THE ROLES OF VERB SEMANTICS, ENTRENCHMENT, AND MORPHOPHONOLOGY IN THE RETREAT FROM DATIVE ARGUMENT-STRUCTURE OVERGENERALIZATION ERRORS

BEN AMBRIDGE

University of Liverpool

JULIAN M. PINE

University of Liverpool

CAROLINE F. ROWLAND

University of Liverpool

FRANKLIN CHANG

University of Liverpool

Children (aged five-to-six and nine-to-ten years) and adults rated the acceptability of well-formed sentences and argument-structure overgeneralization errors involving the prepositional-object and double-object dative constructions (e.g. *Marge pulled the box to Homer*/*Marge pulled Homer the box*). In support of the entrenchment hypothesis, a negative correlation was observed between verb frequency and the acceptability of errors, across all age groups. Adults additionally displayed sensitivity to narrow-range semantic constraints on the alternation, rejecting double-object dative uses of novel verbs consistent with prepositional-dative-only classes and vice versa. Adults also provided evidence for the psychological validity of a proposed morphophonological constraint prohibiting Latinate verbs from appearing in the double-object dative. These findings are interpreted in the light of a recent account of argument-structure acquisition, under which children retreat from error by incrementally learning the semantic, phonological, and pragmatic properties associated with particular verbs and particular construction slots.*

Keywords: language acquisition, retreat from overgeneralization, no negative evidence problem, dative argument structure, semantics, entrenchment, preemption

1. INTRODUCTION. The question of how children acquire their native language is one that is central to the field of linguistics. Clearly, since an English child learns to speak English while a French child learns to speak French, part of the answer must be that children learn imitatively from their caregivers. It has been clear since Chomsky 1957, however, that this cannot be the whole story: the defining characteristic of human language is that it allows speakers to produce utterances that they have not heard before. Indeed, child utterances such as *I said her no* and *Don't say me that* (Bowerman 1988) constitute evidence that children do produce utterances that they have almost certainly not heard spoken by adults.

Consequently, all theories of child language acquisition—of whatever theoretical persuasion—must explain how children, on the one hand, acquire the capacity to produce utterances that they have not heard before, yet, on the other, appropriately restrict their generalizations to avoid the production of ungrammatical utterances. Traditionally, the question has been framed as one of how, having begun to produce errors (e.g. *Don't say me that*), children subsequently retreat (e.g. Bowerman 1988, Marcus 1993). But this seems unnecessarily narrow. The process by which children ultimately become adult speakers who are prepared to generalize some verbs, but not others, into nonattested constructions still requires elucidation, regardless of whether a particular child produces errors of a particular type. That is, the question is not just how children who produce utterances such as *Don't say me that* learn not to do so, but also how other children seemingly avoid such errors, while retaining their capacity for productivity.

Thus, while corrective feedback from caregivers no doubt aids in the RETREAT from overgeneralization (e.g. Chouinard & Clark 2003), some additional mechanism is required to explain how children avoid overgeneralizations that they have not yet produced. Indeed, experimental studies with novel verbs demonstrate that both children and adults rate as ungrammatical sentences that they cannot possibly have produced themselves (e.g. *The funny clown meeked Bart*, where *meek* denotes a novel laughing action; Ambridge et al. 2008, Ambridge et al. 2011).

The present study tests two proposals for how children learn that certain possible generalizations are ungrammatical: Pinker's (1989) semantic verb class hypothesis and Braine and Brooks's (1995) entrenchment hypothesis (a third proposal, preemption— e.g. Goldberg 1995—is considered in the general discussion). We additionally investigate a proposed morphophonological constraint that is specific to the construction under investigation (Green 1974, Oehrle 1976, Pinker 1989).

The present article focuses on verb argument-structure overgeneralizations, which occur when a child uses a verb in a construction in which it may not appear for adult speakers. In particular, we focus on errors where a verb that may appear in the prepositional-object (PO) dative construction (e.g. *I said no to her*) is incorrectly used in a double-object (DO) dative construction (e.g. *I said her no*), or vice versa (e.g. *Marge refused the beer to Homer*; cf. *Marge refused Homer the beer*). The question is how children learn that such generalizations are ungrammatical, while retaining the capacity to generalize so-called 'alternating' verbs into nonattested constructions. For example, when the verb *to text* (send an SMS message) entered the language, speakers who heard an utterance such as *I texted the directions to John* (PO-dative) would have no hesitation in producing—or accepting as grammatical—an utterance such as *I texted John the directions* (DO-dative), even if they had never encountered the verb *text* in this construction.

Note that overgeneralization errors such as *I said her no* could have been produced in a number of different ways. One possibility (e.g. Pinker 1989) is that children form a lexical rule that generates DO-datives from PO-datives after noticing that some verbs (e.g. *give*) appear with both argument structures.

(1) PO-dative: [SUBJECT] [VERB] [DIRECT OBJECT] to [INDIRECT OBJECT]
                 John   gave   a present   to Sue
                                    ⇓
(2) DO-dative: [SUBJECT] [VERB] [INDIRECT OBJECT] [DIRECT OBJECT]
                 John   gave   Sue   a present

Another possibility is that children learn the two constructions as independent 'surface generalizations' (Goldberg 2002) that are functionally very similar. Due to this similarity, when deciding which construction to use in a given scenario, children may select one in which the verb has not been attested, occasionally resulting in an overgeneralization error. It is important to stress, however, that the question of how children avoid and/or retreat from such errors still arises, regardless of the particular theoretical framework assumed.

1.1. SEMANTIC VERB CLASS HYPOTHESIS. Pinker (1989) proposed that children must acquire both BROAD-RANGE RULES and NARROW-RANGE SEMANTIC CLASSES that determine the particular constructions in which a verb may and may not appear. Adherence to the relevant broad-range rule is a necessary but not sufficient criterion for appearing in the construction. For example, to be a candidate for appearing in the DO-dative construction, a verb must be capable of denoting CHANGE IN POSSESSION (Pinker 1989:84). For example, *give*, *hand*, *pull*, *drag*, *shout*, and *screech* all meet this criterion (provided that *shout* and *screech* are construed as denoting metaphorical transfer of information). However, actual

appearance in the construction is contingent upon membership in a relevant narrow-range semantic class. *Give* and *hand* are members of such a class ('verbs of giving'; Pinker 1989:110) and hence can appear in the DO-dative construction (e.g. *I gave/handed him the box*). *Carry*, *pull*, *shout*, and *yell* are not members of such a class, and so cannot (e.g. **I carried/pulled him the box*; **I shouted/yelled him the message*). In fact, they are members of the classes of verbs of 'accompanied motion' and 'manner of speaking' (Pinker 1989:110) respectively, which are relevant narrow-range classes for the PO-dative construction (cf. *I carried/pulled the box to him*; *I shouted/yelled the message to him*). The relevant broad-range rule for this construction is that the verb must be capable of denoting an event of causing an entity to go from one location to another.

The existence of both the broad-range rules and the narrow-range classes has proved highly controversial. The broad-range rule that DO-datives denote change of possession (CAUSE TO HAVE) while PO-datives denote change of location (CAUSE TO GO) is often invoked to explain contrasts such as those in 3.

(3) a. The noise gave Paul a headache. *vs.* *The noise gave a headache to Paul.
b. *John sent Chicago the package. *vs.* John sent the package to Chicago.

The argument is as follows. In the first pair, Paul is 'caused to have' a headache; the headache is not 'caused to go' from the noise to Paul. In the second, the package is caused to go from John to Chicago; Chicago is not caused to have the package and, indeed, is not an entity that is capable of this type of possession (note that if *Chicago* is used metonymically to refer to the people in the Chicago office, the grammaticality of the sentence is much improved). However, the psychological reality of the broad-range rule has been challenged by a number of studies showing that many of the purportedly ungrammatical forms—one example of which is shown in 4—arise frequently in corpus data (e.g. Krifka 2004, Bresnan 2007a,b, Bresnan et al. 2007, Bresnan & Nikitina 2010).

(4) From the heads, offal and the accumulation of fishy, slimy matter, a stench or smell is diffused over the ship that would **give a headache to the most athletic constitution**. (Bresnan et al. 2007)

Similarly, with regard to the narrow-range classes, verbs that are members of Pinker's (1989) PO-only classes, such as accompanied motion and manner of speaking, are also attested in DO-dative sentences.

(5) 'Well … it started like this … ' Shinbo explained while Sumomo **dragged him a can of beer** and opened it for him. (Bresnan et al. 2007)

(6) I still can't forget their mockery and laughter when they heard my question. Finally a kind few (three to be exact) came forward and **whispered me the answer**.

Of course, the fact that such forms are attested does not constitute evidence that all, or even most, speakers would necessarily consider them to be fully acceptable. Nevertheless, these examples raise the possibility that the relative (un)grammaticality of PO- and DO-dative sentences is determined primarily by the interaction of factors such as the accessibility of the recipient/theme, pronominality of the recipient/theme, definiteness of the recipient/theme, animacy of the theme, and so forth (see Bresnan et al. 2007 for a full list).[1] Apparent semantic verb class effects could arise because verbs with similar meanings will often be similar on these dimensions.

---

[1] To give one further well-known example, heavy-NP shift is a phenomenon whereby 'heavy' (long, complex) NPs are more likely to appear sentence-finally (and, hence, in PO- than DO-datives): *That smell would give **anyone** a headache* vs *That smell would give a headache to **the most athletic constitution***.

Some authors (e.g. Braine & Brooks 1995:364) adopt a compromise position, apparently accepting the existence of some kind of broad-range semantic constraint, while arguing that it is implausible that children are sensitive to such fine-grained distinctions as exist between verbs of 'illocutionary communication' (e.g. *tell*, *ask*), which may appear in the DO-dative construction, and verbs of 'manner of speaking' (e.g. *shout*, *screech*), which (according to the semantic verb class hypothesis) may not. Similarly, Bowerman (1988) asks why children should bother to learn such fine-grained rules when the broad-range rules allow them to comprehend all relevant utterances.

Another position, exemplified by Stefanowitsch (2008:527), is that 'whilst speakers might uncover certain semantic motivations for these [verb argument structure] constraints … those semantic motivations are not necessary for learning the constraint in the first place' (see also Bowerman & Croft 2008). For these authors, children learn verbs' restrictions on a purely distributional basis, via processes such as entrenchment (as discussed in the following section).

Despite the controversy in the literature, few experimental studies have investigated the psychological reality of the proposed semantic constraints on the dative for children (or, indeed, adults). One elicited-production study (Gropen et al. 1989) demonstrated that children are sensitive to the broad-range rule of possession transfer for the DO-dative.

However, sensitivity to narrow-range semantic verb classes has been demonstrated (to our knowledge) only for the transitive-causative construction. Brooks and Tomasello (1999) taught children novel intransitive verbs of 'motion in a particular manner' (similar to *spin*), which appear in the transitive-causative construction, and 'motion in a particular direction' (similar to *ascend*), which do not. Children aged 4;5 and older (though not a younger group aged 2;5) were more willing to generalize the novel 'spinning' than the novel 'ascending' verb into the transitive-causative construction (e.g. *The bear meeked the ball*), suggesting sensitivity to the narrow-range classes relevant to this construction (Ambridge et al. 2011 replicated this finding with children and adults, using a judgment task). Similarly, Ambridge and colleagues (2008) found that even the youngest children studied (aged five to six) rejected transitive-causative uses of novel verbs similar in meaning to members of the narrow-range class containing verbs such as *laugh* and *giggle* (e.g. **The funny clown meeked Bart*).

Clearly, any theory of how children restrict their argument-structure overgeneralizations must apply to all constructions, not just the transitive-causative. Thus the primary aim of experiment 1 is to investigate whether adults and children show any evidence of sensitivity to the narrow-range semantic verb classes proposed by Pinker (1989) for the PO- and DO-dative constructions. Relative to those proposed for the intransitive and transitive-causative constructions, these would seem to be particularly fine-grained and hence difficult to acquire. For example, the difference in meaning between verbs of 'illocutionary communication' (e.g. *tell*, *ask*), which may appear in the DO-dative, and verbs of 'manner of speaking' (e.g. *shout*, *screech*), which may not, is not only extremely subtle but also relatively inaccessible to direct observation. For example, a *telling* event and a *shouting* event may, in some cases, be behaviorally indistinguishable, differing only with respect to whether the message or its manner of communication is of primary interest.

1.2. Entrenchment. The entrenchment hypothesis is the claim that repeated presentation of a verb (e.g. *screech*) in one (or more) attested construction (e.g. the PO-dative; *Homer screeched the instructions to Lisa*) causes the learner to gradually form an ever-strengthening probabilistic inference that adult speakers do not use that particular verb in nonattested constructions (e.g. the DO-dative; **Homer screeched Lisa the instruc-*

tions).[2] Entrenchment can be understood as a linguistic case of the general reasoning process of 'inference from absence' (Hahn & Oaksford 2008). For example, repeated cases of the use of a drug with no side effects lead gradually to the probabilistic ever-strengthening inference that it is safe.

A number of recent studies have provided support for this proposal. For example, Ambridge et al. 2008 showed that even the youngest children studied (aged five to six) rated transitive-causative overgeneralizations as least acceptable with high-frequency verbs, more acceptable with low-frequency verbs, and most acceptable with novel verbs (e.g. *The funny clown laughed/giggled/meeked Bart*). This effect held across three different semantic verb classes (see also Theakston 2004, Wonnacott et al. 2008, Ambridge et al. 2009, Perfors et al. 2010, Wonnacott 2011). These findings corroborate those of an elicited-production study (Brooks et al. 1999) in which children (aged between 3;4 and 9;0) produced fewer transitive-causative overgeneralizations for high-frequency verbs (e.g. *The man disappeared the ball*) than semantically matched verbs of lower frequency (e.g. *The man vanished the ball*).

Recently, Stefanowitsch (2008) provided support for the role of entrenchment in constraining dative overgeneralization errors. Across a set of seventeen nonalternating verbs (some PO-only, some DO-only), adults' ratings of the unacceptability of overgeneralization errors were predicted by verb frequency (or, more properly, their frequency relative to the overall frequency of the PO- and DO-dative constructions in the corpus).[3]

The present study builds on that of Stefanowitsch (2008) by extending the judgment paradigm to children, as well as simultaneously investigating and controlling for any effects of verb semantics (experiment 1) and morphophonology (experiment 2), using novel verbs. The present study also uses a larger stimulus set (thirty-six English verbs across both studies) and includes PO-only, DO-only, and, as a control, alternating verbs. A particularly important goal is to see whether an effect of entrenchment is observed for young children. Although five-to-six-year-olds show this effect for transitive-causative overgeneralizations (e.g. *The funny clown meeked Bart*; Ambridge et al. 2008, Ambridge et al. 2009), there is reason to believe that it may not hold for overgeneralizations involving the dative constructions: compared to high-frequency intransitive-only verbs such as *come*, *go*, *laugh*, and *cry*, many PO-only verbs (e.g. *push*, *pull*, *shout*, *yell*) are likely to be encountered only relatively infrequently, with more frequent, early-acquired verbs such as *give*, *bring*, *send*, *tell* (see Campbell & Tomasello 2001) appearing in both the PO- and DO-dative. It may therefore be the case that statistical entrenchment operates for transitive-causative, but not double-object dative, overgeneralization errors among young children.

1.3. MORPHOPHONOLOGICAL CONSTRAINT. While the semantic verb class and entrenchment (and preemption) hypotheses are potentially applicable to all types of argument-structure overgeneralizations, the present study also investigates a constraint specific to dative overgeneralizations. Following Green (1974) and Oehrle (1976), Pinker (1989) and Levin (1993) argue that, for at least some semantic classes (e.g. verbs of illocution-

---

[2] Preemption (to which we return in the general discussion) is similar except that only constructions with sufficiently similar meanings count as evidence. For example, *Homer screeched the instructions to Lisa* would count as both preempting and entrenching evidence against *Homer screeched Lisa the instructions*. In contrast, *Homer screeched the instructions* (i.e. a simple transitive) would contribute to entrenchment, but not preemption, with respect to this overgeneralization.

[3] With regard to the preemption hypothesis, it is interesting to note that frequency in the 'preempting' construction (PO-dative for DO-only verbs, DO-dative for PO-only verbs) was not a significant predictor of the degree of ungrammaticality.

ary communication and giving),[4] verbs that are of Latinate origin are restricted to the PO-dative construction (e.g. *John donated the book to the library*), with DO-datives being ungrammatical (e.g. **John donated the library the book*). The reason for this would seem to be that Latinate verbs entered English via French, bringing with them their argument structure (e.g. French 'to give' = *donner* [DIRECT OBJECT] *à* [INDIRECT OBJECT]), and hence could not be accommodated into the native DO-pattern. The claim is not that speakers are actually sensitive to the etymology of individual verbs. Latinate verbs can be identified by their syllabic stress patterns (they are disyllabic with second-syllable stress (e.g. *donate*, in British English) or trisyllabic (*contribute*)) and perhaps by their use of certain morphemes (e.g. *-ify*, *-ate*). Native (i.e. Germanic) verbs are generally monosyllabic (e.g. *give*, *tell*).[5]

   This claim has recently been challenged on the basis of corpus studies. For example, in a Web-based study, Fellbaum (2005) found over a thousand DO-dative uses of *donate*. While it is of course possible that some of these may be speaker errors (produced, for example, by nonnative speakers), it is equally possible that the proposed morphophonological constraint is not psychologically real for typical speakers of contemporary English. Indeed, this is Fellbaum's conclusion.

   In the present article (experiment 2), we investigate the psychological reality of the morphophonological constraint by obtaining grammaticality judgments for sentences with novel verbs. One study using this paradigm has already been conducted. Gropen and colleagues (1989) introduced adults and children to novel native-like (e.g. *norp*, *pell*) and Latinate (e.g. *orgulate*, *dorfinize*) verbs. Adults rated as more acceptable (experiment 1), and seven-year-olds were more likely to produce (experiment 2), DO-dative sentences containing native-like than Latinate novel verbs, though the effect was not replicated in a second group of children, using a slightly different procedure (experiment 3). In any case, the design of this study does not allow us to address the crucial question of whether children would give higher ratings of acceptability to (or even show a greater propensity to produce) PO- than DO-datives with particular novel Latinate verbs, but NOT with semantically matched novel 'native' verbs. This is a shortcoming that we address in the present study.

   1.4. SUMMARY. Although all enjoy some empirical support, the semantic verb class, entrenchment, and morphophonology hypotheses remain controversial, particularly with regard to the dative constructions, where they have rarely been tested with children. The aim of the present set of studies was therefore to provide the strongest test yet of these proposals. In experiment 1, adults and children rated the acceptability of PO- and DO-dative sentences containing novel verbs from PO-only, alternating, and (for adults) DO-only semantic verb classes. In experiment 2, adults and children rated the acceptability of PO- and DO-dative sentences containing novel Latinate and novel native-like verbs from semantically alternating classes. In both studies, participants also rated a range of semantically matched English verbs differing in overall frequency, to allow for simultaneous investigation of the entrenchment hypothesis.

---

[4] Pinker (1989:119) argues that some verb classes are not sensitive to this constraint, though DO-dative uses of many of these verbs are less than fully grammatical for the present authors (e.g. ?*I recommended him the suit*; ?*I telephoned him the message*).

[5] A referee suggested that *promise* is an exception, being Latinate but productively alternating. However, if, as we suggest, speakers form a rule on the basis of stress patterns as opposed to etymology per se, it is not an exception, as **promise** has adopted an anglicized stress pattern (cf. for example, French pro**mettre**).

2. EXPERIMENT 1: SEMANTIC VERB CLASS (AND ENTRENCHMENT) HYPOTHESIS.
2.1. METHOD.

PARTICIPANTS. Participants were twenty children aged 5;4–6;4 (*M* = 5;10), twenty aged 9;4–10;4 (*M* = 9;10), and twenty adults (undergraduate students aged eighteen to twenty-one). All participants were monolingual English speakers.

DESIGN AND MATERIALS. Six semantic verb classes were chosen from Pinker 1989 and verified against those listed by Levin (1993). The classes do not match perfectly, since Levin generally gives fewer, larger classes, but care was taken to select only verbs and classes for which both authors agree on argument-structure status (PO-only/DO-only/alternating[6]). The chosen classes were as follows.

- Accompanied motion (PO-dative only)
- Manner of speaking (PO-dative only)
- Monetary (DO-dative only; adults only)
- Future not having (DO-dative only; adults only)
- Illocutionary communication (alternating)
- Giving (alternating)

In fact, Pinker (1989) lists only a single DO-dative-only class. To ensure a balanced design, we split this class into two, on the basis that the verbs listed appear to cluster into those involving some kind of financial transaction (*bet*, *wager*, *cost*, *fine*, *save*, *undercharge*) and what Pinker terms 'malefactive/future not having' (*refuse*, *deny*, *envy*, *begrudge*, *forgive*, *excuse*). Only adults completed test items based on the DO-only classes, partly because we were concerned that children would not be able to complete a large number of trials, and partly because we felt that young children would not be able to understand the relevant concepts, and were unlikely to have encountered several of the verbs.

From each class, we selected three high-frequency verbs (e.g. *pull*, *carry*, and *lift* for the class of accompanied motion) and paired each with a lower-frequency verb, as close as possible in meaning (e.g. *drag*, *haul*, and *hoist*). Frequency information was taken from the spoken-texts portion of the British National Corpus (BNC, 2007), verb uses only (see Appendix Table A1 for counts). For each high/low-frequency pair, we then created a novel verb with similar, but distinct, semantics[7] (e.g. pulling/dragging slowly and jerkily; carrying very slowly; lifting by pulling on a rope; see Appendix B for a complete list of definitions). A potential concern is that some of the novel verb meanings (e.g. 'to shout as loud as possible') may be more plausible than others (e.g. 'to bet, but only a very small amount'). In order to allow for plausibility to be factored out statistically, we obtained plausibility ratings for each of the novel verb meanings from ten

---

[6] A referee suggested that, given the present finding that the distinction seems to be probabilistic rather than absolute, the term 'PO/DO-PREFERRING' may be more appropriate. However, we have retained the term 'PO/DO-only', not only because the alternative is more cumbersome, but also because the theory under investigation (Pinker 1989) does in fact make a distinction between 'dativizable' (i.e. alternating) and nondativizable (i.e. PO-only) verbs (e.g. p. 19).

[7] Although this procedure resulted in—descriptively speaking—three frequency bands (high/low/novel), all analyses used continuous corpus frequency (not band) as a predictor. In order to check whether the frequencies in the BNC are representative of child-directed speech, we also obtained frequency counts from the twelve mothers in the Manchester Corpus (MC, available in CHILDES; Theakston et al. 2001). Although many of the verbs do not appear in this corpus, those that are attested always line up in the same order within a given semantic class, whether the counts are based on the BNC or MC (see Appendix Table A1). Because the Manchester Corpus is much smaller (and many verbs are not attested), all analyses used BNC counts. We can, however, be confident that these counts are nevertheless reasonably representative of the speech that children hear.

adult participants. Participants were asked to rate 'how likely it is that there could exist a specific word to describe this action (whether or not such a word happens to exist in English' on a scale of 1 (very unlikely) to 7 (very likely). Mean plausibility ratings are given in Appendix B. Although the novel actions varied considerably as to their perceived plausibility, all received mean ratings above the mid-point of the scale, indicating that all were, broadly speaking, plausible.

In order to ensure that the novel verbs were not only semantically plausible, but also phonologically plausible, we selected phonological forms (*gezz*, *chool*, *stip*, etc.) from the study of Albright and Hayes (2003). These authors used a computational model to derive phonological forms that constitute acceptable English words. The assignment of phonological forms to meanings was counterbalanced across two groups. Counterbalance group was not associated with any fixed effects or interactions in any analysis, and hence is not discussed further here.

Thus, in total, the study included fifty-four verbs: nine from each of six semantic verb classes. For each of these verbs, we created one PO-dative and one DO-dative sentence (see Appendix Table A1). In order to ensure that sentences were matched for NP length, definiteness, aspect, animacy, and pronominality (all factors that have been shown to influence the relative grammaticality of the two dative constructions; Bresnan et al. 2007), all sentences were constructed according to the templates in 7.[8]

> (7) a. PO: [PROPER NAME 1] [VERB$_{PAST}$] the [NOUN$_{INANIMATE}$] to [PROPER NAME 2]
>   b. DO: [PROPER NAME 1] [VERB$_{PAST}$] [PROPER NAME 2] the [NOUN$_{INANIMATE}$]

The sentences in each PO/DO-pair were equivalent, in that each included the same verb and NPs and differed only in argument structure (e.g. *Marge pulled the box to Homer/ *Marge pulled Homer the box*). In addition to matching each PO/DO-pair on the dimensions of NP length, definiteness, aspect, animacy, and pronominality, we endeavored, as far as possible, to ensure that the values chosen for each dimension did not particularly favor one construction over the other (e.g. a pronoun recipient is more commonly found in the DO- than PO-dative). The fact that adult participants showed no consistent preference for PO- or DO-uses of alternating English verbs demonstrates that we were successful in constructing relatively nonbiased sentence pairs.

For each test item, an audio recording of the sentence and a corresponding computer animation illustrating the event described were created. Animations were also created for the grammaticality-judgment training and novel-verb training sentences described below.

It is important to stress that all of the verbs used in this study are semantically consistent with Pinker's (1989) broad-range rule of possession transfer. They differ only as to whether they are members of a PO-only, DO-only, or alternating narrow-range semantic verb class. Thus, unlike the production study of Gropen et al. 1989, which looked only at children's knowledge of the broad-range rule, the present study investigates participants' sensitivity to Pinker's (1989) proposed narrow-range semantic verb classes.

---

[8] One exception is that the sentences with *ask*, *pose*, and the novel equivalent (*glip/bredge*) used the indefinite theme NP *a question*, whereas all other sentences used definite theme NPs (e.g. *the box*, *the answer*). This is because a definite theme NP (e.g. *Marge asked the question to Homer/Marge asked Homer the question*) seems somewhat infelicitous in both constructions. This is potentially problematic because Bresnan and colleagues (2007) found that indefinite theme NPs decrease the likelihood of the PO-dative construction. Indeed, for *ask*, there is some evidence to suggest that this occurred, since, overall, participants rated the DO-dative as 0.77 points more acceptable than the PO-dative (as an alternating verb, this difference score should be zero).

PROCEDURE. Participants were first given oral definitions of all of the novel verbs to be used in the experiment (see Appendix B) and, for each verb, viewed two training animations that depicted the relevant action. No sentences accompanied these animations (i.e. participants never heard a novel verb presented in a PO-dative, DO-dative, in/transitive, etc.), though the animations did include sound effects where appropriate (e.g. for the novel manner-of-speaking actions).

Participants then completed a training procedure designed to familiarize them with the correct use of the five-point 'smiley face' scale used to rate sentences (see Figure 1). Full details of the training and rating procedure can be found in Ambridge et al. 2008 and Ambridge 2011. In brief, participants first select either a green or a red counter to indicate 'broadly grammatical' or 'broadly ungrammatical' respectively, before placing the counter on the scale to indicate the degree of (un)grammaticality. Training sentences (see Appendix C)—two fully grammatical, two fully ungrammatical, and three intermediate—were used to illustrate the appropriate use of the scale, with the experimenter providing feedback where necessary.
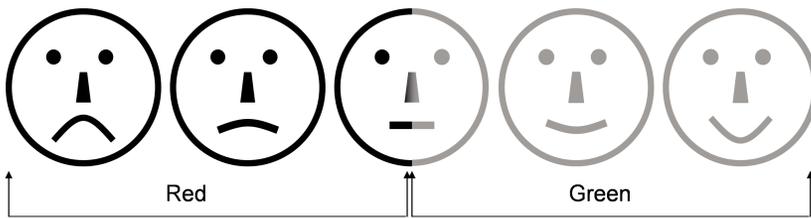
FIGURE 1. Five-point rating scale used by all participants to rate sentences for grammatical acceptability (reproduced from Ambridge et al. 2008, by permission of *Elsevier*).

After training, participants completed the test trials in pseudo-random order, with the stipulation that the same verb was never presented in consecutive trials. Before any trial including a novel verb, participants viewed a single novel-verb training animation to remind them of the verb's meaning. The experimenter did not, however, repeat the verbal definition, and said simply 'Now remember this is called NOVELing'.

2.2. RESULTS. Appendix Table A1 shows, for each verb, the mean ratings for PO- and DO-dative sentences on the five-point scale, and the mean difference score. A participant's difference score for a particular verb is calculated by subtracting his or her rating for the DO-dative sentence (e.g. *Marge pulled Homer the box*) from his or her rating for the equivalent PO-dative sentence (e.g. *Marge pulled the box to Homer*).[9] Thus the difference score is a number between –4 and 4, which reflects participants' preference for PO- over DO-dative uses of a particular verb (negative values indicate a preference for DO- over PO-dative uses). Difference scores are commonly used when testing the entrenchment hypothesis (e.g. Ambridge et al. 2008, Ambridge et al. 2009, Ambridge et al. 2011), as they control for the fact that low-frequency items generally lead to lower sentence-acceptability scores across the board, whether used grammatically or ungrammatically (e.g. Kempen & Harbusch 2003).

---

[9] When calculating difference scores, one must arbitrarily decide which score to subtract from which. We decided to subtract the DO- from the PO-rating because the study included more PO-only verbs than DO-only verbs.

ENGLISH VERBS. The first analysis investigated whether participants performed as expected with the English verbs. For adults, the answer to this question tells us whether Pinker's (1989) classification of verbs as PO-only, DO-only, and alternating was accurate for these speakers. If so, then, for children, the answer to this question tells us (i) whether they have adultlike knowledge of the argument-structure restrictions of these verbs and (ii) whether they are capable of performing the judgment task.

Table 1 shows the mean ratings for the PO- and DO-dative sentences of PO-only, alternating, and (for adults) DO-only verbs.

	AGE 5–6		AGE 9–10		ADULTS	
	M (SD)	M (SD)	M (SD)	M (SD)	M (SD)	M (SD)
SENTENCE TYPE	DO	PO	DO	PO	DO	PO
VERB TYPE						
Alternating	4.34 (1.02)	4.10 (1.16)	4.42 (0.88)	4.33 (0.89)	4.30 (1.02)	4.45 (0.94)
DO-only					3.43 (1.36)	2.51 (1.24)
PO-only	3.70 (1.31)	4.18 (1.12)	3.88 (1.03)	4.53 (0.74)	3.13 (1.13)	4.51 (0.93)

TABLE 1. Experiment 1, English verbs.

Visual inspection of this table suggests that all age groups prefer PO- over DO-uses of verbs from PO-only classes but show no preference for either PO- or DO-uses of verbs from alternating classes. Adults additionally appear to show a preference for DO- over PO-uses of verbs from DO-only classes.

This pattern was investigated statistically using conditional inference trees (Strobl et al. 2009), implemented via the ctree program from the party package (Hothorn et al. 2006) in the R environment (R Development Core Team 2010). Conditional inference trees are particularly useful for analyzing data that are expected to yield complex interactions. The method works by successively partitioning the data into maximally homogenous subsets, using the factor structure specified by the user (see Boyd & Goldberg 2011 for an example). Thus, for the present data set, the analysis creates groups of sentences that received similar acceptability ratings by partitioning the data on the basis of verb type (PO-only, DO-only, alternating) and sentence type (PO, DO) (the inclusion of semantic verb class, nested within verb type, was not supported by either this analysis or the subsequent regression analysis).

First, the analysis was run for each age group separately. Figure 2 shows the conditional inference tree for the adult data.
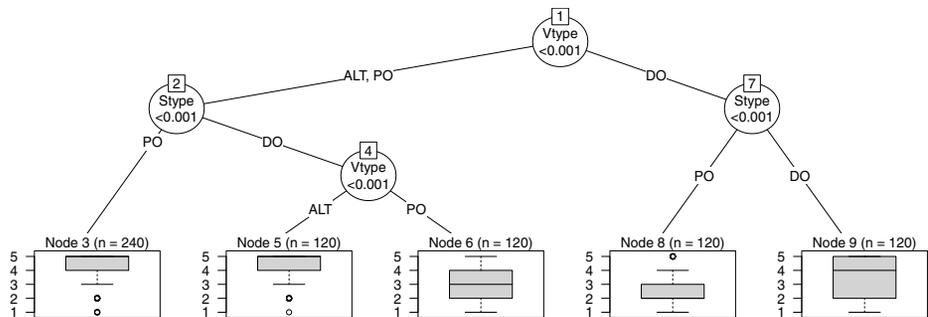
FIGURE 2. Conditional inference tree for experiment 1, English verbs, adults.

The first split is between DO-only verbs (right-hand branch) and alternating + PO-only verbs (left-hand branch). For the DO-only verbs, adults showed a significant preference

for DO-sentences (median = 4, *M* = 3.43, *SD* = 1.36) over PO-sentences (median = 2.5, *M* = 2.51, *SD* = 1.24). These median scores are illustrated graphically in the two right-most panels (medians as opposed to mean values are shown because the conditional-inference-tree procedure is nonparametric). Turning now to the left side of the tree, the next split is between PO-sentences and DO-sentences. Adults rate DO-sentences as significantly more acceptable when they contain alternating verbs (median = 5, *M* = 4.30, *SD* = 1.02) than PO-only verbs (median = 3, *M* = 3.13, *SD* = 1.13). For PO-sentences, no split is posited. This indicates that adults do not give significantly different ratings to PO-sentences with PO-only (*M* = 4.51, *SD* = 0.93) and alternating verbs (*M* = 4.45, *SD* = 0.94).

Figures 3 and 4 show the trees for the five-to-six- and nine-to-ten-year-olds respectively. The older children (Fig. 4) exhibit essentially the same pattern as the adults (after pruning off the split for DO-only verbs, which children did not rate). These children rate DO-sentences as significantly more acceptable when they contain alternating verbs (median = 5, *M* = 4.42, *SD* = 0.88) than PO-only verbs (median = 4, *M* = 3.88, *SD* = 1.03). For PO-sentences, no split is posited. This indicates that the older children did not give significantly different ratings to PO-sentences with PO-only (*M* = 4.53, *SD* = 0.74) and alternating verbs (*M* = 4.33, *SD* = 0.89).

The younger children (Fig. 3) showed essentially the same pattern, though the splits appeared in a different order. Looking first at PO-only verbs (right-hand branch), PO-sentences (median = 5, *M* = 4.18, *SD* = 1.12) were rated as significantly more acceptable than DO-sentences (median = 4, *M* = 3.70, *SD* = 1.12). For alternating verbs, no split is posited. Hence PO-sentences (*M* = 4.10, *SD* = 1.16) and DO-sentences (*M* = 4.34, *SD* = 1.02) do not differ in acceptability.
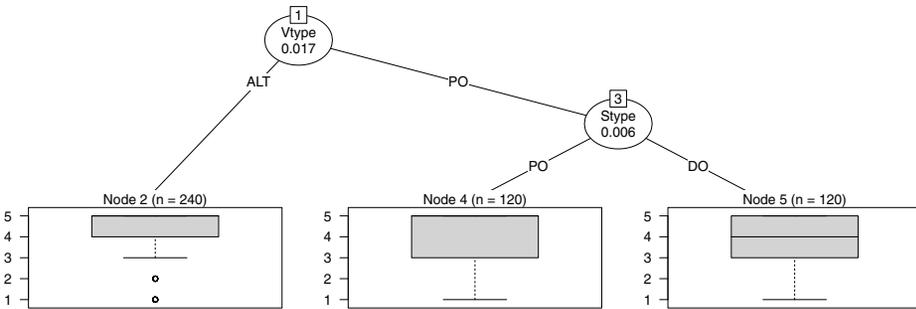
FIGURE 3. Conditional inference tree for experiment 1, English verbs, age five to six.
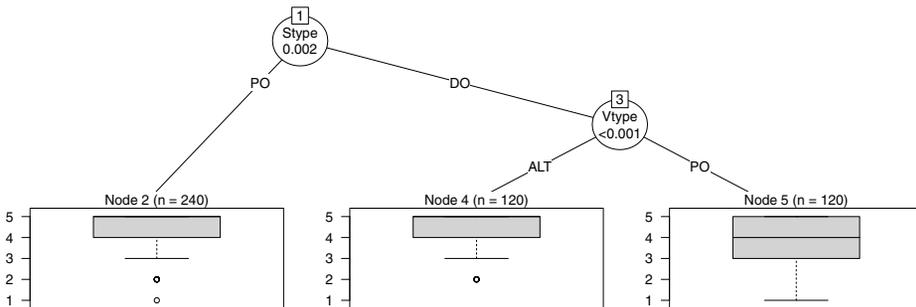
FIGURE 4. Conditional inference tree for experiment 1, English verbs, age nine to ten.

Next, a conditional-inference-tree analysis was run for all participants together, including age as a factor in the model. The details of this analysis are not important for our present purposes; it will suffice to note that two splits based on age were posited ($p < 0.001$ in both cases), thus clearly indicating the presence of an interaction of age by verb type by sentence type.

To confirm this pattern, and to check that it is reliable across participants and items, a linear mixed-effects regression model was fitted to participants' ratings. The model was implemented in R using the lmer program from the lme4 package (Bates et al. 2011). The initial model included participant as a random effect and sentence type as a fixed effect, with participants' ratings as the dependent variable. Fixed effects and their associated two-, three-, and four-way interactions were added in the following order, with reference levels shown in boldface type (treatment coding was used for all categorical factors).

- Sentence type (PO-dative/**DO-dative**)
- Verb type (PO-only/**Alternating**; because this analysis collapsed across all age groups, DO-only semantic verb classes, for which only adults completed trials, were excluded)
- Age group (5–6, 9–10, **Adult**)
- Semantic verb class (nested under verb type: **accompanied motion**/manner of speaking (PO-only); **monetary**/future not having (DO-only); **illocutionary communication**/giving (Alternating))

The models were compared with likelihood ratio tests to identify the solution with the optimal balance between complexity and fit. In order to penalize models with a high number of parameters, model selection was based on the relatively conservative Bayes's information criterion (BIC) measure (with lower values indicating better fit). For this data set, the optimal model included sentence type, verb type, and age and the associated two- and three-way interaction terms. Note that this analysis provided no support for the inclusion of semantic verb class (nested within verb type). That is, once a verb has been classified as belonging to a PO-only, DO-only, or alternating semantic class, which particular class this is (accompanied motion vs. manner of speaking; monetary vs. future not having; illocutionary communication vs. giving) does not significantly affect participants' judgments.

To investigate whether this model could be improved upon, we compared it to models with by-participant random slopes for (a) sentence type, (b) verb type, and (c) sentence type × verb type. This yielded no significant improvement. We then compared this model to models with a random effect for verb (which yielded an improvement) and by-verb random slopes for (a) sentence type (with this model yielding an improvement), (b) verb type, and (c) sentence type × verb type. An anonymous referee suggested that males may be more tolerant of overgeneralization errors than females. However, adding gender and its interactions to the final model did not improve fit (for the subsequent novel-verb analysis, the influence of verb-stem plausibility is also investigated at this stage).

Thus the final model included fixed effects of sentence type, verb type, and age, random effects of participant and verb, and by-verb random slopes for sentence type. The complete model is shown in Appendix Table A2 (though note that the p-values shown are for a slightly simpler model without random slopes, as Markov chain Monte Carlo sampling is not yet implemented for models with random correlation parameters).

Although the final model is rather complex, the important point for our purposes is simply that the interaction of sentence type by verb type by age revealed in the condi-

tional-inference-tree analysis was confirmed. Thus we can be confident in our conclusion that children prefer PO- over DO-dative uses of PO-only verbs, but not alternating verbs, while adults show the same pattern, and additionally prefer DO- over PO-dative uses of DO-only verbs. The significant interaction reflects the fact that the magnitude of this preference increases with age (as reflected in the group means, and by the *p*-values for the splits posited in the conditional-inference-tree analysis).

These findings tell us that (i) the classification of verbs as PO-only, DO-only, and alternating was accurate for these adults, (ii) even the youngest children have learned these restrictions, and (iii) all groups are using the rating scale broadly as expected. Because they are based on familiar English verbs, however, these findings do not tell us anything about how these restrictions were acquired. To investigate whether learners are capable of using verbs' semantics—as opposed to simply attested usage—to determine their argument-structure privileges, it is necessary to investigate performance with novel verbs, which have not been attested in either construction.

Before moving on to consider novel verbs, a note regarding the entrenchment hypothesis is in order. Recall that, in order to test this hypothesis, the frequency of the English verbs was manipulated within each verb class. Nevertheless, many of even the lower-frequency verbs in experiment 1 were relatively common. Thus, in order to maximize the range of verb frequencies, and hence the power of the analysis, the entrenchment hypothesis is investigated in a subsequent analysis that collapses across experiment 1 and experiment 2 (in which some of the English verbs are of particularly low frequency).

NOVEL VERBS. Table 2 shows the mean ratings for the PO- and DO-dative sentences of PO-only, alternating, and (for adults) DO-only verbs.

	AGE 5–6			AGE 9–10			ADULTS		
	M (SD)	*M* (SD)		*M* (SD)	*M* (SD)		*M* (SD)	*M* (SD)	
SENTENCE TYPE	DO	PO		DO	PO		DO	PO	
VERB TYPE									
Alternating	3.25 (1.40)	3.58 (1.50)		3.55 (1.20)	3.68 (1.24)		4.20 (1.02)	4.28 (0.90)	
DO-only							3.22 (1.28)	2.47 (1.27)	
PO-only	3.17 (1.54)	3.45 (1.56)		3.37 (1.23)	3.88 (1.18)		3.73 (1.19)	4.67 (0.54)	

TABLE 2. Experiment 1, novel verbs.

Visual inspection of this table suggests that, as predicted, adults prefer PO- over DO-uses of novel verbs from PO-only classes (and vice versa for DO-only classes), but show no such preference for novel verbs from alternating classes. While children seem to show a small overall preference for PO- over DO-sentences, it is unclear whether, as predicted, this preference holds only for novel verbs from PO-only verb classes.

This pattern was investigated statistically using the same conditional-inference-tree procedure as for the English verbs. Adults essentially displayed the predicted pattern (see Figure 5). Novel verbs from DO-only classes were rated as more acceptable in DO-than PO-sentences (see two rightmost plots), while DO-sentences were rated as more acceptable with alternating than PO-only verbs (see middle two plots). An unexpected, but not problematic, finding was that PO-sentences were rated as slightly more acceptable when they contained PO-only than alternating verbs (see two leftmost plots). This seems to reflect a subtle trade-off effect: a PO-dative sentence is slightly more acceptable when it is the only possible option (i.e. when the verb is consistent with a PO-only class) than when a DO-dative sentence COULD equally have been used instead (i.e. when the verb is consistent with an alternating class).
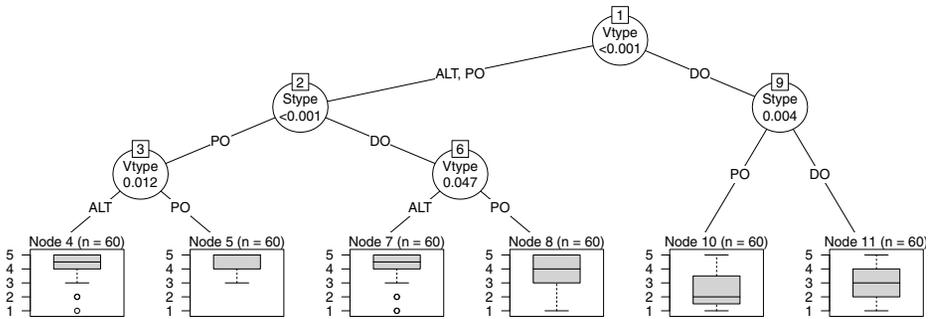
FIGURE 5. Conditional inference tree for experiment 1, novel verbs, adults.

Conditional inference trees plotted for each child group individually did not posit any splits. A single analysis collapsing across both child age groups revealed a significant overall preference for PO- over DO-dative verb uses (medians = 4 vs. 3, $p = 0.03$), but no further splits by either verb type or age. A single analysis collapsing across all participants confirmed the presence of a three-way interaction of sentence type by verb type by age, with a split between adults on one branch and both child age groups on another ($p < 0.001$).

For the subsequent regression analysis, the optimal model (see Appendix Table A3) included an interaction of sentence type by verb type and a main effect of age, but no three-way interaction (nor an effect of verb, gender, or verb-stem plausibility, nor any random slopes), presumably because the variance associated with age is swallowed up by the random effect of participant. In fact, including the three-way interaction of sentence type by verb type by age does improve the model's coverage in absolute terms, but at the cost of introducing considerable complexity, resulting in a lower BIC. Given children's uniformly low scores, the model adopts the more economical solution of simply predicting low scores across the board for children (as Table A3 shows, the mean ratings on the five-point scale are 0.9 points lower than those of adults for the five-to-six-year-olds and 0.6 points lower for the nine-to-ten-year-olds).

2.3. DISCUSSION. In summary, the novel-verb data from experiment 1 indicate that adults are capable of using the semantics of novel dative verbs to determine their argument-structure privileges (i.e. PO-only, DO-only, or alternating), whereas children are not, even at age nine to ten. It is important to note that this finding cannot be explained away as reflecting difficulties with the judgment task alone, as even the youngest children performed as expected for familiar English verbs.

Thus, despite the null finding for children, these results constitute support for Pinker's (1989) semantic verb class hypothesis. In fact, the finding that even the older children show no evidence of forming the semantic verb classes relevant for the dative constructions is not particularly surprising. Compared to, for example, the intransitive/transitive alternation—where children seem to acquire most of the relevant semantic classes by age nine to ten (Ambridge et al. 2008)—the criteria that distinguish PO-only and alternating dative verb classes are very subtle. For example, as we noted in the introduction (§1.1), the difference in meaning between the PO-only class of manner of speaking (e.g. *shout*, *screech*) and the alternating class of illocutionary communication (e.g. *tell*, *ask*) is not only small but also, in some cases, distinguished only by the perspective taken on events (e.g. whether the manner of communication or the fact of information transfer is important to the speaker).

Nevertheless, the adult findings for the novel verbs demonstrate that these semantic classes are indeed psychologically valid for speakers. Furthermore, the findings for English verbs demonstrate that, despite some recent skepticism in the literature (e.g. Krifka 2004, Bresnan 2007a,b, Bresnan et al. 2007, Bresnan & Nikitina 2010), when other factors are held constant, DO-dative uses of verbs such as *pull*, *screech*, and *shriek* are indeed held to be ungrammatical, even by relatively young children.

Finally, a caveat regarding the relationship between judgment and production data is in order. The phenomenon we are trying to explain is that, at some point in development, speakers (i) stop producing overgeneralization errors and (ii) rate such errors as ungrammatical in a judgment task. Since we have collected only judgment data, our findings relate directly to only the second part of this phenomenon. However, although the relationship between judgment data and everyday language use is likely complex, it would seem reasonable to assume that, under normal circumstances, speakers avoid the production of utterances that they would consider to be ungrammatical. Thus while, technically speaking, one could argue that the present findings support the semantic verb class hypothesis with regard to judgment data only, it would be odd to argue that these findings tell us nothing about the retreat from error in production.

3. EXPERIMENT 2: MORPHOPHONOLOGY (AND ENTRENCHMENT) HYPOTHESIS. Following Green (1974) and Oehrle (1976), Pinker (1989) and Levin (1993) argue that, for at least some semantic classes, verbs that are of Latinate origin are restricted to the PO-dative construction (e.g. *John donated the book to the library*), with DO-dative uses ungrammatical (e.g. **John donated the library the book*). The goal of experiment 2 was to investigate whether this constraint is psychologically real for adults, and if so, when it is acquired by children. A second goal was to collect further data to test the entrenchment hypothesis, in combination with the data from experiment 1.

3.1. METHOD.

PARTICIPANTS. Participants were twenty children aged 5;4–6;4 (*M* = 5;10), twenty aged 9;4–10;4 (*M* = 9;10), and twenty adults (undergraduate students aged eighteen to twenty-one). All participants were monolingual English speakers and had not taken part in experiment 1.

DESIGN, MATERIALS, AND PROCEDURE. Two semantic verb classes argued to exhibit the morphophonological constraint—verbs of illocutionary communication and verbs of giving—were selected from Pinker 1989 (Levin 1993 lists Latinate verbs as a separate class). It is important to be clear that both of these narrow-range classes are semantically consistent with both the PO- and DO-dative, and with the broad-range rule governing the alternation (possession transfer). Indeed, we already have evidence from experiment 1 that adults and children consider native (Germanic) verbs from this class to be approximately equally acceptable in PO- and DO-dative sentences.

From each of these two classes, we selected three high-frequency native verbs (*show*, *ask*, *tell*; *give*, *send*, *throw*) and three (relatively) high-frequency Latinate verbs (*explain*, *announce*, *describe*; *contribute*, *transport*, *release*). In the same way as for experiment 1, we then selected for each a semantically matched lower-frequency verb (*teach*, *pose*, *quote*; *hand*, *mail*, *toss*; *confess*, *declare*, *recount*; *donate*, *courier*, *propel*) and created a novel equivalent (see Appendix B for definitions and plausibility ratings). Novel native-like verbs were again taken from Albright & Hayes 2003. Novel Latinate verbs were taken from Gropen et al. 1989 or created by combining morphemes found in real Latinate words (e.g. *org + u + late*). The pairing of phonological forms with novel meanings was again counterbalanced across two groups, with no significant effects or

interactions observed. For each of the thirty-six verbs, a pair of PO- and DO-dative sentences was created in the same way as for experiment 1 (see Appendix Table A4).

The training and testing procedure was identical to that used for experiment 1.

3.2. RESULTS. Appendix Table A4 shows, for each verb, the mean ratings for PO- and DO-dative sentences on the five-point scale, and the mean difference score. Recall that a participant's difference score for a particular verb is calculated by subtracting his or her rating for the DO-dative sentence (e.g. *Lisa explained Homer the mistake) from his or her rating for the equivalent PO-dative sentence (e.g. *Lisa explained the mistake to Homer*). Thus the difference score is a number between –4 and 4 that reflects participants' preference for PO- over DO-dative uses of a particular verb (negative scores indicate a preference for DO- over PO-dative uses).

ENGLISH VERBS. The first question is whether it is indeed the case that Latinate English verbs from the classes of illocutionary communication and giving are restricted to the PO-dative for contemporary adult English speakers. This cannot be taken for granted; indeed, one recent corpus study (Fellbaum 2005) concluded that there is no evidence that this is the case. The relevant means are shown in Table 3.

	AGE 5–6		AGE 9–10		ADULTS	
	M *(SD)*	*M* *(SD)*	*M* *(SD)*	*M* *(SD)*	*M* *(SD)*	*M* *(SD)*
SENTENCE TYPE	DO	PO	DO	PO	DO	PO
VERB TYPE						
Alternating (Germanic)	4.25 (0.92)	4.17 (0.96)	4.13 (1.11)	4.09 (1.11)	4.51 (0.92)	4.65 (0.73)
PO-only (Latinate)	3.55 (1.16)	3.68 (1.16)	3.37 (1.14)	3.94 (1.01)	2.38 (1.03)	4.46 (0.88)

TABLE 3. Experiment 2, English verbs.

Inspection of these means suggests that the adults and older children prefer PO- over DO-dative uses of Latinate English verbs, but show no such preference for Germanic English verbs. The younger children do not show this pattern, but instead seem to exhibit a general dispreference for Latinate verbs, regardless of whether they are used in PO- or DO-dative sentences.

Conditional-inference-tree analysis, conducted in exactly the same way as for experiment 1, confirmed this pattern. For the adults (Figure 6) and older children (Figure 7) the trees are virtually identical (as for experiment 1, neither the conditional-inference-tree analysis nor the subsequent regression analysis supported the inclusion of semantic verb class, nested within verb type, as a predictor).
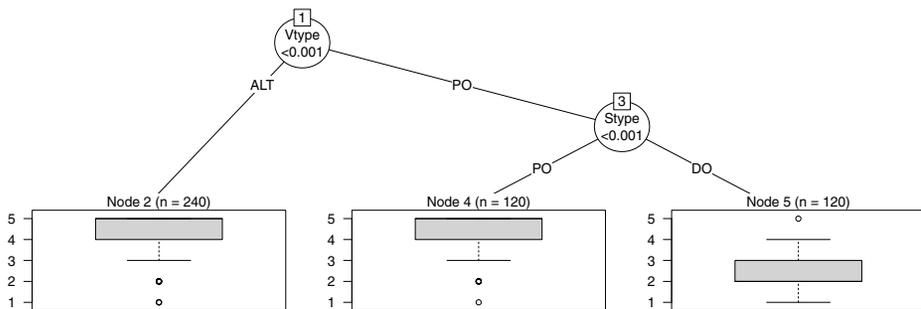
FIGURE 6. Conditional inference tree for experiment 2, English verbs, adults.
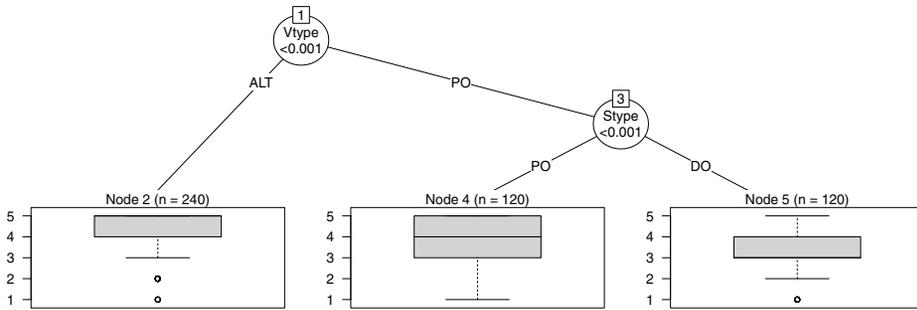
FIGURE 7. Conditional inference tree for experiment 2, English verbs, age nine to ten.

In both cases, participants prefer PO- over DO-uses of Latinate verbs (shown as Vtype = PO in the trees), but no such split is posited for Germanic verbs (Vtype = ALT). For the younger children (Figure 8), only a split of verb type is posited, reflecting an across-the-board preference for Germanic (Vtype = ALT) over Latinate (Vtype = PO) verbs.
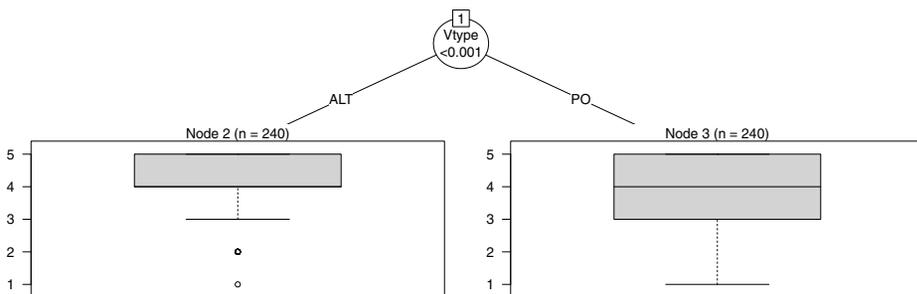
FIGURE 8. Conditional inference tree for experiment 2, English verbs, age five to six.

A conditional-inference-tree analysis collapsing across all ages groups confirmed the presence of a three-way interaction of verb type (Latinate/Germanic) by sentence type (PO/DO) by age (five to six, nine to ten, adult), with age-based splits posited for both PO- and DO-dative sentences containing Latinate verbs. This interaction was further confirmed by a linear mixed-effects regression analysis, conducted in exactly the same way as for experiment 1. The optimal model had a complex random-effects structure with random effects of participant and verb, by-participant random slopes for verb type, and by-verb random slopes for sentence type. Nevertheless, the fixed-effects structure was as predicted, with a three-way interaction of sentence type by verb type by age (gender was not associated with any main effects or interactions). The complete model is shown in Appendix Table A5 (though again the *p*-values correspond to a simpler model with no random slopes).

The findings for English verbs clearly demonstrate that, despite some skepticism in the recent literature, speakers indeed consider English verbs of Latinate origin (or at least those included in the present study) to be less than fully acceptable in the DO-dative construction; and this is true even for children aged nine to ten. The younger children do not appear to have acquired this restriction. We can be confident that this null finding does not simply reflect an inability to complete the judgment task, since children of this age performed as expected with English verbs in experiment 1. The find-

ings for the two older groups do not, of course, address the issue of whether speakers are actually using the proposed morphophonological constraint to identify which verbs may not appear in the DO-dative construction; it remains possible that they acquired this restriction purely distributionally (e.g. by entrenchment). It is to this question that we now turn.

NOVEL VERBS. All of the novel verbs presented in experiment 2 are semantically consistent with both the PO- and DO-dative constructions. According to the hypothesis under investigation, however, those with Latinate morphophonology (e.g. *repetrine*, *toncate*, *orgulate*) are predicted to be judged as significantly more acceptable in PO- than DO-datives. Those with native-like morphophonology (e.g. *blafe*, *nace*, *wiss*) are predicted to be judged as approximately equally acceptable in PO- and DO-datives. Since the verbs are novel, and semantically consistent with both dative constructions, any such finding could not be explained away as an artifact of attested usage or semantics, and hence would provide strong evidence for the psychological validity of the proposed morphophonological constraint.

The mean ratings for PO- and DO-dative uses of Latinate and native-like (Germanic) novel verbs are shown in Table 4.

	AGE 5–6		AGE 9–10		ADULTS	
	M (SD)	M (SD)	M (SD)	M (SD)	M (SD)	M (SD)
SENTENCE TYPE	DO	PO	DO	PO	DO	PO
VERB TYPE						
Alternating (Germanic)	3.18 (1.14)	3.28 (1.21)	3.62 (1.14)	3.80 (1.13)	4.10 (1.12)	4.18 (1.17)
PO-only (Latinate)	3.40 (1.24)	3.42 (1.21)	3.68 (1.13)	3.72 (0.94)	2.85 (1.12)	4.15 (0.99)

TABLE 4. Experiment 2, novel verbs.

Inspection of the mean ratings suggests that adults indeed prefer PO- over DO-dative uses of novel Latinate verbs, but show no such preference for native-like (Germanic) novel verbs. Children do not appear to show any such distinction, giving similar ratings to all sentences. The conditional-inference-tree analysis, conducted in the same way as for experiment 1, confirmed this pattern (Figure 9). For the adults, DO-dative sentences (top right-hand branch) are significantly more acceptable with Germanic novel verbs (Vtype = ALT) than Latinate novel verbs (Vtype = PO; compare the two rightmost plots). PO-dative sentences are rated as equally acceptable with both verb types; hence no split is posited.
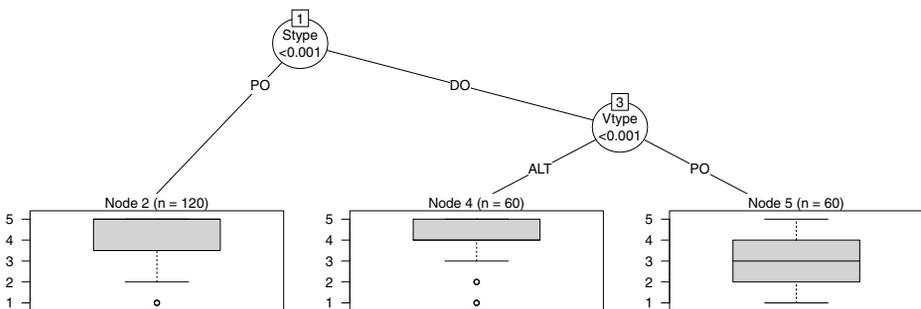
FIGURE 9. Conditional inference tree for experiment 2, novel verbs, adults.

The equivalent trees for the five-to-six- and nine-to-ten-year-olds are not shown since, in each case, no splits were posited. An analysis combining both child groups (again not shown) posited only a split for age, with the older children giving higher acceptability ratings than the younger children across the board (with median ratings of 4 and 3.5 respectively). An analysis combining all participants confirmed the presence of an age by verb type by sentence type interaction, with three age-based splits posited.

The presence of this interaction was confirmed by the linear mixed-effects regression analysis. As for the English verbs, the fixed-effects structure for the optimal model included a three-way interaction of verb type by sentence type by age (again, semantic verb class—in this case illocutionary communication vs. giving—was not associated with any main effects or interactions). The optimal model included a random effect of participant but not verb, and no random slopes. Neither were gender nor verb-stem plausibility associated with any fixed effects or interactions. The complete model is shown in Appendix Table A6.

In summary, the constraint whereby verbs with Latinate morphophonology are prohibited in the DO-dative is psychologically real for adults, and cannot be attributed to attested usage or verb semantics. Indeed, this restriction is productive in that adults apply it to novel verbs that they have not encountered previously. Although nine-to-ten-year-olds respect this restriction for English verbs, they have yet to acquire a productive constraint.

TESTING THE ENTRENCHMENT HYPOTHESIS. The entrenchment hypothesis predicts that the acceptability of overgeneralization errors will decrease with increasing verb frequency, due to the strengthening of the inference that nonattested uses are not permitted. Across experiments 1 and 2, participants rated overgeneralization errors with twenty-four PO-only verbs (i.e. DO-dative uses of *pull*, *drag*, *carry*, *haul*, *lift*, *hoist*, *shout*, *screech*, *whisper*, *hiss*, *scream*, *shriek*, *explain*, *confess*, *announce*, *declare*, *describe*, *recount*, *contribute*, *donate*, *transport*, *courier*, *release*, *propel*) and, for adults only, twelve DO-only verbs (PO-dative uses of *bet*, *wager*, *cost*, *fine*, *save*, *undercharge*, *refuse*, *deny*, *envy*, *begrudge*, *forgive*, *excuse*). Across all of these errors (regardless of whether they are violations of semantic or morphophonological constraints), the entrenchment hypothesis predicts a negative correlation between verb frequency and acceptability (but makes no prediction about alternating verbs). As noted earlier, testing this prediction is complicated by the fact that sentences with low-frequency verbs tend to receive lower acceptability ratings across the board. A common way to control for this confound is to use DIFFERENCE SCORES, obtained by subtracting the rating for each ungrammatical sentence from the rating for its grammatical equivalent (e.g. Pinker et al. 1987, Ambridge et al. 2008, Ambridge et al. 2009, Ambridge et al. 2011). The entrenchment hypothesis therefore predicts a positive correlation between verb frequency and the preference for grammatical over ungrammatical uses (or DISpreference for UNgrammatical uses), as measured by the difference score.

This prediction was tested using linear mixed-effects regression models implemented in R. In addition to English verbs, one could, in principle, include novel verbs with a frequency of zero, on the grounds that DO-dative uses of PO-only novel verbs were rated as ungrammatical by adults and hence constitute overgeneralization errors. The problem, however, is that it is not clear how to interpret children's performance with the novel verbs, where no significant differences were observed. We therefore decided to be maximally conservative by looking for an entrenchment effect across English verbs only.

As for the previous mixed-effects regression analyses, we began with a model that included one random effect (here, participant) and one fixed effect (here, age) and

added further fixed effects and their interactions until the optimal model (by log likeli-
hood test) was reached. Since the main analysis included all participants, DO-verbs—
which were rated by adults only—were excluded. Fixed effects and interactions were
included in the following order: age, verb class, verb frequency (from the BNC, sub-
jected to a log $n + 1$ transformation). This allowed for a particularly stringent test of the
entrenchment hypothesis, since verb frequency was entered into a model that already
contained fixed effects of age and verb class, and the models were compared statisti-
cally. Thus any verb frequency (entrenchment) effect observed reflects the independent
contribution of this predictor, above and beyond age and verb semantics.

   The optimal model included fixed effects of age, verb class, and verb frequency but
no interactions (nor any effect of gender). This model (see Appendix Table A7) in-
cluded a random effect of participant, but not of verb, nor any random slopes. Impor-
tantly, adding verb frequency to a model that already included age and verb class
resulted in a significantly better fit to the data (BIC = 2365 vs. 2369; $\chi^2 = 10.50$,
$p = 0.001$). Thus, in support of the entrenchment hypothesis, a significant positive cor-
relation was observed between verb frequency and participants' preference for gram-
matical over ungrammatical verb uses (which increased an average of 0.2 points on the
five-point scale for each log-frequency unit).

   THE ENTRENCHMENT HYPOTHESIS: INVESTIGATING DEVELOPMENTAL EFFECTS. The analy-
sis outlined above offered no evidence for an interaction of verb frequency by age. In
fact, adding this interaction yielded a higher BIC value (2374), indicating, if anything,
a worse fit (though the difference was not significant, $p = 0.1$, n.s.). Whether the en-
trenchment account actually predicts such an interaction is unclear. On the one hand,
the RELATIVE between-verb frequency differences (e.g. the ratio of attested PO-uses of
pull vs. *drag*) will presumably be of a similar magnitude for each age group, which
would suggest a similar entrenchment effect at each age. On the other hand, the
ABSOLUTE between-verb frequency differences (e.g. the extent to which PO-uses of *pull*
outnumber PO-uses of *drag*) will increase with age, suggesting an interaction (i.e. an
increase of the magnitude of the entrenchment effect with age). The finding of a similar
entrenchment effect at each age suggests that the entrenchment mechanism is somehow
sensitive to the overall size of the linguistic system (as proposed by Stefanowitsch
(2008), though see Goldberg 2011).

   In addition to the frequency effect discussed above, the entrenchment hypothesis pre-
dicts that participants' preference for grammatical over ungrammatical uses will in-
crease with age, as tokens of attested use build up in memory. That is, while the
entrenchment hypothesis may not predict an interaction of frequency by age, it certainly
predicts a main effect of age. This effect was observed in the present study. As shown in
Appendix Table A7, the mean preference for grammatical over ungrammatical uses was
significantly greater for the adults than both the five-to-six-year-olds (a mean prefer-
ence for grammatical over ungrammatical uses that was 1.43 points smaller than the
adults', $M = 0.16$) and the nine-to-ten-year-olds (1.11 points, $M = 0.16$). Tukey post-hoc
tests (implemented via the glht procedure in R) confirmed that while both child groups
differed significantly from the adults ($p < 0.001$), they did not differ significantly from
one another (mean difference = 0.32, $M = 0.16$, $p = 0.11$, n.s.). Note, however, that
while the finding of an increased preference for grammatical over ungrammatical uses
(between the adults and children) is certainly predicted by the entrenchment hypothesis,
it does not constitute strong support for it, since this finding is also consistent with the
less interesting possibility that adults were simply more adept at using the full range of
the rating scale.

Nevertheless, in conclusion, the finding of a positive correlation between verb frequency and participants' preference for grammatical over ungrammatical verb uses, regardless of age, constitutes compelling support for the entrenchment hypothesis.

3.3. Discussion. Experiment 2 investigated the claim that, for relevant semantic verb classes, verbs with Latinate morphophonology are restricted to the PO-dative construction, while those with native morphophonology may appear in both the PO- and DO-dative constructions. Although the psychological reality of this constraint has been disputed on the basis of corpus data (e.g. Fellbaum 2005), it was strongly supported in the present study, with adults showing this effect for Latinate versus native-like novel verbs, and older children for familiar verbs. Collapsing across both studies, the data also supported the entrenchment hypothesis, with all age groups displaying a frequency effect of a similar magnitude.

4. General discussion. The present studies investigated the question of how speakers learn to avoid ungrammatical dative utterances (e.g. *I said her no*) by obtaining ratings for PO- and DO-dative sentences from children aged five to six and nine to ten and adults. The claim that speakers use narrow-range verb semantics to determine the particular constructions in which verbs may and may not appear (Pinker 1989) has proved controversial (e.g. Bowerman 1988, Braine & Brooks 1995). Nevertheless, experiment 1 provided evidence that, with regard to the dative constructions, semantic constraints are indeed psychologically real for adult speakers. Furthermore, the classification of particular verbs as PO-only, DO-only, or alternating outlined by Pinker (1989) and Levin (1993) was supported for all age groups. A proposed morphophonological constraint prohibiting DO-dative uses of (at least some) Latinate verbs has proved equally controversial (e.g. Fellbaum 2005). Again, however, the findings of the present study (here experiment 2) demonstrated the psychological reality of this constraint for adult speakers. Older children rejected DO-dative uses of familiar, but not novel, Latinate verbs. Nevertheless, while they do not yet appear to have acquired a general constraint, the data from the older children (and adults) suggest that, contra Fellbaum (2005), the PO-only restriction on Latinate verbs such as *confess*, *announce*, and *describe* is a fact of English usage.

Thus, at some point between ages nine to ten and eighteen, speakers somehow learn to generalize the prohibition on certain verbs appearing with the DO-dative to all other verbs that share particular semantic and/or morphophonological properties.[10] Even before this point, however, speakers are apparently able to use the frequency of occurrence of verbs in particular constructions (i.e. entrenchment) to begin to restrict their overgeneralization errors. Interestingly, the same pattern (though several years earlier in development) is described by Tomasello (2003:180) when summarizing production studies of the transitive-causative construction: 'entrenchment works early … and semantic subclasses [of verbs] begin to work later, perhaps not until about 4;6 or so'.

Although the semantic verb class, morphophonology, and entrenchment hypotheses were all supported by the present findings, it is clear that none is sufficient on its own to account for the complete pattern of judgments observed in the present study (let alone across all studies that have looked at the retreat from overgeneralization for a variety of

---

[10] As a referee noted, there often seems to be a tacit assumption among researchers that 'language acquisition is more or less complete by age five'. It is therefore interesting to note that, even in this relatively central domain (i.e. the acquisition of verb argument structure), some parts of the system are not adultlike by the age of nine to ten.

constructions). The morphophonology hypothesis is specific to a subset of verbs and a single construction, and hence of course makes no claim to be a sufficient account of the retreat from overgeneralization. The semantic verb class hypothesis is not sufficient because it cannot account for the verb-frequency (entrenchment) effects observed in both the present study and many others. Although Pinker (1989) does not specifically rule out frequency effects (he does not discuss them), it is difficult to see how they could be incorporated into the account while maintaining its key assumption: the existence of discrete verb classes, membership in which determines verbs' participation in the alternation. Neither, of course, can the semantic verb class hypothesis account for the observed effect of morphophonology.

The entrenchment hypothesis is not sufficient as an account of the retreat from overgeneralization because it cannot account for the pervasive semantic effects observed in the present study and several others (e.g. Brooks & Tomasello 1999, Ambridge et al. 2008, Ambridge et al. 2009, Ambridge et al. 2011). Most obviously, it cannot explain why children reject certain uses of novel (zero-frequency) verbs (even when no verbal definition is given; see Ambridge et al. 2011). With regard to the observed morphophonology effect, while the entrenchment account can potentially explain how speakers learn that familiar Latinate verbs are restricted to the PO-dative, it is silent on the question of how this restriction is extended to novel pseudo-Latinate verbs.

Even if these problems could somehow be overcome, neither the semantic verb class nor the entrenchment hypothesis even attempts to explain the many processing and discourse-pragmatic effects (e.g. accessibility, pronominality, definiteness, animacy) that also determine the relative grammaticality of particular PO- and DO-dative utterances. Indeed, in some cases, these factors seem to outweigh both verb semantics and attested usage (Bresnan et al. 2007).

The conclusion that all of these factors interact to determine the relative grammaticality of particular PO- and DO-dative utterances is somewhat unsatisfactory, as it leaves unanswered the question of HOW they interact. What kind of learning mechanism could yield all of these effects? Although a definitive answer to this question remains a long way off, in what follows we sketch a possible account of such a learning procedure, based on a proposal outlined in Ambridge & Lieven 2011 and Ambridge et al. 2011.

The account shares with most usage-based approaches to linguistics the assumption that speakers acquire a construction by abstracting across concrete exemplars of that construction in the input that they have stored in memory.[11] Thus English speakers will acquire two independent dative constructions, as in 8.

(8) a. PO dative: [A] [B] [C] to [D]
                    (e.g. [John] [gave] [a present] to [his beautiful wife])
    b. DO dative: [P] [Q] [R] [S]
                    (e.g. [John] [gave] [her] [the book])

We have labeled the nominal (indeed, all) slots with letters, rather than with traditional labels such as [OBJECT], [THEME], or [RECIPIENT], in order to illustrate a central claim of the approach: each slot in each construction probabilistically exhibits the properties shared by the items that have appeared in this position in input utterances.[12] These prop-

---

[11] Thus the account is an exemplar-based model in that it 'recognizes input and generates outputs by analogical evaluation across a lexicon of distinct memory traces of remembered tokens of speech' (Gahl & Yu 2006:213).

[12] Hence while the D slot in the PO-dative construction will exhibit SOME of the properties exhibited by the R slot in the DO-dative construction, the overlap will not be complete. Since these slots are not 'the same', it makes no sense to label them both (for example) 'RECIPIENT' (and even RECIPIENT$_{PO}$ and RECIPIENT$_{DO}$ would be somewhat misleading)

erties may be semantic, phonological, or discourse-pragmatic in nature (there may be other possibilities too). For example, on the basis of the present studies and others cited, we conclude that the R slot in the DO-dative construction probabilistically exhibits, among others, the properties in 9.

(9) a. Semantic: potential possessor of S
    b. Phonological: monosyllabic/disyllabic with first-syllable stress
    c. Discourse pragmatic: 'light' (vs. 'heavy'), given (vs. new), pronominal (vs. full NP)

Suppose that a speaker wishes to convey the following (somewhat awkwardly paraphrased) semantic 'message': MARGE CAUSED HOMER TO HAVE A BOX BY PULLING A BOX TO HOMER. Suppose further that the speaker has decided to use the NPs *Marge*, *the box*, and *Homer*, and the verb *pull*. The assumption is that ALL of the constructions in the speakers' inventory will compete for activation (i.e. for the right to express the message). Activation is determined by a number of factors, one of which is 'relevance': the extent to which a construction conveys the intended message. For this example, the simple transitive construction (which would yield *Marge pulled the box*) will receive some activation, since it expresses part of the message, but far less than the PO- and DO-dative constructions. Other factors that determine the 'winning' construction are recency of use (to yield syntactic priming effects), overall construction frequency (DO > PO), and verb-in-construction frequency (PO > DO, since *pull* occurs more frequently in the PO- than DO-dative).

The final—and most important—factor is 'fit'. Fit refers to the extent that the properties of a particular construction slot (e.g. the Q-slot in the DO-dative) overlap with the properties of the putative slot filler (e.g. the verb *pull*). For this example, all other things being equal, the PO-dative construction will win out over the DO-dative construction because the semantic properties of *pull* are more consistent with the semantic properties of the 'verb' slot in the PO- than DO-dative construction (roughly CAUSE TO GO vs. CAUSE TO HAVE). Consequently, *Marge pulled the box to Homer* is rated as more acceptable than **Marge pulled Homer the box*. However, the second alternative is not deemed absolutely unacceptable (in fact it received a mean rating of 3.1/5), because the fit between each slot and its filler is good, though not optimal. This proposal therefore accounts for the graded nature of participants' judgments.

Of course, in many cases, all other things are not equal. For example, if *Homer* is discourse-old and realized as a pronoun, the overlap between the pragmatic properties of this NP and the 'recipient' slot in each construction will be greater for the DO- than PO-dative construction, increasing the acceptability (and production probability) of the form ?*Marge pulled him the box*. Similarly, the Latinate 'constraint' is incorporated probabilistically, not as a hard-and-fast prohibition. If the speaker chooses to use a Latinate verb such as *donate*, the overlap between the phonological properties of this item (bisyllabic, second-syllable stress) and the relevant slot will be lower for the 'verb' slot in the DO-dative (where virtually all previously attested forms will have been monosyllabic) than for the 'verb' slot in the PO-dative (where bisyllabic, second-syllable stress verbs will be more common). Thus the choice of a Latinate verb increases the probability/acceptability of the PO-dative at the expense of the DO-dative, but does not necessitate it. Again, other factors (e.g. the use of a discourse-old, pronominal recipient) may tip the balance toward a DO-dative.

In this way, the account yields effects of verb semantics and morphophonology (as well as processing and pragmatic factors), but in a probabilistic way that explains the graded nature of participants' judgments. The account also yields entrenchment effects:

items activate constructions in which they have previously appeared, with a strength proportional to the frequency of previous occurrence. For example, the high-frequency verb *pull* will activate the PO-dative (at the expense of the DO-dative) more strongly than will the lower-frequency verb *drag*. Hence, as observed in the present study, all other things being equal, DO-datives are rated as more unacceptable for *pull* than *drag*.

The account also yields preemption effects (e.g. Goldberg 1995, Boyd & Goldberg 2011), without having to posit an additional mechanism. Preemption is the claim that DO-dative utterances with (for example) *pull* are blocked specifically by the occurrence of PO-dative utterances with *pull*, as opposed to by occurrences of *pull* in ALL attested constructions (as under the classic entrenchment account). Under the present account (and the classic entrenchment account), occurrences of *pull* in other constructions (e.g. the simple transitive) will probabilistically block DO-dative uses. This is because, when all constructions are competing for the right to express a message, *pull* will activate all the constructions in which it has previously appeared (including the simple transitive) at the partial expense of the DO- (and PO-) dative (remember that ALL constructions in the speaker's inventory compete for activation to express every message). However, as proposed under a preemption account, occurrences of *pull* in the PO-dative will have a particularly large effect, since this will be the most highly activated competitor construction when the speaker wants to express a message that could alternatively be expressed with a DO-dative. That is, when the DO-dative scores highly on relevance, so will the PO-dative (and vice versa). Thus there is no need to specify in advance that the PO- and DO-dative preempt one another, or even—more generally—that constructions with similar meanings preempt one another (e.g. Goldberg 1995). Instead, this is a natural consequence of the way that all constructions compete for the right to express a given message, with activation levels determined by (among other things) relevance of each construction to the message.

One way to test this account would be to obtain human ratings for the extent to which individual verbs exhibit semantic features (and perhaps also pragmatic and phonological features) thought to be relevant to the constructions (e.g. possession, transfer) and to investigate whether these ratings can predict the relative (un)grammaticality of PO- and DO-dative utterances containing particular verbs. We have already begun to do this for other constructions that exhibit semantic constraints (e.g. the reversative *un*-prefixation morphological construction (Ambridge 2012) and the locative constructions (Ambridge et al. 2012). Running such studies with the dative constructions would seem to be the next logical step.

Of course, many of the details of this account remain to be fleshed out, not the least of which is precisely how the many different semantic, phonological, and pragmatic factors compete to yield a particular choice of construction in each case. It is also unclear whether this account could yield the observed pattern whereby entrenchment effects are evident earlier in development than effects of verb semantics or morphophonology. Investigation of these questions will likely require implementation of the account as a computational model. Nevertheless, this remains the only proposal of which we aware for a single account that yields effects of verb semantics, entrenchment/preemption, morphophonology, and pragmatic/processing factors. Furthermore, the account can potentially be applied to many different constructions for which overgeneralization errors have been observed, including the transitive-causative (e.g. Ambridge et al. 2008), the locative (Ambridge et al. 2012), and even morphological constructions such as the regular and irregular past-tense constructions (Ambridge 2011) and the reversative *un*-prefixation construction (Ambridge 2012).

In conclusion, the present study has provided evidence that, for adults, semantics, entrenchment, and morphophonology are all important determinants of the relative grammaticality of particular PO- and DO-dative utterances, and that, by the age of nine to ten, children have begun to use at least some of these factors to constrain their generalizations. We have proposed one possible account for how these factors—and others relevant to the constructions—interact. Whether or not this account turns out to be correct, it is becoming increasingly clear that any account of the formation and restriction of linguistic generalizations will have to incorporate a role for each of these factors, and, in particular, that accounts based purely on statistical learning of surface distributions (i.e. entrenchment, and—arguably—preemption) are unlikely to be sufficient.

APPENDIX A: RAW DATA TABLES AND STATISTICAL ANALYSIS (BOTH STUDIES)

VERB (CB1/CB2)	FREQUENCY (PO-ONLY) MC	FREQUENCY (PO-ONLY) BNC	FREQ. BAND	SENT. TYPE	SENTENCE	RAW SCORES AGE 5–6 M (SD)	RAW SCORES AGE 9–10 M (SD)	RAW SCORES ADULTS M (SD)	RAW SCORES TOTAL M (SD)	DIFFERENCE SCORES (PO minus DO) AGE 5–6 M (SD)	DIFFERENCE SCORES (PO minus DO) AGE 9–10 M (SD)	DIFFERENCE SCORES (PO minus DO) ADULTS M (SD)	DIFFERENCE SCORES (PO minus DO) TOTAL M (SD)
ACCOMPANIED MOTION (PO-ONLY)													
pull	591	1,421	high	PO	Marge pulled the box to Homer.	4.30 (0.82)	4.70 (0.67)	4.10 (1.10)	4.37 (0.89)	1.10 (1.10)	1.20 (1.03)	1.60 (1.43)	1.30 (1.18)
				DO	Marge pulled Homer the box.	3.20 (1.23)	3.50 (0.97)	2.50 (1.18)	3.07 (1.17)				
drag	4	162	low	PO	Marge dragged the box to Homer.	4.70 (0.48)	5.00 (0.00)	4.90 (0.32)	4.87 (0.35)	0.80 (0.92)	1.50 (0.71)	2.50 (1.18)	1.60 (1.16)
				DO	Marge dragged Homer the box.	3.90 (0.88)	3.50 (0.71)	2.40 (1.17)	3.27 (1.11)				
gezz/ spack	0	0	novel	PO	Marge NOVELed the box to Homer.	3.80 (1.69)	4.00 (0.94)	4.10 (0.74)	3.97 (1.16)	0.30 (1.70)	0.50 (1.08)	1.20 (1.81)	0.67 (1.56)
				DO	Marge NOVELed Homer the box.	3.50 (1.51)	3.50 (1.18)	2.90 (1.29)	3.30 (1.32)				
carry	140	2,349	high	PO	Bart carried the box to Lisa.	4.70 (0.48)	4.90 (0.32)	4.60 (0.70)	4.73 (0.52)	0.60 (1.07)	1.70 (0.82)	2.20 (0.79)	1.50 (1.11)
				DO	Bart carried Lisa the box.	4.10 (1.20)	3.20 (0.92)	2.40 (0.84)	3.23 (1.19)				
haul	1	23	low	PO	Bart hauled the box to Lisa.	4.60 (1.26)	4.20 (0.92)	3.40 (1.65)	4.07 (1.36)	0.90 (1.29)	1.00 (1.49)	0.70 (1.57)	0.87 (1.41)
				DO	Bart hauled Lisa the box.	3.70 (1.57)	3.20 (1.32)	2.70 (0.82)	3.20 (1.30)				
chool/ dape	0	0	novel	PO	Bart NOVELed the box to Lisa.	3.60 (1.35)	3.60 (1.17)	4.60 (0.52)	3.93 (1.14)	0.70 (1.34)	0.40 (0.84)	1.40 (1.17)	0.83 (1.18)
				DO	Bart NOVELed Lisa the box.	2.90 (1.20)	3.20 (1.23)	3.20 (1.03)	3.10 (1.12)				
lift	115	362	high	PO	Bart lifted the box to Lisa.	4.60 (1.26)	4.30 (0.82)	4.10 (1.29)	4.33 (1.12)	0.10 (0.32)	0.70 (1.49)	1.40 (1.65)	0.73 (1.36)
				DO	Bart lifted Lisa the box.	4.50 (1.27)	3.60 (1.35)	2.70 (1.25)	3.60 (1.45)				
hoist	2	12	low	PO	Bart hoisted the box to Lisa.	3.60 (1.07)	4.70 (0.48)	4.70 (0.67)	4.33 (0.92)	0.00 (1.25)	1.00 (0.82)	1.40 (1.07)	0.80 (1.19)
				DO	Bart hoisted Lisa the box.	3.60 (1.07)	3.70 (0.67)	3.30 (0.95)	3.53 (0.90)				
stip/ tesh	0	0	novel	PO	Bart NOVELed the box to Lisa.	2.80 (1.81)	4.50 (0.71)	4.60 (0.52)	3.97 (1.40)	−1.10 (1.66)	0.50 (0.71)	1.30 (0.95)	0.23 (1.52)
				DO	Bart NOVELed Lisa the box.	3.90 (1.66)	4.00 (0.94)	3.30 (1.16)	3.73 (1.28)				
MANNER OF SPEAKING (PO-ONLY)													
shout	37	500	high	PO	Homer shouted the instructions to Lisa.	4.30 (0.82)	4.60 (0.70)	4.80 (0.63)	4.57 (0.73)	−0.10 (0.57)	0.10 (0.88)	0.80 (1.32)	0.27 (1.01)
				DO	Homer shouted Lisa the instructions.	4.40 (0.70)	4.50 (0.53)	4.00 (1.15)	4.30 (0.84)				
screech	1	6	low	PO	Homer screeched the instructions to Lisa.	4.40 (0.84)	4.60 (0.52)	4.60 (0.84)	4.53 (0.73)	1.40 (1.35)	0.40 (0.84)	1.40 (1.07)	1.07 (1.17)
				DO	Homer screeched Lisa the instructions.	3.00 (1.41)	4.20 (0.63)	3.20 (1.03)	3.47 (1.17)				
stire/ nace	0	0	novel	PO	Homer NOVELed the instructions to Lisa.	3.10 (1.52)	3.70 (1.42)	4.90 (0.32)	3.90 (1.40)	0.00 (1.63)	0.30 (0.67)	0.40 (0.52)	0.23 (1.04)
				DO	Homer NOVELed Lisa the instructions.	3.10 (1.79)	3.40 (1.35)	4.50 (0.71)	3.67 (1.45)				
whisper	5	40	high	PO	Lisa whispered the answer to Bart.	4.50 (0.53)	4.90 (0.32)	5.00 (0.00)	4.80 (0.41)	−0.30 (0.48)	0.30 (0.82)	1.30 (0.82)	0.43 (0.97)
				DO	Lisa whispered Bart the answer.	4.80 (0.42)	4.60 (0.70)	3.70 (0.82)	4.37 (0.81)				
hiss	0	6	low	PO	Lisa hissed the answer to Bart.	3.10 (1.29)	4.20 (1.03)	4.40 (0.97)	3.90 (1.21)	−0.10 (0.88)	−0.20 (0.79)	1.00 (1.70)	0.23 (1.28)
				DO	Lisa hissed Bart the answer.	3.20 (1.23)	4.40 (0.97)	3.40 (0.97)	3.67 (1.15)				
dize/ fro	0	0	novel	PO	Lisa NOVELed the answer to Bart.	3.90 (1.52)	3.50 (1.43)	4.90 (0.32)	4.10 (1.32)	1.20 (1.93)	0.70 (1.57)	0.40 (0.70)	0.77 (1.48)
				DO	Lisa NOVELed Bart the answer.	2.70 (1.64)	2.80 (1.48)	4.50 (0.71)	3.33 (1.54)				

(TABLE A1. *Continues*)

VERB (CB1/CB2)	MC	BNC	FREQ. BAND	SENT. TYPE	SENTENCE	RAW SCORES AGE 5–6 M	(SD)	AGE 9–10 M	(SD)	ADULTS M	(SD)	TOTAL M	(SD)	DIFF AGE 5–6 M	(SD)	AGE 9–10 M	(SD)	ADULTS M	(SD)	TOTAL M	(SD)
scream	2	153	high	PO	Marge screamed the warning to Homer.	3.80	(1.14)	4.50	(0.71)	4.80	(0.42)	4.37	(0.89)	0.60	(1.71)	0.30	(0.82)	1.30	(0.95)	0.73	(1.26)
				DO	Marge screamed Homer the warning.	3.20	(1.14)	4.20	(1.32)	3.50	(0.97)	3.63	(1.19)								
shriek	1	10	low	PO	Marge shrieked the warning to Homer.	3.50	(1.72)	3.80	(1.03)	4.70	(0.48)	4.00	(1.26)	0.70	(1.77)	-0.10	(1.52)	1.00	(1.05)	0.53	(1.50)
				DO	Marge shrieked Homer the warning.	2.80	(1.81)	3.90	(0.99)	3.70	(1.16)	3.47	(1.41)								
dape/ stip	0	0	novel	PO	Marge NOVELed the warning to Homer.	3.50	(1.51)	4.00	(1.25)	4.90	(0.32)	4.13	(1.25)	0.60	(0.84)	0.70	(1.16)	0.90	(1.29)	0.73	(1.08)
				DO	Marge NOVELed Homer the warning.	2.90	(1.45)	3.30	(1.16)	4.00	(1.25)	3.40	(1.33)								
MONETARY (DO-ONLY)																					
bet	122	1,027	high	PO	Homer bet the $5 to Marge.	NA	NA	NA	NA	3.50	(1.18)	3.50	(1.18)	NA	NA	NA	NA	-0.50	(1.08)	-0.50	(1.08)
				DO	Homer bet Marge the $5.	NA	NA	NA	NA	4.00	(0.94)	4.00	(0.94)								
wager	0	0	low	PO	Homer wagered the $5 to Marge.	NA	NA	NA	NA	2.70	(1.16)	2.70	(1.16)	NA	NA	NA	NA	-0.30	(1.57)	-0.30	(1.57)
				DO	Homer wagered Marge the $5.	NA	NA	NA	NA	3.00	(1.25)	3.00	(1.25)								
tesh/ chool	0	0	novel	PO	Homer NOVELed the $5 to Marge.	NA	NA	NA	NA	2.40	(0.97)	2.40	(0.97)	NA	NA	NA	NA	-1.10	(1.20)	-1.10	(1.20)
				DO	Homer NOVELed Marge the $5.	NA	NA	NA	NA	3.50	(0.97)	3.50	(0.97)								
cost	16	1,263	high	PO	Bart cost the $50 to Marge.	NA	NA	NA	NA	2.10	(1.10)	2.10	(1.10)	NA	NA	NA	NA	-1.40	(1.84)	-1.40	(1.84)
				DO	Bart cost Marge the $50.	NA	NA	NA	NA	3.50	(0.97)	3.50	(0.97)								
fine	0	72	low	PO	Bart fined the $50 to Marge.	NA	NA	NA	NA	1.50	(0.97)	1.50	(0.97)	NA	NA	NA	NA	-1.90	(1.20)	-1.90	(1.20)
				DO	Bart fined Marge the $50.	NA	NA	NA	NA	3.40	(1.35)	3.40	(1.35)								
fro/ wiss	0	0	novel	PO	Bart NOVELed the $50 to Marge.	NA	NA	NA	NA	1.80	(0.92)	1.80	(0.92)	NA	NA	NA	NA	-1.40	(1.26)	-1.40	(1.26)
				DO	Bart NOVELed Marge the $50.	NA	NA	NA	NA	3.20	(1.40)	3.20	(1.40)								
save	68	1,429	high	PO	Lisa saved the $10 to Homer.	NA	NA	NA	NA	1.90	(0.57)	1.90	(0.57)	NA	NA	N/A	NA	-2.20	(1.40)	-2.20	(1.40)
				DO	Lisa saved Homer the $10.	NA	NA	NA	NA	4.10	(1.20)	4.10	(1.20)								
undercharge	0	0	low	PO	Lisa undercharged the $10 to Homer.	NA	NA	NA	NA	1.90	(0.74)	1.90	(0.74)	NA	NA	NA	NA	-1.30	(1.49)	-1.30	(1.49)
				DO	Lisa undercharged Homer the $10.	NA	NA	NA	NA	3.20	(1.32)	3.20	(1.32)								
gare/ dize	0	0	novel	PO	Lisa NOVELed the $10 to Homer.	NA	NA	NA	NA	2.40	(1.26)	2.40	(1.26)	NA	NA	NA	NA	-1.00	(0.94)	-1.00	(0.94)
				DO	Lisa NOVELed Homer the $10.	NA	NA	NA	NA	3.40	(0.70)	3.40	(0.70)								
FUTURE NOT HAVING (DO-ONLY)																					
refuse	1	248	high	PO	Marge refused the beer to Homer.	NA	NA	NA	NA	3.40	(1.17)	3.40	(1.17)	NA	NA	NA	NA	-1.00	(1.33)	-1.00	(1.33)
				DO	Marge refused Homer the beer.	NA	NA	NA	NA	4.40	(0.70)	4.40	(0.70)								
deny	1	249	low	PO	Marge denied the beer to Homer.	NA	NA	NA	NA	3.40	(1.43)	3.40	(1.43)	NA	NA	NA	NA	-1.20	(1.32)	-1.20	(1.32)
				DO	Marge denied Homer the beer.	NA	NA	NA	NA	4.60	(0.70)	4.60	(0.70)								
drice/ gare	0	0	novel	PO	Marge NOVELed the beer to Homer.	NA	NA	NA	NA	3.90	(1.10)	3.90	(1.10)	NA	NA	NA	NA	-0.20	(1.40)	-0.20	(1.40)
				DO	Marge NOVELed Homer the beer.	NA	NA	NA	NA	4.10	(1.20)	4.10	(1.20)								
envy	0	15	high	PO	Bart envied the chocolate to Lisa.	NA	NA	NA	NA	1.50	(0.53)	1.50	(0.53)	NA	NA	NA	NA	-0.20	(0.63)	-0.20	(0.63)
				DO	Bart envied Lisa the chocolate.	NA	NA	NA	NA	1.70	(0.82)	1.70	(0.82)								

(TABLE A1. *Continues*)

VERB (CB1/CB2)	FREQ. MC	FREQ. BNC	FREQ. BAND	SENT. TYPE	SENTENCE	RAW AGE 5–6 M	SD	RAW AGE 9–10 M	SD	RAW ADULTS M	SD	RAW TOTAL M	SD	DIFF AGE 5–6 M	SD	DIFF AGE 9–10 M	SD	DIFF ADULTS M	SD	DIFF TOTAL M	SD
begrudge	0	7	low	PO	Bart begrudged the chocolate to Lisa.	NA	NA	NA	NA	3.30	(1.34)	3.30	(1.34)	NA	NA	NA	NA	−1.00	(1.63)	−1.00	(1.63)
				DO	Bart begrudged Lisa the chocolate.	NA	NA	NA	NA	4.30	(1.34)	4.30	(1.34)								
ffidge/ glip	0	0	novel	PO	Bart NOVELed the chocolate to Lisa.	NA	NA	NA	NA	1.60	(0.70)	1.60	(0.70)	NA	NA	NA	NA	−0.30	(0.95)	−0.30	(0.95)
				DO	Bart NOVELed Lisa the chocolate.	NA	NA	NA	NA	1.90	(1.10)	1.90	(1.10)								
forgive	2	162	high	PO	Homer forgave the accident to Bart.	NA	NA	NA	NA	2.40	(0.97)	2.40	(0.97)	NA	NA	NA	NA	−0.40	(0.97)	−0.40	(0.97)
				DO	Homer forgave Bart the accident.	NA	NA	NA	NA	2.80	(1.23)	2.80	(1.23)								
excuse	0	566	low	PO	Homer excused the accident to Bart.	NA	NA	NA	NA	2.50	(1.18)	2.50	(1.18)	NA	NA	NA	NA	0.40	(0.84)	0.40	(0.84)
				DO	Homer excused Bart the accident.	NA	NA	NA	NA	2.10	(0.99)	2.10	(0.99)								
rife/ gezz	0	0	novel	PO	Homer NOVELed the accident to Bart.	NA	NA	NA	NA	2.70	(1.34)	2.70	(1.34)	NA	NA	NA	NA	−0.50	(1.18)	−0.50	(1.18)
				DO	Homer NOVELed Bart the accident.	NA	NA	NA	NA	3.20	(1.32)	3.20	(1.32)								
ILLOCUTIONARY COMMUNICATION (ALTERNATING)																					
show	373	3,484	high	PO	Lisa showed the answer to Homer.	3.60	(1.58)	4.20	(0.79)	4.00	(1.63)	3.93	(1.36)	−1.00	(1.49)	0.00	(0.82)	−0.20	(1.32)	−0.40	(1.28)
				DO	Lisa showed Homer the answer.	4.60	(0.70)	4.20	(1.14)	4.20	(1.23)	4.33	(1.03)								
teach	32	823	low	PO	Lisa taught the answer to Homer.	3.90	(1.29)	4.00	(0.67)	3.50	(1.08)	3.80	(1.03)	−0.30	(0.82)	−0.40	(0.70)	−0.40	(1.58)	−0.37	(1.07)
				DO	Lisa taught Homer the answer.	4.20	(1.32)	4.40	(0.70)	3.90	(1.20)	4.17	(1.09)								
spack/ blafe	0	0	novel	PO	Lisa NOVELed the answer to Homer.	3.20	(1.81)	3.80	(1.23)	3.70	(1.34)	3.57	(1.45)	−0.30	(1.64)	−0.20	(0.79)	−0.20	(1.03)	−0.23	(1.17)
				DO	Lisa NOVELed Homer the answer.	3.50	(0.85)	4.00	(1.25)	3.90	(1.37)	3.80	(1.16)								
ask	294	7,650	high	PO	Homer asked a question to Marge.	4.20	(0.92)	4.40	(0.84)	3.30	(1.06)	3.97	(1.03)	−0.50	(0.71)	−0.40	(1.17)	−1.40	(1.26)	−0.77	(1.14)
				DO	Homer asked Marge a question.	4.70	(0.48)	4.80	(0.63)	4.70	(0.48)	4.73	(0.52)								
pose	0	68	low	PO	Homer posed a question to Marge.	3.50	(1.35)	3.10	(1.29)	4.40	(0.70)	3.67	(1.24)	−0.80	(1.40)	−0.10	(1.29)	1.00	(0.94)	0.03	(1.40)
				DO	Homer posed Marge a question.	4.30	(0.82)	3.20	(0.92)	3.40	(0.84)	3.63	(0.96)								
glip/ bredge	0	0	novel	PO	Homer NOVELed a question to Marge.	3.80	(1.55)	3.70	(1.16)	3.90	(0.88)	3.80	(1.19)	0.40	(1.71)	0.20	(1.14)	−0.50	(1.58)	0.03	(1.50)
				DO	Homer NOVELed Marge a question.	3.40	(1.51)	3.50	(1.08)	4.40	(1.26)	3.77	(1.33)								
tell	1,682	12,201	high	PO	Lisa told the story to Bart.	4.40	(0.84)	4.90	(0.32)	4.70	(0.48)	4.67	(0.61)	−0.50	(0.85)	−0.10	(0.32)	0.10	(0.88)	−0.17	(0.75)
				DO	Lisa told Bart the story.	4.90	(0.32)	5.00	(0.00)	4.60	(0.97)	4.83	(0.59)								
quote	1	375	low	PO	Lisa quoted the story to Bart.	3.30	(1.49)	3.80	(0.92)	4.60	(0.52)	3.90	(1.16)	−0.50	(1.35)	0.20	(0.92)	1.60	(0.84)	0.43	(1.36)
				DO	Lisa quoted Bart the story.	3.80	(1.40)	3.60	(0.97)	3.00	(1.05)	3.47	(1.17)								
bredge/ stire	0	0	novel	PO	Lisa NOVELed the story to Bart.	3.70	(1.49)	4.20	(1.03)	4.30	(0.82)	4.07	(1.14)	0.60	(1.17)	0.10	(0.74)	0.20	(1.14)	0.30	(1.02)
				DO	Lisa NOVELed Bart the story.	3.10	(1.10)	4.10	(0.74)	4.10	(0.99)	3.77	(1.04)								
GIVING (ALTERNATING)																					
give	1,097	14,841	high	PO	Lisa gave the book to Bart.	4.60	(0.70)	4.90	(0.32)	5.00	(0.00)	4.83	(0.46)	−0.10	(0.57)	0.10	(0.32)	0.20	(0.42)	0.07	(0.45)
				DO	Lisa gave Bart the book.	4.70	(0.48)	4.80	(0.42)	4.80	(0.42)	4.77	(0.43)								
hand	42	319	low	PO	Lisa handed the book to Bart.	4.80	(0.42)	4.80	(0.42)	4.80	(0.63)	4.80	(0.48)	0.00	(0.00)	0.30	(0.48)	−0.20	(0.63)	0.03	(0.49)
				DO	Lisa handed Bart the book.	4.80	(0.53)	4.50	(0.53)	5.00	(0.00)	4.77	(0.43)								

(TABLE A1. *Continues*)

VERB (CB1/CB2)	FREQUENCY MC	FREQUENCY BNC	FREQ. BAND	SENT. TYPE	SENTENCE	RAW SCORES AGE 5–6 M	(SD)	AGE 9–10 M	(SD)	ADULTS M	(SD)	TOTAL M	(SD)	DIFFERENCE SCORES (PO MINUS DO) AGE 5–6 M	(SD)	AGE 9–10 M	(SD)	ADULTS M	(SD)	TOTAL M	(SD)
blafe/flidge	0	0	novel	PO	Lisa NOVELed the book to Bart.	3.30	(1.57)	3.10	(1.20)	4.60	(0.52)	3.67	(1.32)	0.20	(0.79)	−0.30	(1.25)	0.10	(0.88)	0.00	(0.98)
				DO	Lisa NOVELed Bart the book.	3.10	(1.52)	3.40	(1.26)	4.50	(0.71)	3.67	(1.32)								
send	139	2,891	high	PO	Bart sent the package to Marge.	4.40	(0.84)	4.70	(0.48)	4.70	(0.67)	4.60	(0.67)	−0.10	(0.88)	−0.20	(0.63)	−0.20	(0.79)	−0.17	(0.75)
				DO	Bart sent Marge the package.	4.50	(0.97)	4.90	(0.32)	4.90	(0.32)	4.77	(0.63)								
mail	0	15	low	PO	Bart mailed the package to Marge.	3.70	(1.42)	4.10	(0.99)	4.60	(0.97)	4.13	(1.17)	0.10	(1.60)	−0.20	(0.92)	0.90	(1.29)	0.27	(1.34)
				DO	Bart mailed Marge the package.	3.60	(1.35)	4.30	(1.06)	3.70	(1.25)	3.87	(1.22)								
nace/drice	0	0	novel	PO	Bart NOVELed the package to Marge.	3.10	(1.52)	3.60	(1.51)	4.40	(0.84)	3.70	(1.39)	0.10	(2.02)	0.10	(1.10)	0.40	(1.26)	0.20	(1.47)
				DO	Bart NOVELed Marge the package.	3.00	(1.83)	3.50	(1.18)	4.00	(0.94)	3.50	(1.38)								
throw	551	1,158	high	PO	Homer threw the ball to Bart.	4.50	(0.97)	4.70	(0.48)	4.90	(0.32)	4.70	(0.65)	0.00	(1.25)	0.10	(0.88)	0.30	(0.67)	0.13	(0.94)
				DO	Homer threw Bart the ball.	4.50	(0.85)	4.60	(0.70)	4.60	(0.70)	4.57	(0.73)								
toss	5	49	low	PO	Homer tossed the ball to Bart.	4.30	(0.95)	4.30	(0.95)	4.90	(0.32)	4.50	(0.82)	0.80	(1.69)	−0.40	(0.97)	0.10	(0.32)	0.17	(1.21)
				DO	Homer tossed Bart the ball.	3.50	(1.43)	4.70	(0.67)	4.80	(0.42)	4.33	(1.09)								
wiss/rife	0	0	novel	PO	Homer NOVELed the ball to Bart.	4.40	(0.84)	3.70	(1.34)	4.80	(0.42)	4.30	(1.02)	1.00	(1.94)	0.90	(1.66)	0.50	(0.97)	0.80	(1.54)
				DO	Homer NOVELed Bart the ball.	3.40	(1.65)	2.80	(1.40)	4.30	(0.82)	3.50	(1.43)								

TABLE A1. Sentences and mean ratings for experiment 1.

EFFECT	$M (\beta)$	SE	t	HPD INTERVALS		p
				LOWER	UPPER	
(intercept)	4.30	0.16	26.29	4.03	4.60	**0.00**
Sentence type (PO vs. DO)	0.15	0.15	1.02	–0.08	0.36	0.20
Verb type (PO vs. Alt)	–1.18	0.19	–6.03	–1.53	–0.83	**0.00**
Age (5–6 vs. Adult)	0.04	0.17	0.25	–0.31	0.31	0.81
Age (9–10 vs. Adult)	0.12	0.17	0.69	–0.18	0.44	0.49
Sentence type × Verb type	1.23	0.21	5.91	0.90	1.54	**0.00**
Sentence type × Age (5–6)	–0.39	0.16	–2.43	–0.74	–0.10	**0.02**
Sentence type × Age (9–10)	–0.24	0.16	–1.50	–0.57	0.09	0.14
Verb type × Age (5–6)	0.53	0.16	3.31	0.21	0.85	**0.00**
Verb type × Age (9–10)	0.63	0.16	3.93	0.31	0.96	**0.00**
Sentence type × Verb type × Age (5–6)	**–0.52**	**0.23**	**–2.27**	**–0.97**	**–0.06**	**0.03**
Sentence type × Verb type × Age (9–10)	**–0.48**	**0.23**	**–2.12**	**–0.98**	**–0.09**	**0.04**
Participant *SD*	0.39					
Verb *SD*	0.39					
By-verb random slopes for Sentence type *SD*	0.32					

TABLE A2. Experiment 1, English verbs, linear mixed-effects regression model.

EFFECT	$M (\beta)$	SE	t	HPD INTERVALS		p
				LOWER	UPPER	
(intercept)	4.15	0.19	21.62	3.85	4.46	**0.00**
Sentence type (PO vs. DO)	0.18	0.10	1.75	–0.01	0.39	0.08
Verb type (PO vs. Alt)	–0.24	0.10	–2.33	–0.44	–0.04	**0.02**
Age (5–6 vs. Adult)	**–0.86**	**0.26**	**–3.35**	**–1.25**	**–0.47**	**0.00**
Age (9–10 vs. Adult)	**–0.60**	**0.26**	**–2.34**	**–1.01**	**–0.19**	**0.02**
Sentence type × Verb type	**0.39**	**0.15**	**2.66**	**0.11**	**0.67**	**0.01**
Participant *SD*	0.75					

TABLE A3. Experiment 1, novel verbs, linear mixed-effects regression model.

VERB (CB1/CB2)	FREQUENCY MC	BNC	FREQ. BAND	SENT. TYPE	SENTENCE	RAW SCORES AGE 5–6 M	(SD)	AGE 9–10 M	(SD)	ADULTS M	(SD)	TOTAL M	(SD)	DIFFERENCE SCORES (PO MINUS DO) AGE 5–6 M	(SD)	AGE 9–10 M	(SD)	ADULTS M	(SD)	TOTAL M	(SD)
ILLOCUTIONARY COMMUNICATION (LATINATE; PO-ONLY)																					
explain	0	1,122	high	PO	Lisa explained the mistake to Homer.	4.50	(0.71)	4.20	(0.92)	5.00	(0.00)	4.57	(0.73)	0.60	(0.97)	1.20	(1.48)	2.90	(1.20)	1.57	(1.55)
				DO	Lisa explained Homer the mistake.	3.90	(0.99)	3.00	(1.33)	2.10	(1.20)	3.00	(1.36)								
confess	0	70	low	PO	Lisa confessed the mistake to Homer.	3.70	(0.67)	4.40	(0.70)	4.60	(0.52)	4.23	(0.73)	0.40	(1.17)	1.10	(0.88)	2.10	(0.74)	1.20	(1.16)
				DO	Lisa confessed Homer the mistake.	3.30	(0.95)	3.30	(0.95)	2.50	(0.97)	3.03	(1.00)								
calimode/toncate	0	0	novel	PO	Lisa NOVELed the mistake to Homer.	3.50	(1.08)	3.70	(1.25)	4.50	(0.71)	3.90	(1.09)	0.20	(1.03)	−0.30	(1.16)	1.90	(1.37)	0.60	(1.50)
				DO	Lisa NOVELed Homer the mistake.	3.30	(1.16)	4.00	(0.82)	2.60	(0.97)	3.30	(1.12)								
announce	0	208	high	PO	Homer announced the news to Marge.	3.60	(1.07)	4.40	(0.84)	5.00	(0.00)	4.33	(0.96)	0.20	(1.14)	0.90	(2.18)	2.90	(0.74)	1.33	(1.84)
				DO	Homer announced Marge the news.	3.40	(1.43)	3.50	(1.65)	2.10	(0.74)	3.00	(1.44)								
declare	0	156	low	PO	Homer declared the news to Marge.	4.00	(0.94)	4.20	(1.23)	4.60	(0.52)	4.27	(0.94)	0.40	(1.26)	0.60	(1.78)	2.40	(1.35)	1.13	(1.70)
				DO	Homer declared Marge the news.	3.60	(0.84)	3.60	(1.17)	2.20	(1.23)	3.13	(1.25)								
sinnate/dorfinate	0	0	novel	PO	Homer NOVELed the news to Marge.	3.70	(1.42)	3.60	(0.97)	3.30	(1.06)	3.53	(1.14)	0.50	(1.27)	0.50	(1.58)	0.70	(1.34)	0.57	(1.36)
				DO	Homer NOVELed Marge the news.	3.20	(1.32)	3.10	(1.52)	2.60	(0.97)	2.97	(1.27)								
describe	0	655	high	PO	Lisa described the story to Bart.	4.30	(0.95)	4.60	(0.70)	5.00	(0.00)	4.63	(0.72)	0.40	(0.52)	1.30	(1.16)	2.50	(1.18)	1.40	(1.30)
				DO	Lisa described Bart the story.	3.90	(1.20)	3.30	(1.25)	2.50	(1.18)	3.23	(1.30)								
recount	0	9	low	PO	Lisa recounted the story to Bart.	4.00	(1.15)	3.30	(0.82)	4.60	(0.52)	3.97	(1.00)	−0.20	(1.32)	−0.10	(0.99)	2.00	(1.25)	0.57	(1.55)
				DO	Lisa recounted Bart the story.	4.20	(1.03)	3.40	(1.07)	2.60	(0.97)	3.40	(1.19)								
orgulate/repetrine	0	0	novel	PO	Lisa NOVELed the story to Bart.	3.10	(1.20)	3.80	(0.79)	4.70	(0.67)	3.87	(1.11)	−0.40	(1.65)	−0.50	(0.71)	1.20	(1.14)	0.10	(1.42)
				DO	Lisa NOVELed Bart the story.	3.50	(1.18)	4.30	(0.95)	3.50	(0.97)	3.77	(1.07)								
GIVING (LATINATE; PO-ONLY)																					
contribute	0	218	high	PO	Lisa contributed the book to Bart.	3.20	(1.32)	4.20	(0.79)	3.50	(0.97)	3.63	(1.10)	0.10	(1.97)	0.50	(0.97)	1.60	(1.51)	0.73	(1.62)
				DO	Lisa contributed Bart the book.	3.10	(1.45)	3.70	(0.67)	1.90	(0.88)	2.90	(1.27)								
donate	0	39	low	PO	Lisa donated the book to Bart.	3.30	(1.34)	4.10	(0.88)	4.50	(0.97)	3.97	(1.16)	−0.30	(1.34)	0.90	(0.57)	2.10	(1.20)	0.90	(1.45)
				DO	Lisa donated Bart the book.	3.60	(0.84)	3.20	(0.63)	2.40	(0.84)	3.07	(0.91)								
repetrine/calimode	0	0	novel	PO	Lisa NOVELed the book to Bart.	3.50	(1.18)	3.70	(1.06)	3.50	(1.08)	3.57	(1.07)	0.40	(1.51)	0.20	(0.63)	0.80	(1.81)	0.47	(1.38)
				DO	Lisa NOVELed Bart the book.	3.10	(1.60)	3.50	(0.97)	2.70	(1.49)	3.10	(1.37)								
transport	0	52	high	PO	Bart transported the package to Marge.	3.50	(1.43)	3.90	(0.88)	4.90	(0.32)	4.10	(1.12)	0.20	(1.14)	0.10	(0.88)	2.50	(1.18)	0.93	(1.53)
				DO	Bart transported Marge the package.	3.30	(1.25)	3.80	(0.79)	2.40	(1.26)	3.17	(1.23)								
courier	2	0	low	PO	Bart couriered the package to Marge.	3.30	(1.06)	3.40	(1.07)	3.80	(1.32)	3.50	(1.14)	−0.50	(1.84)	0.50	(1.35)	0.80	(0.79)	0.27	(1.46)
				DO	Bart couriered Marge the package.	3.80	(1.40)	2.90	(1.37)	3.00	(1.05)	3.23	(1.30)								
toncate/orgulate	0	0	novel	PO	Bart NOVELed the package to Marge.	3.50	(1.35)	3.60	(0.97)	4.50	(0.71)	3.87	(1.11)	−0.10	(0.99)	0.00	(0.82)	1.60	(1.65)	0.50	(1.41)
				DO	Bart NOVELed Marge the package.	3.60	(0.70)	3.60	(1.07)	2.90	(1.10)	3.37	(1.00)								
release	0	260	high	PO	Homer released the ball to Bart.	3.50	(1.51)	3.50	(0.97)	3.90	(1.20)	3.63	(1.22)	−0.10	(1.20)	0.30	(0.95)	1.70	(1.34)	0.63	(1.38)
				DO	Homer released Bart the ball.	3.60	(0.97)	3.20	(1.55)	2.20	(1.14)	3.00	(1.34)								

(TABLE A4. *Continues*)

VERB (CB1/CB2)	FREQUENCY MC	BNC	FREQ. BAND	SENT. TYPE	SENTENCE	RAW SCORES AGE 5–6 M	(SD)	AGE 9–10 M	(SD)	ADULTS M	(SD)	TOTAL M	(SD)	DIFFERENCE SCORES (PO MINUS DO) AGE 5–6 M	(SD)	AGE 9–10 M	(SD)	ADULTS M	(SD)	TOTAL M	(SD)
propel	0	4	low	PO	Homer propelled the ball to Bart.	3.20	(1.14)	3.10	(1.20)	4.10	(0.99)	3.47	(1.17)	0.30	(1.06)	−0.40	(1.84)	1.40	(1.35)	0.43	(1.59)
				DO	Homer propelled Bart the ball.	2.90	(1.29)	3.50	(1.08)	2.70	(0.82)	3.03	(1.10)								
dorfinate/ sinmate	0	0	novel	PO	Homer NOVELed the ball to Bart.	3.20	(1.23)	3.90	(0.74)	4.40	(0.84)	3.83	(1.05)	−0.50	(1.18)	0.30	(1.06)	1.60	(1.51)	0.47	(1.50)
				DO	Homer NOVELed Bart the ball.	3.70	(1.49)	3.60	(1.17)	2.80	(1.14)	3.37	(1.30)								

ILLOCUTIONARY COMMUNICATION (NATIVE; ALTERNATING)

VERB (CB1/CB2)	FREQUENCY MC	BNC	FREQ. BAND	SENT. TYPE	SENTENCE	RAW SCORES AGE 5–6 M	(SD)	AGE 9–10 M	(SD)	ADULTS M	(SD)	TOTAL M	(SD)	DIFFERENCE SCORES (PO MINUS DO) AGE 5–6 M	(SD)	AGE 9–10 M	(SD)	ADULTS M	(SD)	TOTAL M	(SD)
show	373	3,484	high	PO	Lisa showed the answer to Homer.	4.50	(0.53)	4.20	(1.23)	4.20	(1.23)	4.30	(1.02)	0.30	(0.82)	−0.10	(1.20)	−0.30	(0.67)	−0.03	(0.93)
				DO	Lisa showed Homer the answer.	4.20	(0.92)	4.30	(1.25)	4.50	(0.97)	4.33	(1.03)								
teach	32	823	low	PO	Lisa taught the answer to Homer.	4.10	(0.74)	3.00	(1.25)	3.90	(0.88)	3.67	(1.06)	−0.20	(0.92)	−0.50	(1.72)	−0.90	(1.10)	−0.53	(1.28)
				DO	Lisa taught Homer the answer.	4.30	(0.67)	3.50	(1.08)	4.80	(0.42)	4.20	(0.92)								
spack/ blafe	0	0	novel	PO	Lisa NOVELed the answer to Homer.	3.50	(1.08)	3.80	(0.92)	3.70	(1.42)	3.67	(1.12)	0.20	(0.42)	0.50	(1.18)	−0.50	(0.85)	0.07	(0.94)
				DO	Lisa NOVELed Homer the answer.	3.30	(0.95)	3.30	(0.82)	4.20	(0.92)	3.60	(0.97)								
ask	294	7,650	high	PO	Homer asked a question to Marge.	3.40	(1.17)	4.20	(1.03)	3.80	(1.14)	3.80	(1.13)	−1.30	(1.25)	−0.60	(1.26)	−1.20	(1.14)	−1.03	(1.22)
				DO	Homer asked Marge a question.	4.70	(0.48)	4.80	(0.42)	5.00	(0.00)	4.83	(0.38)								
pose	0	68	low	PO	Homer posed a question to Marge.	3.80	(0.79)	3.10	(0.74)	4.60	(0.52)	3.83	(0.91)	0.50	(1.08)	0.00	(1.25)	1.00	(1.56)	0.50	(1.33)
				DO	Homer posed Marge a question.	3.30	(1.25)	3.10	(1.29)	3.60	(1.26)	3.33	(1.24)								
glip/ bredge	0	0	novel	PO	Homer NOVELed a question to Marge.	3.30	(0.95)	4.50	(0.97)	3.70	(1.16)	3.83	(1.12)	−0.20	(0.42)	0.20	(0.92)	−0.90	(0.99)	−0.30	(0.92)
				DO	Homer NOVELed Marge a question.	3.50	(0.97)	4.30	(0.67)	4.60	(0.70)	4.13	(0.90)								

GIVING (NATIVE; ALTERNATING)

VERB (CB1/CB2)	FREQUENCY MC	BNC	FREQ. BAND	SENT. TYPE	SENTENCE	RAW SCORES AGE 5–6 M	(SD)	AGE 9–10 M	(SD)	ADULTS M	(SD)	TOTAL M	(SD)	DIFFERENCE SCORES (PO MINUS DO) AGE 5–6 M	(SD)	AGE 9–10 M	(SD)	ADULTS M	(SD)	TOTAL M	(SD)
tell	1,682	12,201	high	PO	Lisa told the story to Bart.	4.60	(0.70)	4.60	(0.70)	4.70	(0.48)	4.63	(0.61)	0.10	(0.32)	0.00	(0.67)	−0.10	(0.57)	0.00	(0.53)
				DO	Lisa told Bart the story.	4.50	(0.71)	4.60	(0.97)	4.80	(0.42)	4.63	(0.72)								
quote	1	375	low	PO	Lisa quoted the story to Bart.	4.10	(0.99)	3.80	(1.32)	4.80	(0.42)	4.23	(1.04)	0.20	(1.55)	0.60	(0.84)	1.40	(0.84)	0.73	(1.20)
				DO	Lisa quoted Bart the story.	3.90	(0.88)	3.20	(1.32)	3.40	(0.97)	3.50	(1.07)								
bredge/ stire	0	0	novel	PO	Lisa NOVELed the story to Bart.	3.80	(1.03)	3.70	(1.25)	4.40	(0.97)	3.97	(1.10)	0.40	(0.70)	0.20	(0.63)	0.10	(1.10)	0.23	(0.82)
				DO	Lisa NOVELed Bart the story.	3.40	(1.07)	3.50	(1.27)	4.30	(0.82)	3.73	(1.11)								
give	1,097	14,841	high	PO	Lisa gave the book to Bart.	4.60	(0.52)	4.90	(0.32)	5.00	(0.00)	4.83	(0.38)	−0.20	(0.63)	0.10	(0.57)	0.20	(0.42)	0.03	(0.56)
				DO	Lisa gave Bart the book.	4.80	(0.42)	4.80	(0.42)	4.80	(0.42)	4.80	(0.41)								
hand	42	319	low	PO	Lisa handed the book to Bart.	4.40	(0.97)	4.60	(0.70)	4.80	(0.00)	4.67	(0.71)	0.00	(0.94)	0.00	(0.67)	0.00	(0.00)	0.00	(0.64)
				DO	Lisa handed Bart the book.	4.40	(0.70)	4.60	(0.52)	5.00	(0.00)	4.67	(0.55)								
blafe/ ffidge	0	0	novel	PO	Lisa NOVELed the book to Bart.	3.20	(1.55)	3.60	(1.07)	4.60	(0.70)	3.80	(1.27)	0.20	(1.32)	0.20	(1.62)	0.40	(1.07)	0.27	(1.31)
				DO	Lisa NOVELed Bart the book.	3.00	(1.15)	3.40	(1.58)	4.20	(1.03)	3.53	(1.33)								
send	139	2,891	high	PO	Bart sent the package to Marge.	3.90	(1.10)	4.60	(0.52)	5.00	(0.00)	4.50	(0.82)	−0.90	(0.88)	0.10	(0.57)	0.00	(0.00)	−0.27	(0.74)
				DO	Bart sent Marge the package.	4.80	(0.42)	4.50	(0.71)	5.00	(0.00)	4.77	(0.50)								
mail	0	15	low	PO	Bart mailed the package to Marge.	4.10	(1.10)	3.10	(1.29)	4.80	(0.63)	4.00	(1.23)	0.50	(1.08)	−0.10	(0.88)	0.50	(0.71)	0.30	(0.92)
				DO	Bart mailed Marge the package.	3.60	(1.17)	3.20	(1.32)	4.30	(1.25)	3.70	(1.29)								

(TABLE A4. *Continues*)

VERB (CB1/CB2)	FREQUENCY MC	BNC	FREQ. BAND	SENT. TYPE	SENTENCE	RAW SCORES AGE 5–6 M	(SD)	AGE 9–10 M	(SD)	ADULTS M	(SD)	TOTAL M	(SD)	DIFFERENCE SCORES (PO minus DO) AGE 5–6 M	(SD)	AGE 9–10 M	(SD)	ADULTS M	(SD)	TOTAL M	(SD)
nace/	0	0	novel	PO	Bart NOVELed the package to Marge.	3.10	(0.99)	3.10	(1.45)	4.40	(1.35)	3.53	(1.38)	–0.10	(1.45)	–0.50	(1.08)	0.60	(1.43)	0.00	(1.36)
drice				DO	Bart NOVELed Marge the package.	3.20	(1.69)	3.60	(1.26)	3.80	(1.48)	3.53	(1.46)								
throw	551	1,158	high	PO	Homer threw the ball to Bart.	4.00	(1.41)	4.70	(0.67)	5.00	(0.00)	4.57	(0.97)	–0.40	(1.07)	0.00	(0.47)	0.20	(0.42)	–0.07	(0.74)
				DO	Homer threw Bart the ball.	4.40	(0.97)	4.70	(0.48)	4.80	(0.42)	4.63	(0.67)								
toss	5	49	low	PO	Homer tossed the ball to Bart.	4.50	(0.71)	4.30	(0.82)	5.00	(0.00)	4.60	(0.67)	0.40	(1.43)	0.00	(0.94)	0.90	(1.29)	0.43	(1.25)
				DO	Homer tossed Bart the ball.	4.10	(0.99)	4.30	(0.67)	4.10	(1.29)	4.17	(0.99)								
wiss/	0	0	novel	PO	Homer NOVELed the ball to Bart.	2.80	(1.55)	4.10	(0.74)	4.30	(1.25)	3.73	(1.36)	0.10	(1.37)	0.50	(0.71)	0.80	(2.04)	0.47	(1.46)
rife				DO	Homer NOVELed Bart the ball.	2.70	(0.95)	3.60	(0.97)	3.50	(1.43)	3.27	(1.17)								

TABLE A4. Sentences and mean ratings for experiment 2.

EFFECT	M (β)	SE	t	HPD INTERVALS		p
				LOWER	UPPER	
(intercept)	4.51	0.14	31.62	4.26	4.79	**0.00**
Sentence type (PO vs. DO)	0.14	0.15	0.95	−0.09	0.36	0.23
Verb type (PO vs. Alt)	−2.13	0.20	−10.75	−2.45	−1.82	**0.00**
Age (5–6 vs. Adult)	−0.26	0.15	−1.76	−0.56	0.04	0.11
Age (9–10 vs. Adult)	−0.38	0.15	−2.55	−0.67	−0.07	**0.02**
Sentence type × Verb type	1.93	0.24	8.21	1.63	2.23	**0.00**
Sentence type × Age (5–6)	−0.23	0.16	−1.43	−0.53	0.13	0.18
Sentence type × Age (9–10)	−0.18	0.16	−1.17	−0.53	0.15	0.27
Verb type × Age (5–6)	1.43	0.20	7.12	1.12	1.75	**0.00**
Verb type × Age (9–10)	1.36	0.20	6.78	1.05	1.66	**0.00**
Sentence type × Verb type × Age (5–6)	**−1.73**	**0.27**	**−6.46**	**−2.16**	**−1.28**	**0.00**
Sentence type × Verb type × Age (9–10)	**−1.32**	**0.27**	**−4.93**	**−1.77**	**−0.89**	**0.00**
Participant *SD*	0.31					
Verb *SD*	0.34					
By-participant random slopes for verb type *SD*	0.39					
By-verb random slopes for sentence type	0.34					

TABLE A5. Experiment 2, English verbs, linear mixed-effects regression model.

EFFECT	M (β)	SE	t	HPD INTERVALS		p
				LOWER	UPPER	
(intercept)	4.10	0.18	22.95	3.77	4.43	**0.00**
Sentence type (PO vs. DO)	0.08	0.18	0.46	−0.27	0.44	0.64
Verb type (PO vs. Alt)	−1.25	0.18	−6.93	−1.60	−0.88	**0.00**
Age (5–6 vs. Adult)	−0.92	0.25	−3.63	−1.40	−0.50	**0.00**
Age (9–10 vs. Adult)	−0.48	0.25	−1.91	−0.91	−0.01	0.06
Sentence type × Verb type	1.22	0.26	4.77	0.78	1.80	**0.00**
Sentence type × Age (5–6)	0.02	0.26	0.07	−0.46	0.54	0.95
Sentence type × Age (9–10)	0.10	0.26	0.39	−0.46	0.61	0.70
Verb type × Age (5–6)	1.47	0.26	5.75	0.99	1.98	**0.00**
Verb type × Age (9–10)	1.32	0.26	5.16	0.85	1.87	**0.00**
Sentence type × Verb type × Age (5–6)	**−1.30**	**0.36**	**−3.61**	**−1.99**	**−0.60**	**0.00**
Sentence type × Verb type × Age (9–10)	**−1.37**	**0.36**	**−3.79**	**−2.05**	**−0.59**	**0.00**
Participant *SD*	0.56					

TABLE A6. Experiment 2, novel verbs, linear mixed-effects regression model.

EFFECT	M (β)	SE	t	HPD INTERVALS		p
				LOWER	UPPER	
(intercept)	1.35	0.25	5.39	0.88	1.80	0.00
Age (5–6 vs. Adult)	**−1.43**	**0.16**	**−9.00**	**−1.69**	**−1.13**	**0.00**
Age (9–10 vs. Adult)	**−1.11**	**0.16**	**−7.01**	**−1.38**	**−0.84**	**0.00**
Verb class (manner of speaking vs. accomp. mtn.)	**−0.50**	**0.19**	**−2.70**	**−0.81**	**−0.20**	**0.01**
Verb class (Latinate illoc. comm. vs. accomp. mtn.)	0.04	0.18	0.22	−0.26	0.35	0.83
Verb class (Latinate giving vs. accomp. mtn.)	−0.35	0.19	−1.87	−0.65	−0.02	0.06
Verb frequency (log *n* + 1, BNC)	**0.18**	**0.05**	**3.26**	**0.07**	**0.28**	**0.00**
Participant *SD*	0.55					

TABLE A7. Entrenchment analysis (both experiments), all participants, linear mixed-effects regression model.

APPENDIX B. NOVEL VERB DEFINITIONS AND PLAUSIBILITY RATINGS (BOTH STUDIES)

SEMANTIC VERB CLASS	VERB DEFINITION: VERB is when you ...	PLAUSIBILITY
Accompanied motion (E1)	pull, but really slowly and jerkily because it's really heavy	4.1
	carry, but really slowly because it's really heavy	4.4
	lift, but by pulling on a rope	4.8
Manner of speaking (E1)	shout, but as loud as you possibly can	6.1
	whisper, but just a bit louder than a normal whisper	5.0
	scream something, but as fast as you can	3.7

SEMANTIC VERB CLASS	VERB DEFINITION: VERB is when you ...	PLAUSIBILITY
Monetary (E1)	bet, but it's only a really small amount	3.3
	fine, but it's not that much	3.6
	save and get lots of money off	5.5
Future not having (E1)	refuse, but it's something the person really, really wants	4.3
	envy, but only a tiny bit	4.3
	forgive, but what happened isn't really that bad anyway	3.5
Illocutionary communication: Latinate (E2)	explain, but you've done something really bad	3.7
	announce, but it's something really important	4.6
	describe, but making sure you get the details exactly right	5.5
Giving: Latinate (E2)	contribute but it's only something really small	5.5
	transport, and it gets there really quickly	5.3
	release, and it goes really quickly	4.6
Illocutionary communication: Native-like (E1 & E2)	show, but really slowly and carefully	5.1
	ask, but you don't really care about the answer	5.2
	tell, but making sure you get all the details exactly right	4.9
Giving: Native-like (E1 & E2)	give, but it's only something really small	4.7
	send, and it gets there really quickly	4.2
	throw, but really quickly	5.6

APPENDIX C. GRAMMATICALITY-JUDGMENT TRAINING SENTENCES (BOTH STUDIES)

Grammaticality-judgment training trials and 'typical' scores reported to the participants (based on overall mean ratings in the study of Ambridge et al. 2008). Children completed two more training trials than the adults, to provide them with extra practice.

The frog caught the fly. (experimenter completes)	5
His teeth man the brushed. (experimenter completes)	1
The cat drank the milk. (children only)	5
The dog the ball played with. (children only)	1
The man tumbled Bart into a hole.	2 or 3
The magician vanished Bart.	2 or 3
The funny clown giggled Lisa.	1 or 2

REFERENCES

ALBRIGHT, ADAM, and BRUCE HAYES. 2003. Rules vs. analogy in English past tenses: A computational/experimental study. *Cognition* 90.2.119–61.

AMBRIDGE, BEN. 2011. Assessing grammatical knowledge (with special reference to the graded grammaticality judgment paradigm). *Research methods in child language: A practical guide*, ed. by Erika Hoff, 113–32. London: Wiley-Blackwell.

AMBRIDGE, BEN. 2012. How do children restrict their linguistic generalizations? A grammaticality judgment study. Liverpool: University of Liverpool, MS.

AMBRIDGE, BEN, and ELENA V. M. LIEVEN. 2011. *Child language acquisition: Contrasting theoretical approaches*. Cambridge: Cambridge University Press.

AMBRIDGE, BEN; JULIAN M. PINE; and CAROLINE F. ROWLAND. 2011. Children use verb semantics to retreat from overgeneralization errors: A novel verb grammaticality judgment study. *Cognitive Linguistics* 22.2.303–23.

AMBRIDGE, BEN; JULIAN M. PINE; and CAROLINE F. ROWLAND. 2012. Semantics versus statistics in the retreat from locative overgeneralization errors. *Cognition*, to appear.

AMBRIDGE, BEN; JULIAN M. PINE; CAROLINE F. ROWLAND; REBECCA L. JONES; and VICTORIA CLARK. 2009. A semantics-based approach to the 'no negative-evidence' problem. *Cognitive Science* 33.7.1301–16.

AMBRIDGE, BEN; JULIAN M. PINE; CAROLINE F. ROWLAND; and CHRIS R. YOUNG. 2008. The effect of verb semantic class and verb frequency (entrenchment) on children's and adults' graded judgements of argument-structure overgeneralization errors. *Cognition* 106.1.87–129.

BATES, DOUGLAS; MARTIN MAECHLER; and BEN BOLKER. 2011. lme4: Linear mixed-effects models using S4 classes. R package version 0.999375-3. Online: http://cran.r-project.org/web/packages/lme4/index.html.

BOWERMAN, MELISSA. 1988. The 'no negative evidence' problem: How do children avoid constructing an overly general grammar? *Explaining language universals*, ed. by John A. Hawkins, 73–101. Oxford: Blackwell.

BOWERMAN, MELISSA, and WILLIAM CROFT. 2008. The acquisition of the English causative alternation. *Crosslinguistic perspectives on argument structure: Implications for learnability*, ed. by Melissa Bowerman and Penelope Brown, 279–307. Hillsdale, NJ: Lawrence Erlbaum.

BOYD, JEREMY K., and ADELE E. GOLDBERG. 2011. Learning what NOT to say: The role of statistical preemption and categorization in *a*-adjective production. *Language* 85.1.55–83.

BRAINE, MARTIN D. S., and PATRICIA J. BROOKS. 1995. Verb argument structure and the problem of avoiding an overgeneral grammar. *Beyond names for things: Young children's acquisition of verbs*, ed. by Michael Tomasello and William E. Merriman, 352–76. Hillsdale, NJ: Lawrence Erlbaum.

BRESNAN, JOAN. 2007a. Is syntactic knowledge probabilistic? Experiments with the English dative alternation. *Roots: Linguistics in search of its evidential base*, ed. by Sam Featherston and Wolfgang Sternefeld, 75–96. Berlin: Mouton de Gruyter.

BRESNAN, JOAN. 2007b. A few lessons from typology. *Linguistic Typology* 11.1.297–306.

BRESNAN, JOAN; ANNA CUENI; TATIANA NIKITINA; and R. HARALD BAAYEN. 2007. Predicting the dative alternation. *Cognitive foundations of interpretation*, ed. by Gerlof Boume, Irene Kramer, and Joost Zwarts, 69–94. Amsterdam: Royal Netherlands Academy of Science.

BRESNAN, JOAN, and TATIANA NIKITINA. 2010. The gradience of the dative alternation. *Reality exploration and discovery: Pattern interaction in language and life*, ed. by Linda Uyechi and Lian-Hee Wee, 161–84. Stanford, CA: CSLI Publications.

BRITISH NATIONAL CORPUS. 2007. BNC XML edition (3rd edn.). Oxford: Oxford University Computing Services (distributor), on behalf of the BNC Consortium. Online: http://www.natcorp.ox.ac.uk/.

BROOKS, PATRICIA J., and MICHAEL TOMASELLO. 1999. How children constrain their argument structure constructions. *Language* 75.4.720–38.

BROOKS, PATRICIA J.; MICHAEL TOMASELLO; KELLY DODSON; and LAWRENCE B. LEWIS. 1999. Young children's overgeneralizations with fixed transitivity verbs. *Child Development* 70.6.1325–37.

CAMPBELL, AIMEE L., and MICHAEL TOMASELLO. 2001. The acquisition of English dative constructions. *Applied Psycholinguistics* 22.2.253–67.

CHOMSKY, NOAM. 1957. *Syntactic structures*. The Hague: Mouton.

CHOUINARD, MICHELLE M., and EVE V. CLARK. 2003. Adult reformulations of child errors as negative evidence. *Journal of Child Language* 30.3.637–69.

FELLBAUM, CHRISTIANE. 2005. Examining the constraints on the benefactive alternation by using the World Wide Web as a corpus. *Evidence in linguistics: Empirical, theoretical, and computational perspectives*, ed. by Stephan Kepser and Marga Reis, 209–40. Berlin: Mouton de Gruyter.

GAHL, SUSANNE, and ALAN C. L. YU. 2006. Introduction to the special issue on exemplar-based models in linguistics. *The Linguistic Review* 23.213–16.

GOLDBERG, ADELE E. 1995. *Constructions: A construction grammar approach to argument structure*. Chicago: University of Chicago Press.

GOLDBERG, ADELE E. 2002. Surface generalizations: An alternative to alternations. *Cognitive Linguistics* 13.4.327–56.

GOLDBERG, ADELE E. 2011. Corpus evidence of the viability of statistical preemption. *Cognitive Linguistics* 22.1.131–54.

GREEN, GEORGIA. 1974. *Semantics and syntactic regularity*. Bloomington: Indiana University Press.

GROPEN, JESS; STEVEN PINKER; MICHELLE HOLLANDER; RICHARD GOLDBERG; and RONALD WILSON. 1989. The learnability and acquisition of the dative alternation in English. *Language* 65.2.203–57.

HAHN, ULRIKE, and MIKE OAKSFORD. 2008. Inference from absence in language and thought. *The probabilistic mind: Prospects for Bayesian cognitive science*, ed. by Nick Chater and Mike Oaksford, 221–43. Oxford: Oxford University Press.

HOTHORN, TORSTEN; KURT HORNIK; and ACHIM ZEILEIS. 2006. Unbiased recursive partitioning: A conditional inference framework. *Journal of Computational and Graphical Statistics* 15.3.651–74.

KEMPEN, GERARD, and KARIN HARBUSCH. 2003. An artificial opposition between grammaticality and frequency: Comment on Bornkessel, Schlesewsky, and Friederici (2002). *Cognition* 90.2.205–10.

KRIFKA, MANFRED. 2004. Semantic and pragmatic conditions for the dative alternation. *Korean Journal of English Language and Linguistics* 4.1–32.

LEVIN, BETH. 1993. *English verb classes and alternations: A preliminary investigation*. Chicago: University of Chicago Press.

MARCUS, GARY F. 1993. Negative evidence in language acquisition. *Cognition* 4.1.53–85.

OEHRLE, RICHARD T. 1976. *The grammatical status of the English dative alternation*. Cambridge, MA: MIT dissertation.

PERFORS, AMY; JOSHUA B. TENENBAUM; and ELIZABETH WONNACOTT. 2010. Variability, negative evidence, and the acquisition of verb argument constructions. *Journal of Child Language* 37.3.607–42.

PINKER, STEVEN. 1989. *Learnability and cognition: The acquisition of argument structure*. Cambridge, MA: MIT Press.

PINKER, STEVEN; DAVID S. LEBEAUX; and LOREN ANN FROST. 1987. Productivity and constraints in the acquisition of the passive. *Cognition* 26.3.195–267.

R DEVELOPMENT CORE TEAM. 2010. R: A language and environment for statistical computing. Vienna: R Foundation for Statistical Computing. Online: http://www.R-project.org.

STEFANOWITSCH, ANATOL. 2008. Negative evidence and preemption: A constructional approach to ungrammaticality. *Cognitive Linguistics* 19.3.513–31.

STROBL, CAROLIN; JAMES MALLEY; and GERHARD TUTZ. 2009. An introduction to recursive partitioning: Rationale, application and characteristics of classification and regression trees, bagging and random forests. *Psychological Methods* 14.4.323–48.

THEAKSTON, ANNA L. 2004. The role of entrenchment in children's and adults' performance on grammaticality judgment tasks. *Cognitive Development* 19.1.15–34.

THEAKSTON, ANNA L.; ELENA V. M. LIEVEN; JULIAN M. PINE; and CAROLINE F. ROWLAND. 2001. The role of performance limitations in the acquisition of verb-argument structure: An alternative account. *Journal of Child Language* 28.1.127–52.

TOMASELLO, MICHAEL. 2003. *Constructing a language: A usage-based theory of language acquisition*. Cambridge, MA: Harvard University Press.

WONNACOTT, ELIZABETH. 2011. Balancing generalization and lexical conservatism: An artificial language study with child learners. *Journal of Memory and Language* 65.1–14.

WONNACOTT, ELIZABETH; ELISSA L. NEWPORT; and MICHAEL K. TANENHAUS. 2008. Acquiring and processing verb argument structure: Distributional learning in a miniature language. *Cognitive Psychology* 56.3.165–209.

[Ben.Ambridge@Liverpool.ac.uk]