the picture of John*, or *take care of me*. Melissa Bowerman (personal communication, 1988) has pointed out, however, that her daughters Christy and Eva uttered productive sentences with privative *of*-objects at the ages of 8;4 and 4;4, respectively, suggesting that the construction has been mastered. But in Bowerman 1982b, Eva at 4;11 is reported as using an *of*-object incorrectly, and with a role similar to that of our pseudoconstruction: *I don't want it because I spilled it of orange juice* [spilled orange juice on her toast]. Though we cannot prove it conclusively, we believe, then, that the English privative *of*-object form is unlikely to be mastered well enough by children in the ages tested to account for the children's reluctance to be influenced by the priming of the pseudoconstruction in this experiment. (Note, moreover, that even if such a conflict was the cause of the reluctance, it would show that children processed the priming sentences as examples of constructions they were familiar with, as our account requires, rather than as category sequences to be memorized as part of a game.)

Means for the 24 groups within all conditions are presented in Table 12. An Analysis of Variance reveals a main effect for Recipient, $F(2, 60) = 13.61$, $p < .001$, reflecting the fact that more double-object forms were produced when the recipient was the child himself or herself (mean = 0.52) than when the recipient was a toy animal (mean = 0.38), and more were produced for animal recipients than for inanimate recipients (mean = .32). Both of these differences are significant in planned comparisons: for self versus animate, $F(1, 31) = 11.97$, $p < .005$; for animate versus inanimate, $F(1, 31) = 7.95$, $p < .01$. Although some of the increase in the proportion of double-object forms produced when the child was the recipient could be explained by the greater number of priming trials for these forms, the difference between the animate and inanimate conditions cannot be so explained, and therefore must be a manifestation of a sensitivity to the possession constraint on double-object forms. A main effect for Repetition reflects the fact that more double-object forms were elicited after the second query with a given recipient (mean = 0.42) than after the first query (mean = 0.39, $F(1, 30) = 7.71$, $p < .01$).

| | CHILD AS RECIPIENT | | Mean |
|-------------------|---------------------|--------------|------|
| | Monosyllabic | Polysyllabic | |
| 5;8-7;6 | | | |
| First Repetition | 0.50 | 0.50 | 0.50 |
| Second Repetition | 0.59 | 0.56 | 0.58 |
| 7;6-8;11 | | | |
| First Repetition | 0.53 | 0.44 | 0.48 |
| Second Repetition | 0.53 | 0.53 | 0.53 |
| Mean Correct: | 0.54 | 0.51 | 0.52 |
| | ANIMATE RECIPIENT | | |
| | Monosyllabic | Polysyllabic | Mean |
| 5;8-7;6 | | | |
| First Repetition | 0.44 | 0.34 | 0.39 |
| Second Repetition | 0.44 | 0.41 | 0.42 |
| 7;6-8;11 | | | |
| First Repetition | 0.34 | 0.34 | 0.34 |
| Second Repetition | 0.38 | 0.31 | 0.34 |
| Mean Correct: | 0.40 | 0.35 | 0.38 |
| | INANIMATE RECIPIENT | | |
| | Monosyllabic | Polysyllabic | Mean |
| 5;8-7;6 | | | |
| First Repetition | 0.31 | 0.31 | 0.31 |
| Second Repetition | 0.41 | 0.31 | 0.36 |
| 7;6-8;11 | | | |
| First Repetition | 0.41 | 0.22 | 0.31 |
| Second Repetition | 0.34 | 0.25 | 0.30 |
| Mean Correct: | 0.37 | 0.27 | 0.32 |

TABLE 12. Experiment 3: Proportion of trials in which children produced double-object dative sentences.

As in Experiment 2, double-object forms with monosyllabic verbs (mean = 0.43) were produced more often than those with polysyllabic verbs (mean = 0.38). This difference can be seen in the data of both age groups and in all

animacy conditions. However, the effect did not reach statistical significance, $F(1, 30) = 2.10$, $p = .16$.

A fairly large proportion of responses, 55%, fell into the category marked 'other'. Prepositional datives were given in response to 44% of the queries, with 24 children producing at least one such form; this pattern is consistent with the results of Wilson et al. 1981, where prepositional dative forms were frequently used to describe transfers of toys even in circumstances in which the verb had never been used in that form, as long as three-argument sentences were used in the same session. As in Wilson et al. 1981, other locatives (e.g. *You're norping the ball on top of the record*) and simple dyadic transitives were occasionally given in response to the queries (totaling 5% of the responses).

In sum, we have shown that children will use novel verbs in the double-object construction even if they have never heard such combinations before, and they will do so in the absence of such extreme measures as reminding them that certain events can be described in two ways. Furthermore, when children are given equal access to the double-object form and a distractor construction, they often use the double-object form but virtually never use the distractor form in describing events about prospective transfers of possession, suggesting that the experimental paradigm does not force the child to learn ad hoc strings of phrases. Finally, we found that children were more likely to produce a double-object form if the recipient could be construed as animate than if it was inanimate, suggesting that children are sensitive to the possessor constraint on the double-object form by the age of six. Finally, a consistent but nonsignificant effect of phonology in the predicted direction was observed.

6. GENERAL DISCUSSION. In the Introduction, we mentioned three ways in which children might treat argument structure alternations such as the dative. First, they could use a syntactic rule that reassigned the grammatical functions of a verb's argument structure completely productively. As Baker 1979 pointed out, this raises the problem of how they avoid or recover from overgeneralizations to exceptional verbs in the absence of detailed negative evidence. Second, they could be strictly conservative. Third, they could apply a rule productively, but learn constraints on how freely the rule may apply in the language they are acquiring and use these constraints as criteria on which verbs to apply the rule to. We conducted four studies to distinguish between the second and third possibilities. The outcomes of the four studies are consistent with one another, but not perfectly consistent with any of the hypotheses originally considered.

Strict conservatism is false. Children do not invariably use the double-object construction with verbs they have heard in that construction. In spontaneous speech, 4 of the 5 children studied produced double-object forms (22 in all) containing verbs that could not have been heard in the double-object construction in adult speech, and in two experiments children used novel verbs in the double-object form after having heard them only in the prepositional form or in the gerund. However, a weaker version of conservatism is true. In spon-

taneous speech productive uses of verbs in the double-object form constitute a tiny minority of children's usages, both absolutely and relative to verbs that are grammatical in that form, and the vast majority of the verbs that they used in both dative constructions could have been based on forms actually used by the particular adults who interacted with the children. In the experiments, children always used verbs more often in the constructions they heard them used in than in related constructions requiring the application of a rule, and extensive exposure to a construction with other verbs was required to get them to use that construction productively at all.

Criteria-governed productivity is consistent with the data, but only in a very general way. Adults are sensitive to the prospective-possession constraint on the double-object dative, but they are sensitive to the morphophonological constraint only for certain kinds of verbs and only probabilistically. Children were also sensitive to the morphophonological constraint and the semantic constraint in the experiments, but also only in a probabilistic way. In their spontaneous speech errors, children also flout the semantic constraint of prospective possession in a strict sense by using benefactive/malefactive double-object forms. Thus criteria-governed productivity falls short as a solution to Baker's paradox at both ends: children are not as productive within the confines of the constraints as the hypothesis would lead one to expect, and they do not invariably confine themselves within the bounds of the putative adult rule. Therefore Baker's paradox reappears as we try to explain what would impel children to add constraints to their dative rule that make it more selective with respect to verbs in the absence of negative evidence.

Other errors from children's speech raise an even more embarrassing question for criteria-governed productivity. A frequent kind of childhood error is *Don't say me that*. But why is it an error in the adult language to begin with? Any criterion on dativization that would allow *Don't tell me that*, presumably as a metaphorical extension of the notion of transfer of possession applied to ideas, should also allow *say* to dativize, but it does not. And *say* is not the only 'negative exception' to the semantic constraint on the dative:

- (7) a. *John pulled Bill the box. (cf. John threw Bill the box.)
- b. *Sam shouted John the story. (cf. Sam told John the story.)
- c. *Becky credited Bill the money. (cf. Becky promised Bill the money.)
- d. *Irv chose her a dress. (cf. Irv found her a dress.)

Negative exceptions to semantic constraints—verbs that should be permitted to alternate, but do not—bring back Baker's paradox, since they would require negative evidence to be avoided or unlearned (see Bowerman 1987a). (Positive exceptions—verbs that should not be permitted to alternate, but do, such as *Dr. Schmidt referred me a patient*—are more benign, because they could be learned through positive evidence, as long as they are not so numerous that they cause the child to abandon the constraint altogether.)

A final problem with criteria-governed productivity as a solution to Baker's paradox, expressed by Fodor 1985, is more theoretical. Why would a rule like

the dative be constrained by prospective possession and native morphophonology to begin with? An unconstrained rule would confer more expressive power on the speaker and be simpler to learn and represent. It seems puzzling that adults possess an arbitrarily constrained dative rule, and that children, who appear to have a less constrained version of it, are impelled to complicate the rule. It is also unclear how they succeed at finding these constraints, given that negative evidence is unavailable and positive evidence for the constraints is quite subtle: just because a child has not heard a verb alternate, he cannot conclude that the verb is forbidden to alternate in the language; the parent may simply not have used that verb in both constructions in the presence of the child.

In sum, past theoretical proposals do not leave us with a way of reconciling the data from the studies with the learnability paradox that Baker pointed out. The child is neither strictly conservative nor fully productive within constraints that delineate the boundaries of the alternation in the adult state. Furthermore, it is unclear whether perfectly predictive constraints exist or, if they do, why they take the form they do, and how they are learned.

In the rest of this paper we present a theory which incorporates the criteria-governed productivity hypothesis and which attempts to answer these questions and explain the data obtained in the studies reported in this paper. The theory, which combines Green's 1974 analysis of the dative with Rappaport & Levin's 1985 analysis of the lexical rule for the locative alternation, is presented in depth in Pinker 1989 (see also Pinker et al. 1987). The theory attempts to answer three questions: why are lexical rules constrained? What are the constraints? How do children learn them? We begin with a discussion of the semantic constraints; the morphophonological constraint will be discussed in §6.4.

6.1. WHY ARE RULES THAT CHANGE ARGUMENT STRUCTURE SEMANTICALLY CONSTRAINED? Semantic criteria on lexical rules are puzzling because there is no clear reason why a syntactic operation should be constrained by an arbitrary semantic condition. But what if the dative rule were an operation changing semantic structure? Then its sensitivity to semantic conditions would be natural. We have been assuming that the dative rule maps between a $V-NP_{\text{theme-to-NP}_{\text{goal}}}$ structure and a $V-NP_{\text{goal}}-NP_{\text{theme}}$ structure. But let's say that each of these structures is decomposed into two parts, a semantic structure and a syntactic argument structure. The semantic structure (which Pinker et al. 1987 called the 'thematic core' of the argument structure) for the prepositional dative would be 'X causes Y to go to Z'. Its syntactic argument structure (containing specifications for a subject, object, and oblique object marked by the preposition *to*) would not be arbitrarily paired with it, but would be predictable from universal 'linking rules'. Specifically, a causal agent argument would be linked to subject, a causee or patient argument would be linked to object, and an argument of a path-function or place-function (such as 'to') would be linked to an oblique object. (See Gropen 1989, Gropen et al. 1989, and Pinker 1989 for reviews of evidence about linking rules.)

The double-object dative construction would also consist of a semantic or thematic core structure and a syntactic argument structure projected from it by linking rules. The thematic core would be 'X causes Z to have Y'. The syntactic argument structure would have a subject linked to the causal agent, as in the prepositional argument structure, but since the causally affected argument is now the possessor rather than the transferred thing, the linking rule for objects would map the possessor, rather than the transferred thing, to the syntactic object role. There is no path-function in this thematic core, so the linking rule for oblique objects would not apply; instead, a fourth kind of linking rule maps the possession onto the second-object role.

Now the dative rule can be seen as an operation that converts one of these lexicosemantic structures into the other. It takes as input the structure 'X causes Y to go to Z', and produces as output the structure 'X causes Z to have Y'. In a sense, it is like a conceptual gestalt shift, from construing an event as causing a thing to change location to construing it as causing a person to change his possessions. No syntactic information need be mentioned, because both the prepositional and the double-object argument structures are completely predictable from the respective semantic structures via the application of the linking rules. And as an operation on semantic structure, the dative rule can interact with the INHERENT semantic structures of the verbs it applies to. Since the output of the dative rule inherently specifies a possessor-possession relation, verbs whose meanings are not cognitively compatible with the notion of a possession change will not yield a cohesive semantic structure that would serve as the basis for a double-object form. For example, **I drove Chicago the car* would be malformed because it would require a semantic structure corresponding to 'causing Chicago to possess the car', which is nonsense if only people can be possessors. Likewise, **I drove Mary the car* (from *I drove the car for Mary*) is ruled out while *I bought Mary the car* is permitted, because buying, but not driving, is a form of causing to possess. Thus, in this account the syntactic change and semantic constraints of the dative rule are consequences of a single operation.

There is independent evidence that the semantic structures underlying prepositional and double-object dative forms are different, and that the dative rule changes one into the other. We have already seen that the prepositional form is compatible with events that the double-object form is not compatible with—events where a thing goes to something but no one comes to possess anything, as in *John drove the car to Chicago*. Green 1974 points out that the converse is also true. The double-object form is compatible with events that the prepositional form is not compatible with—events where a person changes his possession of something, but nothing goes to anything. One kind of example comes from idioms like *Mary's behavior gave John an idea*. John is caused to have an idea as a result of Mary's behavior, but the idea did not 'go' from Mary or her behavior to John. Mary's behavior never had the idea to begin with; the idea sprang from within John. Thus **?Mary's behavior gave an idea to John* sounds odd. Another kind of example comes from verbs of 'future not having'. In sentences like the following, there is a threat or intention of someone's losing

possession of a thing, but since the thing does not 'go to' the possessor, the prepositional form is ruled out.

- (8) a. Alex bet Leon \$600 that the Red Sox would lose.
 *Alex bet \$600 to Leon that the Red Sox would lose.
 b. That remark might cost you your job.
 *That remark might cost your job to you.
 c. Please spare me your sarcasm.
 *Please spare your sarcasm to me.
 d. Carolyn envied her her good looks.
 *Carolyn envied her good looks to her.
 e. The bank charged me \$25.
 *The bank charged \$25 to me.

Furthermore, if the dative rule changes the semantic structure of a verb, then the interpretation of a sentence should be able to change when the verb dativizes: whereas the prepositional form specifies motion (literal or metaphorical) towards a goal, the double-object form specifies actual causation of possession. We have already seen in 4 that the verb *send* in the prepositional form is ambiguous between sending to a location or sending to a person, whereas in the double-object form it can only mean sending to a person. Green 1974 also notes that there is a difference between *She taught French to the students*, which does not imply that the students learned anything, and *She taught the students French*, which implies that they learned French. Similarly, *I threw the ball to John* can mean that John is merely the spatial target (possibly asleep), analogous to *I threw the ball to the target*, but *I threw John the ball* entails that he was meant to receive it and invites the inference that he did. Thus *Jim threw the catcher the ball, but a bird got in the way* sounds somewhat self-contradictory (Oehrle & Ross 1975). Similarly, it would be odd to say *I told John the news* if he were deaf or dead, whereas *I told the news to John* may be a bit less anomalous in those circumstances.

Thus, viewing the dative as an operation on lexicosemantic structure, changing 'cause Y to go to Z' to 'cause Z to have Y', solves four problems at once. It explains why different arguments get mapped onto the syntactic surface object position in the two constructions; it explains why the interpretation of a single verb can change when it undergoes the alternation; it explains why verbs which take the prepositional dative form and are incompatible with causation of change of possession cannot be transformed into taking the double-object form; and, symmetrically, it explains why certain verbs can only exist in the double-object form. The criterion is no longer an ad hoc addition to a rule, but falls out of the very nature of the rule itself.

6.2. WHAT ARE THE CONSTRAINTS ON THE DATIVE RULE? Although we have an explanation as to WHY the dative rule is confined to verbs implying causation of change of possession, it is not clear how such a constraint could rule out the negative exceptions listed in 7, since all of them would appear to be cognitively compatible with causation of possession change. The basic problem is

that we do not have a precise specification of what it means for a verb to be 'compatible' with 'causation of a change of possession'. Human cognition is flexible enough that almost any event *COULD* be construed as involving a possession change. But languages seem to be more restrictive than that.

Let's say that the dative rule actually works at two levels. We will call the general operation on thematic structure discussed in the previous section the 'broad-range' dative rule. Crucially, a broad-range rule is a property-predicting regularity, not an existence-predicting regularity (see Aronoff 1983, Fodor 1985). That is, the broad-range dative rule dictates the kinds of properties that a double-object form must have if it exists. Specifically, it must be cognitively compatible with causation of change of possession; this is a *NECESSARY* condition on such forms. However, it is not a *SUFFICIENT* condition; there are verbs that are cognitively compatible with causation of possession change that *COULD* exist in the double-object form, according to the rule, but *DO NOT IN FACT* exist in that form. Let's say that each speaker also possesses a set of 'narrow-range' dative rules. Each narrow-range rule incorporates some version of the semantic operation of the broad-range rule, but applies only to narrow sets of verbs with similar kinds of meanings, which we will call 'narrow conflation classes'. The narrow-range rules are existence-predicting; if a verb falls into a conflation class that a narrow-range rule applies to, it automatically gets assigned a double-object structure. In a sense, narrow-range rules, which are in part conventionalized structures varying from language to language and dialect to dialect, tell a speaker what kinds of events, among those that are potentially cognitively construable as involving causation of possession change, are licensed by the language to be construed in that way for the purposes of rule application.

Formulating a set of narrow conflation classes to which narrow-range dative rules apply allows one to account for the subtle patterns of dativizability that the simple 'prospective possessor' constraint misses. It is important to note that what differentiates the subclasses of verbs with different syntactic privileges is not the general kinds of events they refer to, represented in conceptual scripts or stereotypes such as those for acts of 'physical transfer' or of 'communication'. Rather, it is the specific aspects of events that verbs are selective about—that precisely define the kinds of situations that the verb could truthfully describe—that count in delineating the classes. The principal subclasses of verbs that have narrow-range dative rules applying to them are as follows (see also Green 1974, Pinker 1989):

- i. Verbs that inherently signify acts of giving, e.g. *give, pass, hand, sell, pay, trade, lend, loan, serve, feed*.
- ii. Verbs of instantaneous causation of ballistic motion, e.g. *throw, toss, flip, slap, kick, poke, fling, shoot, blast*.
- iii. Verbs of sending, e.g. *send, mail, ship*.
- iv. Verbs of continuous causation of accompanied motion in a deictically-specified direction: *bring* (i.e. 'cause to go to here'), *take* (i.e. 'cause to go away from here'; see Miller & Johnson-Laird 1976).
- v. Verbs of future having (commitments that a person will have some-

- thing at some later point); e.g. *offer, promise, bequeath, leave, refer, forward, allocate, guarantee, allot, assign, allow, advance, award, reserve, grant.*
- vi. Verbs of type of communicated message (differentiated by something like 'illocutionary force') e.g. *tell, show, ask, teach, pose, write, spin, read, quote, cite.*
- vii. Verbs of instrument of communication, e.g. *radio, E-mail, telegraph, wire, telephone, netmail, fax.*
- viii. Verbs of creation, e.g. *bake, make, build, cook, sew, knit, toss* (when a salad results), *fix* (when dinner results), *pour* (when a drink results).
- ix. Verbs of obtaining, e.g. *get, buy, find, steal, order, win, earn, grab.*

Note that there are subclasses of verbs that pertain to the same general kinds of events but that pick out different aspects of it and fail to dative:

- i. Verbs of fulfilling (X gives something to Y that Y deserves, needs, or is worthy of): *?I presented him the award; *I credited his account the amount of the check; *I credited him the discovery; *Bill entrusted/trusted him the sacred chalice; ?I supplied them a bag of groceries.* These verbs are all fully acceptable only if the preposition *with* is used to mark the theme.
- ii. Verbs of continuous causation of accompanied motion in some manner: *I pulled the box to John/*pulled John the box; also carry, push, schlep, lift, lower, haul.*
- iii. Verbs of manner of speaking: **John shouted/screamed/murmured/whispered/shrieked/yodeled/yelled/bellowed/grunted/barked Bill the news.*
- iv. Verbs of communication of propositions and propositional attitudes: **I said/asserted/questioned/claimed/thought aloud about/doubted her something.*
- v. Verbs of choosing: **I chose/picked/selected/favored/indicated/preferred/designated her a dress.*

Is there a motivation or rationale to explain why certain narrow conflation classes are dative and others are not? For verbs of giving, where change of possession is inherent to the meaning of the verb, the answer is obvious. More generally, since the double-object dative involves an actor acting on a recipient causing him to possess something (as opposed to acting on an object causing it to go into someone's possession), we would expect that verb subclasses which suggest that the action inherently involves the possessor as causee in some direct fashion would be more likely to enjoy dative. Since *throw to X* verbs involve aiming in the direction of the receiver concurrently with causing the motion, whereas the action in *pull to X* verbs can be initiated without having the receiver in mind and can have an ever-changing goal throughout its duration, there is a sense in which the receiver is more naturally construed as a causee of the action for *throw* than as the causee of the action of *pull*. So if we knew only that one of the two classes was dative, we

could predict that it would be the *throw*-class. Similarly, when one asks a question, what makes it *asking* is how a hypothetical listener is supposed to react to it, but when one shouts a question, what makes it *shouting* has nothing to do with a listener and can be defined in terms of the physical properties of the behavior of the speaker alone. Therefore it is not surprising that type-of-illocutionary-message verbs but not manner-of-speaking verbs dativize. In other words, the point in the semantic landscape where the productive lines are drawn is not completely arbitrary on cognitive grounds.

However, it is not necessary to claim that all speakers grasp this rationale—they needn't do so to apply the alternation properly—or to claim that there is a linguistic constraint which pre-establishes that the dative alternation cannot apply to verbs of manner of speaking (it would not be surprising if there were languages or even dialects of English in which one could say *John whispered him the story*.) Instead, it could simply be that the historical processes which cause lexical rules to be defined over some subclasses but not others seem to favor the addition or retention of narrow classes of verbs whose meanings exemplify or echo the semantic structure created by the rule most clearly. The full motivation for the dativizability of a narrow class may come from the psychology of the first speakers creative enough or liberal enough to extend the dative to an item in a new class, since such speakers are unlikely to make such extensions at random. Thereafter speakers may add that narrow class to the list of dativizable classes with varying degrees of attention to the motivation provided by the broad-range rule—by recording that possibility as a brute memorized fact, by grasping its motivation with the aid of a stroke of insight recapitulating that of the original coiners, or by depending on some intermediate degree of appreciation of the rationale to learn its components efficiently, depending on the speaker and the narrow class involved.

In sum, broad-range rules are property-predicting operations on core semantic structures which establish necessary conditions for verbs to undergo an alternation and which motivate narrow classes of verbs that do. The speaker's actual decision as to whether the dative rule can be applied to predict the existence of a given verb in the double-object construction, however, is made by referring directly to these narrow classes, which are delineated by confluences of semantic elements listed in the verb's lexicosemantic structure.

6.3. HOW DO CHILDREN LEARN CONSTRAINTS ON RULES? There are two kinds of constraints on the dative rule: the broad-range constraint that the double-object form involves causation of change of possession, and the narrow-range constraints that restrict actual dativization to subclasses of verbs with similar meaning structures. Fortunately for any theory of how these rules are learned, both kinds of constraints are inherent to structures that must be acquired anyway, and the child need not search through a large space of possible constraints in an attempt to find one that matches the complex data available.

Constraints on broad-range rules are inherent to the nature of broad-range rules themselves, which are operations on semantic structure whose effects on syntactic argument structure are mediated by linking rules. Assume that the

child possesses linking rules by the time he or she tries to formulate the broad-range rules (the linking rules appear to be near-universal, so they may be innate or very easily learned; see Pinker 1989). Say the child possesses a set of lexical entries, acquired conservatively from the input, some of them in both double-object and prepositional forms. The child could then observe the syntactic and semantic properties of the alternating verbs and formulate a semantic operation that was jointly consistent with the existing entries and with the linking rules. In the case of the dative, the fact that the recipient is the syntactic first object in the double-object form means that it should be a causee in the semantic structure underlying it (running the 'causee \rightarrow object' linking rule backwards). The existence of a second syntactic object strongly implies that the verb refers to possession in a broad sense (Dryer 1986, Pinker 1989), and a look at what is common to the meanings of all the verbs that were heard in both forms of the dative would confirm that the recipient is a causee of a possession change. Many complex issues in this learning process are discussed further in Gropen 1989 and Pinker 1989; for now it is sufficient to note that if the child is built to formulate lexical rules as operations on lexicosemantic structure that are projected onto syntactic argument structure, the semantic constraint of possession-change is a necessary property of the broad-range dative rule that he or she will be forced to posit from the very start.

Narrow-range rules could be acquired by a procedure that was weakly conservative in the following sense: the only verbs that would be allowed to undergo a lexical rule freely are those verbs that have actually been heard to undergo that alternation, or verbs that are semantically similar to them. A narrow conflation class would simply be the set of verbs that are similar to a verb heard to alternate. A narrow-range dative rule would be a version of the dative rule confined to this class of similar verbs. Crucially, 'similarity' would be defined as follows. Verbs' meanings would be representational structures composed of two kinds of elements. 'Grammatically-relevant' semantic elements would come from a pool of special semantic features which are common across verbs within and across languages, and which also appear in closed-class morphemes in various languages. They would include the notions 'go', 'be', 'have', 'act', kinds of places and paths, temporal/aspectual properties such as event versus state, manner, and kinds of causal relations such as 'cause', 'let', 'prevent', and 'means' (see Talmy 1985, Jackendoff 1983, Pinker 1989). 'Idiosyncratic' semantic elements would come from a much larger pool of conceptual features pertaining to specific properties of things and manners. Thus, in the verb *to butter* the elements 'cause to go on' would be in the grammatically-relevant set, and the element 'butterlike' would be in the idiosyncratic set. This provides a possible definition of 'semantic similarity' and 'narrow class'. Verbs are semantically similar if they share most or all of their grammatically-relevant semantic structure, while being permitted to differ arbitrarily in their idiosyncratic semantic structure.

Thus definitions of narrow-range conflation classes of verbs are formed by taking the basic semantic structure of a verb in the class and substituting a variable in all of the slots filled by idiosyncratic elements. Every alternating

verb therefore implicitly defines a narrow-range rule; the complexity and specificity of the rule simply mirrors the complexity and specificity of the grammatically-relevant portion of the verb's meaning, which the child must learn anyway in order to know how to use the verb. In the case of the dative, the child, upon hearing *throw the ball to me* and *throw me the ball*, would convert the part of the definition of *throw* that pertained to the exact way in which the arm is moved into a variable standing for any manner of motion, but would preserve the part that pertained to instantaneous causation of motion (in some manner). Generalization of the dative to *kick* would be automatic, but generalization of the dative to *pull* would not be licensed.

6.4. THE MORPHOPHONOLOGICAL CONSTRAINT. To explain the existence and acquisition of the morphophonological constraint, we need only add that when the child hears a verb alternate and formulates a narrow-range rule based on it, he or she not only reproduces the grammatically-relevant semantic structure of the alternating verb, but also its significant morphophonological properties. If a set contains alternating verbs that are all in the native class, the narrow-range rule formed from them will be restricted to the native class. If a set of alternating verbs is morphophonologically heterogeneous, the narrow-range rule will not be morphophonologically constrained. This is a simple extension of the weak conservatism hypothesis: the child restricts the dative rule to verbs that are semantically AND morphophonologically similar to those that have been heard to alternate.

This account correctly predicts that the morphophonological constraint could apply to some semantic subclasses but not others. Of the ten subclasses of dativizable verbs discussed in the preceding section, five are clearly subject to the morphophonological constraint: giving (**donate/*contribute him some money*), type of communication (**explain/*report/*announce him the news*), sending (*ship/*transport him the goods*), creation (**construct/*design/*create him a house*), and obtaining (**purchase/*obtain/*collect him some food*). One class is not subject to it, the verbs of future having: *assign/allot/guarantee/bequeath him four tickets; Can you prescribe me some Valium?* Two others (*bring/take* and ballistic motion) seem to consist entirely of native verbs; it is not clear whether there are any Latinate verbs in the class that would allow a test of whether the constraint holds. Finally, the class of instrument of communication verbs (*E-mail/radio/arkanet him a message*) includes polysyllabic and Latinate stems, but each of them is probably classified independently of the Latinate/native distinction as a special kind of complex stem having a noun or name as its root. This third kind of morphological representation would also embrace a subclass of verbs of creation which name specific instruments and which seem to escape the restriction to native-sounding stems (e.g. *I xeroxed/thermofaxed/nroff'd him a copy*), without licensing Latinate verbs of creation in general. (In many other areas of morphology, tacit knowledge that a word's stem is from another category gives it a special status regarding the rules that apply to it: *The defenseman of the Toronto Maple Leafs/*Leaves high-sticked/*high-stuck the goalie*. See Pinker & Prince 1988.)

The non-independence of the semantic and morphophonological constraints suggests solutions to two puzzles concerning the results of Experiment 1. First, how can the morphophonological constraint on the dative be psychologically real but at the same time be so ridden with exceptions? (See Green 1974, Randall 1987, Fodor 1985.) The answer is that the constraint, when properly formulated so as to apply to some semantic subclasses but not others, may not have exceptions after all. Second, why were subjects only sensitive to the constraint for one of the four nonce verbs we tested? Recall that the three verbs that did not elicit sensitivity to the constraint had stems derived from instruments—a sports implement used to cause ballistic motion, a machine used to create something, and a currency used to obtain something—whereas the verb that did occasion use of the constraint referred to a legal process of giving with no instrument mentioned. This seems to show that subjects were sensitive to the pattern in English according to which verbs that are transparently derived from namelike nouns seem to escape the binary native/Latinate dichotomy and can dativize regardless of their prosodic properties.

The process of acquiring the morphophonological constraints raises three questions. First, why are the narrow-range dative rules potentially sensitive to morphophonological properties of stems to begin with? A possible answer is that rules that change argument structure are inherently rules in the morphological or lexical component of the language, formally capable of affecting both the semantic structure and the morphological structure of a verb. For example, the passive in English and dative rules in other languages (Foley & Van Valin 1985) add an affix to the verb. Rules that effect morphological changes can be sensitive to the morphophonological properties of the words they apply to. Thus the English dative rule, though it has no actual morphological operation, is formally a kind of rule that can have morphological operations, and therefore it can be sensitive to salient morphological subclasses in the vocabulary of the language.

Second, why is the native/Latinate distinction salient to children learning the dative classes in English? For one thing, the constraint is not ad hoc to the dative: many morphology-related operations in English respect some version of it (Aronoff 1976, Chomsky & Halle 1968, Pinker 1989). For example, the comparative suffix *-er* attaches preferentially to native adjectives (*nice/nicer, intelligent/*intelligenter*), and the negative prefix *in-/il-/im-/ir-* attaches only to Latinate adjectives (*illiterate/*illucky*). At least two other studies (Baldi et al. 1985, Randall 1980) have shown that adults are sensitive to the native/Latinate distinction when making judgments about novel combinations of stems and prefixes. But why is it so salient to begin with? Note that, compared to native verbs, Latinate verbs are lower in frequency, longer, more specialized, and more frequently used in formal prose. Thus the distinction may correspond to a psycholinguistic discrimination between words that are felt to be basic, minimal, natural, and inherent to English and those that are felt to be complex, foreign, special, or learned. It could be that the native/Latinate distinction is a special case of a basic/nonbasic distinction which is salient in many languages,

marked with characteristic phonological properties, and which affects the application of morphological rules (see McCarthy & Prince 1989).¹

A third question is: why in fact are the dativizable verbs—in particular, the verbs of giving, telling, obtaining, and creation—subject to the native constraint in English? The developmental data from Study 1 suggest an answer. Recall that in parental speech virtually no Latinate dative verbs were used at all, even in the prepositional form where they are grammatically permitted. Parents use the native vocabulary when talking to their children because it contains simpler and more common words. But this statistical phenomenon has an interesting consequence: even if English didn't have a morphophonological constraint on the dative, children would think that it did if they were looking for one. And strikingly, the subclasses that don't obey the constraint in adult English (the *bequeath/guarantee*-class, the *arpanet*-class, perhaps even the *throw*-class) were virtually absent from the children's and adults' dative forms; presumably they are learned later in life when long nonnative words are common.

6.5. COMBINING THE DEVELOPMENTAL DATA WITH THE LEARNING THEORY. Now that we have presented a theory that can help explain why the dative rule is constrained semantically and morphophonologically, what those constraints are, and how they are learned, we have a potential solution to Baker's paradox, combining aspects of criteria-governed productivity and (weak) conservatism. In this final section we support this theory of the learnability problem with the developmental data.

First, we observed that conservative usage of prepositional and double-object forms precedes the productive application of a dative rule to new verbs that could not have been learned from the input. This pattern, familiar from Bowerman's studies (1982a, b) of the acquisition of the causative and locative alternations, supports the claim that the child acquires the dative rule at least in part by examining properties of prior independently-acquired argument structures associated with particular stems.

Second, we found that the child's use of the dative rule appears to follow broad-range constraints pertaining to causation of possession at all stages. In Experiment 3, the effect of type of recipient on frequency of productive double-object utterances could be seen in the younger age group, whose means were 54%, 40%, and 34% for self, animate goal, and inanimate goal, respectively; and the size of the effect was no larger in the older age group, whose means were 51%, 34%, and 30%. In Study 1 we saw that children never apply the dative rule to structures that are similar to dativizable verbs only in surface form but not in semantic structure; they do not make errors such as *He drove the garage the car* or *I found the garbage can the lid*. The use of the double-object form for benefactive/malefactive relations may appear to be a counterexample, but these relations are probably metaphoric extensions of possession:

¹ Sarah Thomason (personal communication, 1989) has pointed out to us that the nonbasicness of the Latinate vocabulary in English is consistent with a general tendency across languages for borrowed words to be less basic.

to benefit someone is to give him something (a physical gift or just an advantage or benefit), to disadvantage someone is to deprive him of something (see Green 1974 and Pinker 1989 for evidence from English and other languages). If children find this metaphoric extension natural (and there is evidence that they naturally extend physical locutions to abstract metaphoric domains; see Bowerman 1978), then even the benefactive/malefactive usages may conform to the broad-range constraint on the double-object form.

Interestingly, early and consistent adherence to the possession-change constraint is not consistent with the hypothesis of Mazurkewich & White 1984 and Pinker 1984, according to which children should first go through a stage in which they apply the dative rule as a pure syntactic operation before appending constraints to it. However, it is consistent with the theory described here; in fact, it is virtually demanded by the theory, because the dative rule is inherently an operation on lexicosemantic structure, not an operation on syntactic structure with semantic constraints tacked on.

Third, we found that, while children can be productive, their background tendency is one of conservatism. Most dative forms in their speech mirrored forms their parents used; getting them to utter dative forms in the experiments required special measures, including extensive exposure to similar verbs in the targeted dative construction. Since the acquisition of narrow-range rules requires learners to stick closely either to verbs they have heard alternate or to verbs that are semantically and morphologically similar to them, a strong tendency toward conservatism is what the new theory would predict. In this regard, our choice of verbs of manner and instrument of motion in the experiments on productive dativization was, in hindsight, ill-advised. The children in Study 1 did not use a single verb of manner of motion in the double-object form in their spontaneous speech; in fact, for one subclass of these verbs (continuous causation of accompanied motion), the verbs do not even dativize in the adult language. The theory proposed here would therefore predict that children at these ages should not easily dativize them, or should dativize them only with extensive evidence that some verbs within that narrow semantic subclass exist in the double-object form in adult speech. This is exactly what we found.

Finally, one must ask why children overgeneralize at all, and how they progress to an adult state at which only correct narrow-range rules are used and overgeneralization errors based on broad-range rules never appear. This question has two answers. First, children's verb meanings are not perfect; indeed, there is evidence that adultlike verb meanings are often acquired quite slowly (Gentner 1975, 1978, 1982; Bowerman 1978). Incorrect verb meanings combined with correct rules would lead to syntactic errors according to the theory, and as verb meanings are refined these syntactic errors should disappear. Thus errors such as *Put Eva the yukky one* or *Write me a snowman* would disappear as the child learned that *put* does not mean *give* and *write* does not mean *draw*. See Pinker 1989, Gropen 1989, and Gropen et al. 1989 for discussion and evidence.

The second and more general answer is that in most cases children do not differ from adults after all. The simplest assumption is that children develop

broad-range and narrow-range rules in parallel, the former property-predicting, the latter existence-predicting. However, we have noticed that, in adults, broad-range rules are occasionally used in an existence-predicting mode, resulting in the creation of innovative, ungrammatical dative forms. We have reproduced in Table 13 a number of forms of this type that we have observed in adults' speech and writing.

- I. Violations of the morphophonological constraint:
- a. Sun donated them a bunch of computers.
 - b. What do they want me to do—donate them blood?
 - c. I returned her the books.
 - d. I explained him the problem.
 - e. Can you explain me language breakdown?
 - f. An intriguing down side to the three-hour ceremonies ... was the snub extended Michael Jackson.
 - g. I just want to schedule you some appointments.
 - h. I'll suggest her that she come over.
 - i. Information Systems will reimburse you the difference.
 - j. The most precious gift a father could bestow a son. (TV advertisement for a car)
- II. Violations of semantic constraints:
- a. Can you reach me that book?
 - b. Will you reach me my socks for me? Reach me my socks.
 - c. It will add the grant a little legitimacy. (a letter of support)
 - d. Even if he dribbles me in one subject a year ...
 - e. Mr. [] was made no bones about the fact that ...
 - f. When you go I'm going to preach you a great funeral.
 - g. I put you out a big piece.
 - h. Fix me up a handle.
 - i. She didn't have to snap me about it.
 - j. The next time you make eyes at someone, make them eyes they'll find unforgettable. (magazine advertisement for colored contact lenses)
 - k. He stripped him the ball. (basketball play-by-play)
 - l. We'll credit you back the full purchase price.
 - m. If you'll indulge me just two in-jokes.
 - n. She demonstrated fine teaching abilities in training other students the complex procedures and complex equipment we use in our lab.
 - o. The uses of such a program are myriad and include use as a compositional device and as a method for individually tutoring students musical improvisation.

TABLE 13. Ungrammatical datives in adult speech and writing.

These examples all obey the possession-change constraint, at least in extended senses of possession, but they fall outside of the narrow-range constraints on the dative rule (morphophonological for the first set of examples, semantic or both semantic and morphophonological for the second set). They should not be taken as evidence that these constraints are false (although a few of the usages could have been from speakers of dialects in which they are fully grammatical): these sentences sound deviant to most speakers of standard American English, including some of the speakers who produced them—who, we found, cringed when confronted with these errors at later dates. Nor are they conventional slips of the tongue (e.g. Spoonerisms): many are from written

sources, and none was self-corrected. We suggest that these utterances represent one-shot innovative usages of a broad-range dative rule (or, for examples for which the prepositional form itself would be ungrammatical, innovative insertions of a nondative verb into the broad conflation class underlying the double-object structure). They are perceived as semigrammatical because they conform to the broad semantic conflation implicated in the broad-range rule while not conforming to any of the narrow semantic conflations defining the narrow-range rules. More specifically, these examples may be perceived as possible or likely ways to extend English by a minimal amount, but not as full-fledged current sentences of English. (Note that these examples also confirm that adults possess and use a broad-range rule, and not just a list of independent narrow-range rules.)

What is most interesting is that, after developmental differences in word knowledge are accounted for, there are few reasons to distinguish these adult innovations from the ones we call 'overgeneralization errors' in children. Both adults' and children's innovations obey some version of the possession-change constraint, and both are rare, occurring against a background of conservatism or the minimal exceptions to it licensed by narrow-range rules. Both children and adults, then, may possess a broad-range dative rule mapping cause-to-go forms onto cause-to-have forms, and may occasionally use them productively for one-time innovations in addition to their main function of licensing and motivating more low-level lexical alternations. This is a happy result, because the easiest kind of developmental change to explain is no change at all.

APPENDIX I: PARAGRAPHS USED IN EXPERIMENT 1

Paragraph 1 (Possessive *to*-dative):

John, the star player of the Boston Whalers, was eager to begin the match against the New York Maulers. He knew that he would be facing their champion—Ben—also adept at using the pell. And sure enough, at a critical point in the game, John summoned all of his strength and pelled the disc to Ben.

Paragraph 2 (Possessive *to*-dative):

Sue, who had wanted the deed to the house for twenty years, was very excited when her lawyer called with the good news. Her lawyer told her that Bob, the current owner, was ready to begin pellation, the formal (and only legal) process by which she could obtain the house from him. After Bob had finally pelled the house to Sue, she pelled her duplex to Francis.

Paragraph 3 (Possessive *for*-dative):

Ted, a native of the North, was quite unfamiliar with the customs of the South. For instance, at one point in his journey he offered a man cash for a souvenir, not knowing that Southerners used the pellation exchange system instead of the Northern currency. Eventually, however, Ted pelled a souvenir for Kate.

Paragraph 4 (Possessive *for*-dative):

Gail, a brand new graduate of Automata Inc., was eager to help Frank with his presentation. She thought that by running the pell program on his incomplete file, it would produce quite a presentable report. And sure enough, after Gail pelled the report for Frank, he was ready to make a great impression.

Paragraph 5 (Nonpossessive *to*-dative):

Ron, who had promised Dave that he would try to help him make the flight, entered the garage with some regret. It had been a full month since he fired up the pell, and he was unsure how it would handle the rough atmosphere. Later, after having pelled Dave to the hotel, Ron was quite relieved.

Paragraph 6 (Nonpossessive *to*-dative):

Ann, concerned for her family, convinced Jill to help her with the medical supplies. Ann knew that her family would be near the lake at dusk, so she wanted Jill to use her pell, a device which would make the movement instantaneous. To Ann's relief, at the appointed hour Jill pelled the item to the lake.

Paragraph 7 (Nonpossessive *for*-dative):

George, the famous computer programmer, was disgusted by the data matrix which Carl had showed him. The matrix was so difficult to read that he decided to use pell, his new program which was designed to remove excess spacing from a file and thereby save disk space as well as eye strain. Carl was certainly grateful after George had pelled the matrix for him.

Paragraph 8 (Nonpossessive *for*-dative):

Ned, a young but upcoming inventor, was eager to spring his latest idea on the unsuspecting world. He thought he'd begin with his neighbor, Cindy, by offering to do her ceiling with his new pell. It is a profound understatement to say that Cindy was displeased after Ned had pelled the ceiling for her.

APPENDIX 2: EXAMPLE OF A RESPONSE FORM, EXPERIMENT 1

| | | | | | | | |
|----|----|----|---|---|---|---|------------------------------------------|
| | | | | | | | A ball was pelled to the player by Fred. |
| -3 | -2 | -1 | 0 | 1 | 2 | 3 | Fred pelled a ball to the player. |
| -3 | -2 | -1 | 0 | 1 | 2 | 3 | Fred pelled a ball. |
| -3 | -2 | -1 | 0 | 1 | 2 | 3 | The player was pelled a ball. |
| -3 | -2 | -1 | 0 | 1 | 2 | 3 | A ball was pelled by Fred. |
| -3 | -2 | -1 | 0 | 1 | 2 | 3 | Pell the player a ball! |
| -3 | -2 | -1 | 0 | 1 | 2 | 3 | A ball was pelled. |
| -3 | -2 | -1 | 0 | 1 | 2 | 3 | Pell a ball! |
| -3 | -2 | -1 | 0 | 1 | 2 | 3 | Fred pelled the player a ball. |
| -3 | -2 | -1 | 0 | 1 | 2 | 3 | The player was pelled a ball by Fred. |
| -3 | -2 | -1 | 0 | 1 | 2 | 3 | Pell a ball to the player! |
| -3 | -2 | -1 | 0 | 1 | 2 | 3 | |

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Jess Gropen
Department of Linguistics
Stanford University
Stanford, CA 94305

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