Animacy in early child and child-directed transitives: a corpus study

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1. INTRODUCTION
Animacy influences a variety of phenomena in early child development. For example, 12-month-olds treat novel objects as agents when these objects exhibit animate characteristics (viz. eyes), but not when they lack them (Johnson 2003, see also Childers 1998). Similarly, 5-month-olds have different expectations for the actions of human versus robot arms (Woodward 1998). Thus, even pre-linguistic infants attend to animacy features and distinguish between animates and inanimates. The present research considers animacy effects in child language development and, in particular, investigates the link between animacy and syntactic argument position in multi-word utterances.

Previous studies indicate that animacy plays an important role in early sentence comprehension. Chapman and Miller (1975) found that 2-year-olds had the least difficulty in comprehension tasks with animate subjects and inanimate objects and the most difficulty in tasks with the reverse animacy pattern (but cf. Chapman & Kohn 1978). The same result was later obtained by Childers (1998) in research with novel animate and inanimate nouns. In another comprehension study, Dewart (1979) asked older children (ages 3 to 5) to choose a suitable referent for novel nouns in active transitive sentences. These children selected toys that represented animates significantly more often when choosing a subject referent than when choosing an object referent (see also Braine & Wells 1978). In sum, animacy is a relevant category in child language and, as Dewart argued, “young children expect a noun in first position in a noun-verb-noun sentence to be animate and in second position to be inanimate” (p. 528).

Consistent with these results, production studies reveal that animate-verb-inanimate is the preferred sequence in early child and child-directed transitives. Slobin and Bever (1982) mention that “in an extensive corpus of adult-child discourse, … almost every utterance involving two nouns and a verb was semantically nonreversible, in that the agent was animate and the patient inanimate” (p. 234). Similar observations were made by Bowerman (1973a), Brown (1973), de Villiers and de Villiers (1974), and Limber (1976). Unfortunately, though, none of these studies specified whether
deviations from the animate-verb-inanimate pattern ever involved inanimate subjects. Moreover, although the pronoun *it* occasionally occurs as the subject of maternal transitives (Cameron-Faulkner, Lieven and Tomasello 2003), *it* could denote an animal or a surrogate animate (e.g. doll) (see §3.1), rather than an unambiguously inanimate entity.

In elicited production tasks, Dodson and Tomasello (1998) likewise noted a strong bias toward animate subjects (96%) (see also Marantz 1982). But these results are problematic, since five of their six types of linguistic models had animate subjects. Also, given that this study combined the results for one- and two-argument utterances, the remaining 4% of child productions may have been intransitives. When Chapman and Miller (1975) presented two-year-olds with equal numbers of animate and inanimate actor prompts, elicited event descriptions were apparently unaffected by the actor’s animacy. Nevertheless, these responses were scored as correct as long as they contained at least one argument, and only 22.4% of all of correct responses involved two arguments. Chapman and Miller did not report whether any of the two-argument combinations had inanimate subjects.

While comprehension and production studies agree that children prefer animate subjects and inanimate objects, very little is known about the extent to which children produce and hear other noun-verb-noun sequences. In particular, it is unclear whether spontaneous child and/or child-directed inanimate subject transitives (henceforth: IS-transitives) ever occur (see Budwig, Stein, & O’Brien 2001, Uziel-Karl 2003, Cameron-Faulkner et al. 2003 regarding IS-intransitives). In fact, the prevailing assumption in the literature is that children exhibit a so-called “animacy-paradox” (see Golinkoff & Kerr 1978:54): they purportedly fail to use animates in contexts where adults use them (e.g. in subjects of transitives) but employ them in presumably non-adult-like contexts as in the much-cited example *hi spoon* (Brown 1973:212).

The goal of the present paper is to assess the use of inanimate subjects in early child and child-directed transitives. There can be little doubt that subjects of transitives are predominately animate, but the question of when, how, and to what extent children and their adult interlocutors produce IS-transitives is of considerable theoretical import. The following section addresses the relevance of this research for semantic, cognitive, and input-based theories of first language acquisition. Sections 3 and 4 then present the
results of two studies on child and child-directed IS-transitives, and Section 5 offers a general discussion of the results. Ultimately, I show that young children produce IS-transitives and that input factors account for the frequency of these constructions in child speech.

2. **Theoretical Implications**

One implication of research on IS-transitives concerns strategies children use to map a verb’s arguments. For example, children might observe a semantically based rule that the first noun in all noun-verb-noun sequences must be animate. As Marantz (1982) noted, “reluctance on the part of 4-year-olds to put inanates before the verb (an association of subject position with animacy) might explain these children’s difficulty [in producing IS-transitives]” (p. 53). Given that child transitives usually involve animate subjects and inanimate objects, children might initially solve the mapping problem via a principle that always links animates to subject position in two-argument utterances (see also Chapman and Miller 1975:367f). If so, there should be no early IS-transitives.

Alternatively, young children could map arguments based on an animacy hierarchy (see Withersoon 1977, Marcotte 2005). This sort of mapping principle would link the argument with the highest degree of animacy to subject position. For example, if children employ an animacy hierarchy that ranks humans as more animate than animals, they might produce animate-verb-animate sentences such as *the boy chased the dog* but not *the dog chased the boy*. Given a sufficiently fine-grained hierarchy, some sentences with two inanimate participants might also surface. For instance, inanmates with internal power sources (e.g. *car*) might appear in subject position if the object is an inanimate that lacks potential for autonomous action (e.g. *stop sign*). Importantly, though, this approach would rule out inanimate-verb-animate sequences.

Interestingly, child transitives cited in the literature seem to support such an analysis. For example, out of 37 early two-argument transitives cited in Bowerman (1990), only one has an inanimate subject (viz. *swing haven’t a mouth*; Christy, 1;11, p. 1266), and the objects are basically all inanimate. There are no cases in which the subject is clearly *less* animate than the object (cf. Withersoon 1977, Marcotte 2005). Moreover, in the given IS-transitive, the child is denying that the subject has a property typical of
The implicit comparison to animates might, then, license an otherwise prohibited use of an IS-transitive. Although Bowerman uses these examples to discount Pinker’s (1984) semantic bootstrapping approach, the data do not fully rule out the possibility that mapping in two-argument combinations is still established via some sort of semantic bootstrapping (i.e. a rule based on animacy rather than Pinker’s rules based on thematic roles). Of course, proponents of animacy-based mapping principles would need to explain why children have such a rule and when and how they correct it.

Research on child IS-transitives also has important consequences for cognitive theories of development. Some theorists hold that early concepts of agency are limited to animate entities and later expand to include inanimates (i.e. when children realize that inanimates also function as actors). According to Corrigan (1988), “[i]f a child’s schema for an event first includes only the sense of the verb involving a typical animate actor, then understanding changes in verb meaning requires an extension of the schema to include nonprototypical participants” (p. 296, see also Bowerman 1973a, 1973b, Horgan 1978). Under this view, linguistic development should reflect an expansion of the agent concept (e.g. Bever 1970; Schlesinger 1975, 1977). Because events involving a typical agent (i.e. an animate, volitional actor) and patient (an affected object) are the most perceptually salient two-participant events, they should be the easiest to conceptualize and the earliest to receive grammatical expression (see Slobin 1973, 1981, 1985).

Though the literature is unclear on when we should expect a shift from animate subject transitives (henceforth: AS-transitives) to IS-transitives, it might occur a few years after two-argument combinations emerge. Tinker, Beckwith, and Dougherty (1989) suggested that 4-year-olds have difficulty mapping non-agentive experiencer-object psych-verbs because their concept of cause is limited to prototypical agents (see also Di Desidero 1999:65f). Comprehension studies argue that children from 2 to 6-years-old have difficulty comprehending IS-transitives. If these studies are an indication of the child’s ability to conceptualize inanimates as agents, we might expect a rather long delay in the onset of IS-transitives relative to AS-transitives. Furthermore, if the category expansion applies on a verb-by-verb basis, each verb should appear first with an AS-transitive regardless of when it is acquired. On the other hand, if the expansion applies across predicates, verbs acquired after the child’s agency concept has broadened should
not necessarily show a delay in their occurrence with IS-transitives. In general, these cognitive approaches and the semantic mapping approaches all imply that older speakers should produce IS-transitives more frequently than younger ones.

As Bowerman (1974) noted an alternative cognitive hypothesis is conceivable: “a child might initially form an overextended agent concept in which animate agents and instruments like knives are regarded as equivalent, and gradually, thorough observation of the way these are treated linguistically, he would differentiate agent and instrument into two separate categories” (p. 202). If so, younger children might actually produce more IS-transitives than older speakers, and early IS-transitives should be prone errors as in the infelicitous sentence the fork ate the spaghetti. In fact, although English is relatively generous with respect to subject animacy (e.g. Hawkins 1985, van Voorst 1996), many verbs are only felicitous with animate subjects, and the criteria for acceptability are not straightforward (cf. Cruse 1973, Kearns 2000, among many others). One might reasonably expect children to make semantic and pragmatic errors in early IS-transitives.

Finally, the study of child and child-directed IS-transitives is also relevant to the body of research suggesting that statistical patterns in the input play a crucial role in linguistic development. For instance, Rowland, Pine, Lieven, and Theakston (2003) demonstrated that the order of acquisition of wh-questions could be accurately predicted by patterns in the input and that factors such as semantic and syntactic complexity were not predictive once input frequency was taken into account. Smith, Durham and Fortune (2007) found that children used non-standard phonological variables in ways that reflected statistical tendencies in parent speech. Importantly, verb frequency and item-based syntactic frames also correspond highly in child and input data (e.g. Chenu & Jisa 2006, Cameron-Faulkner et al. 2003, Naigles & Hoff-Ginsberg 1998, de Villiers 1985).

Together these studies indicate that children are sensitive to input factors for a rage of linguistic phenomena. Although no study has yet established that child speech mirrors patterns of animacy in the input, children may be sensitive to these finer-grained semantic input properties of predicate-argument combinations. This possibility accords well with Dodson and Tomasello’s (1998) tentative hypothesis that “as children make the transition from verb-specific constructions to more verb-general constructions, such as
the transitive construction, the content of the participant roles is not unimportant” (p. 169, see also Laakso & Smith 2007). The question at present is whether regularities in the animacy features of participant roles in the input play a role in the early acquisition of transitives. In other words, could the frequency of IS-transitives in child speech be a consequence of item-based or global input factors, rather than a non-adult-like semantic rule or cognitive hypothesis?

Determining the precise way in which children deviate from the canonical animate-verb-inanimate pattern should yield insight into which of these hypotheses best accounts for the data. For example, while most of the theories could explain a substantial delay in the onset of IS-transitives (i.e. by a semantic rule prohibiting them, an overly specific concept of agency, or low input frequency); input theories, unlike the others, are not dependent on such a delay. The primary prediction of input-based accounts is that patterns in child speech will correspond to those in parent speech. On the basis of corpus data from four children and their parents, I argue that child IS-transitives reflect item-based regularities in the input. In Study 1, I address the frequency distribution and order of emergence of IS-transitives. A more fine-grained analysis of child and child-directed IS-transitives is provided in Study 2.

3. STUDY 1

Study 1 was designed to assess (1) the frequencies and proportions of IS-transitives in child and child-directed speech, (2) the relative order of emergence of IS-transitives, and (3) whether these patterns apply globally or on a verb-by-verb basis. Though this study focuses on inanimate subjects in canonical transitives, I also briefly consider whether the patterns differ for object control verbs. Like canonical transitives, sentences with object control verbs involve two NP arguments, the second of which allows passivization. Object control verbs differ crucially from transitive verbs, however, in that the agency of their subject is generally less direct (e.g. Dixon 2000). For instance, the subjects in (1) and (2) facilitate the embedded events but are not the proximate causes.

1) they [=hinges] make the door open? (Nina, 2;9.21)
2) my eyes will help me read (Abe, 4;1.15)
Because the subject of these predicates need not directly act on the object, there are fewer subject restrictions. Thus, while the sentence *hinges open the door* is unnatural, the example in (1) is perfectly sensible. Inanimate subjects might, then, appear more often with object control verbs than with transitive verbs. Nevertheless, if children are simply reluctant to allow inanimate-verb-object sequences, results for object control verbs might not differ from those for transitive verbs, regardless of the input frequencies.

3.1 Methods

The data for this study consist of child and parent utterances extracted from four American English corpora in the CHILDES database (MacWhinney 2000). The analysis focuses primarily on transcripts of children younger than 3;4, though a later subset of data was included for comparison (see Table 1.1 for corpus details). The primary results are based on the early data from 18 transitive verbs. Two of these (viz. *knock*, *run*) occur with a particle (*down/over*), but otherwise behave like canonical transitive verbs. I also included data for three object control verbs. All of the 21 verbs allow passivization and permit animate and inanimate subjects (see Table 1.2 for examples). Child and parent uses of the 21 verbs were extracted from the corpora using the CLAN Program (MacWhinney 2000). The following types of utterances were removed from the data by hand: false starts, routines and idioms (e.g. *that makes sense*), utterances in elicited production tasks (the Kuczaj corpus only), incomplete utterances, non-main-verb uses of the search term (e.g. auxiliaries, adjectival passives, etc.), and utterances involving irrelevant senses of the verb. Passives and uses of the verb in isolation or with unclear animacy or argument structure were also excluded from the analysis (n=522).

The remaining utterances (n=6548) were grouped by hand into eight mutually exclusive categories on the basis of animacy and sentence type as shown in Table 1.3.

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1 These corpora were chosen for their number of files (n>50) in the given age range. The first Kuczaj transcript was excluded because of the high number of elicited productions. With the exception of Nina’s father who lived far away and only appeared in one transcript, I included utterances from both parents.

2 Verbs were included based on their use in the Suppes corpus in at least one IS-transitive (by child or parent). Copular and stative verbs (e.g. *the house has a chimney*) were excluded. All verbs in the corpus were hand-checked for IS-transitives. The main verb *do* also met the criteria for inclusion, but was eventually excluded for practical purposes. I searched the other corpora for additional verbs that might be likely appear with an inanimate-subject transitive. I only found one (viz. *melt*) and added it to the study.
Only overt NP arguments were considered, and no assumptions were made regarding the animacy (or existence) of implicit arguments. For embedded verbs, arguments were counted as overt when expressed in the larger structure (e.g. \textit{the noise [my tummy maked]}, Abe 4:4.4). With double object constructions, I only counted the second object (i.e. the theme). I assumed that all two-argument combinations were mapped correctly. In spontaneous speech, children usually order these arguments accurately (de Villiers & de Villiers 1974), and I found no clear cases of such mapping errors in the present data.

In order to reduce the possibility that the inanimate subjects were being imbued with animate properties such as sentience and volition, the coding scheme for inanimates was conservative. Inanimate objects with human or animal form (e.g. dolls, toy animals) were coded uniformly as \textit{animates}, as were mythical beings and objects that were clearly anthropomorphized in context (e.g. \textit{daddy pumpkin}). As exemplified in the conversation below, parents and children talk about such entities as though they were typical animates, even when they refer to them with the pronoun \textit{it}.

(3) \textbf{Sample conversation from the Brown corpus}

[Child (4;5.22) enters hiding a \textit{doll} behind her back.]
Melanie: I see \textit{it}.
Melanie: how does she...
Child: she's dead.
Mother: how does she work?
Child: she don't work.
...
Child: she don't walk anymore.
Melanie: what is she supposed to do?
Child: she (sup)posed to walk, but she don't walk no more.
Child: see, watch.
Mother: why doesn't she walk?
Mother: she should walk.
Child: see, \textit{it} move(d) but it didn't walk.

Nouns coded as inanimates fell into seven categories: (1) concrete inanimate objects (e.g. tree), (2) non-concrete inanimates (e.g. noise), (3) objects with an internal power source (e.g. vehicles), (4) natural forces (e.g. wind), (5) events and activities (e.g. growling), (6) human and toy body parts, and (7) subjects queried with the \textit{wh}-word \textit{what}. Both full NPs and pronouns were coded for animacy according to these criteria (see Dodson & Tomasello 1998 for the importance of including pronouns). The pronouns \textit{I}, \textit{we}, \textit{you}, \textit{he}, and \textit{she} were always coded as animates since they reliably refer to the types of entities...
designated as animates above. Other pronouns (*it, they, that, these, those, one*) were hand-checked for animacy. Though time-consuming, this was necessary to ensure consistent animacy coding. As exemplified in (3), certain types of entities (esp. surrogate animates and animals) can be referred to with either personal or impersonal pronouns. Finally, I noted the age of the child for each child use of an IS-transitive. For each child, I also looked through the transcripts for the first appearance of two argument transitives. 3

3.2 Results

The following subsections present the distribution and the order of emergence data in turn. Unless otherwise noted, results refer to data on transitive verbs. Comparisons with object control verbs are presented at the end of each subsection. All statistical comparisons reported in this paper were made using either Spearman’s rank order correlation tests or Fisher’s exact test. When multiple comparisons were carried out on the same dataset, the acceptable *α*-level (here *α*=.05) was divided by the number of comparisons to establish a stricter significance threshold as required by the Bonferroni correction. 4 The use of the Bonferroni correction is clearly indicated in the text and figures.

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3 I also searched the Switchboard LINK Project Corpus (Bresnan et al. 2002, Godfrey et al. 1992) to compare CDS and adult-adult speech, but no firm conclusions could be drawn. Beyond substantial differences in the corpora (e.g. conversation topics, number of speakers, etc.), the methods used in the CHILDES study were ill-suited for Switchboard. For example, Switchboard contained far more metaphorical uses, and identifying irrelevant verb senses was not straightforward. A rough attempt at using the same coding schema with Switchboard data showed that ca. 12% of transitives had inanimate-subjects, though some of these were metaphorical. In order to reliably compare these data, a more controlled study would be necessary. For the present purposes, I only report findings from the CHILDES data.

4 I used a conservative definition of “dataset” for the Bonferroni corrections. Instead of dividing *α* by the total number of tests performed in the study, I divided *α* by the number of the relevant subset of tests performed on a particular subset of the data. For example, comparisons made on the individual early corpora for the four types of transitives in child and child-directed speech were considered a separate set of comparisons to those made on the individual early and late corpora for IS-transitives vs. AS-transitives. Although this use of the Bonferroni correction does not yield the strictest possible threshold for significance, it is a more conservative correction with respect to my hypothesis that child and parent speech should not show significant differences. When comparisons were testwise significant, the p-values for these tests are noted in the relevant figures. In contrast to test for proportions, however, I expect that correlations between child and parent speech should be highly significant. For this study, dividing *α* by either the total number of correlation tests (*n*=22) or by subsets of correlation tests does not change the results. P-values for all of the correlation tests are given in Appendix 1. All p-values reported in this paper are two-sided.
3.2.1 Distribution results

*Overall distribution.* IS-transitives were infrequent for all speakers, accounting for only 3.8% of the data. By contrast, AS-transitives made up 73.5% of the data. Table 1.4 gives the token frequencies for each of the eight sentence types. Overall, these frequencies were strongly correlated in child and parent speech (Spearman’s rank order correlation [a], \( r=0.88, p<.001 \)). Taken together, the data show a strong bias toward animate subjects. Constructions with inanimate subjects (viz. II, IA, I, \( I_1 \)) represented only 8.7% of the child utterances and 11% of the adult utterances. For the three corpora in which children produced more than five IS-transitives (early Kuczaj, late Kuczaj, Suppes), there was no significant correlation between the use of IS-transitives and IS-intransitives (for all three tests [b], \( r<.3 \ p>.05 \)). The results reported below only consider sentences with two-overt arguments.

*Distribution of the four types of transitives in the early data.* Child and parent percentages of the four transitive sentence types were very similar. AI-transitives were the most frequent, followed by AA-transitives and then by the two types of IS-transitives. Fisher’s exact tests reveal that only AA- and II-transitives show significantly different proportions in the child versus parent data (see Figure 1.1).\(^5\) The higher proportion of II-transitives in the parent data seems to be driven by the fact that the parents talked much more about things making messes or noises than did the children (see Study 2). When types of transitives are compared by corpus, there was also high agreement between child and parent data. Only the Suppes corpus evidenced reliable differences between child and parent proportions of AS-transitives, and none of the IS-comparisons were significant when the \( \alpha \)-level was adjusted for the Bonferroni correction (see Figure 1.2).

While the most frequent verbs were used predominately in AI-transitive across speakers, this pattern was not categorical (see Table 1.5). Some verbs showed a bias toward AA-transitives. This was true for verbs like *scare* and *help*, which are only felicitous with animate objects, as well as for some verbs that are natural with animate or

\(^5\) Here Fisher’s exact test (henceforth: FET) measures whether the ratio of tokens of a particular animacy combination in child speech differs significantly from the same ratio in CDS (i.e. the strength of the association between the animacy of arguments and whether the speaker is the child or the parent). Fisher’s exact tests are particularly suited to the present data since they are unaffected by small cell counts and substantial imbalances in the data.
inanimate objects (e.g. *catch, cover*). There are a few verbs (*run_down/over, prick*) for which IS-transitives made up the majority of transitive uses, but these were very low-frequency verbs. The frequencies of child and parent uses of the four types of transitives by verb were highly correlated, regardless of which child and parent were paired (see Table 1.6). Even so, each child’s data correlated most highly with the data from his or her parent. Given the low frequency of II- and IA-transitives, I collapse the transitive data into two groups (viz. AS- and IS-transitives) for all subsequent comparisons.

*Distribution of IS-transitives relative to AS-transitives.* In the combined early data, the proportion of transitives with an inanimate subject was significantly higher in parent speech than child speech (5.9% parent vs. 4.18% child, FET, p<.05). For the later data, however, child and parent proportions of IS-transitives were nearly identical (ca. 4%, FET, p=1). When individual corpora were compared using the Bonferroni correction, none of the corpora showed a reliably different proportion of IS-transitives within the child/parent dyad (see Figure 1.3). Although Abe’s proportion of IS-transitives in his later data was higher than in his early data (4.5% early vs. 10% late), neither proportion differed significantly from the corresponding input proportion. There was essentially no difference between the proportions of IS-transitives in Sarah’s early and late data (0% early vs. 0.9% late), and the input proportions in both cases were also very similar (2.6% early vs. .98% late).

When child and parent proportions of IS-transitive for each verb in the combined early data were compared using the Bonferroni correction, only one of the 18 verbs showed a significant difference (*make*, 1.7% chi vs. 5.2% par, FET, p<.001, cf. Table 1.5 for frequencies), and only one other verb (*hit*, 0% chi vs. 12.1% adult, FET, p<.05) revealed a difference that was testwise significant. Due to data sparsity, verb-by-verb comparisons of IS-transitive proportions for individual corpora were not feasible.

Finally, there was no relationship between the frequency of a verb in the early corpora and the combined early child frequency of a verb with an IS-transitive ([c], r=.09, p=.35). Neither was there any correlation between child frequencies of a given verb with AS-versus IS-transitives ([d] r=.08, p=.75). Thus, a verb’s likelihood to appear in an IS-
transitive does not seem to be a function of its overall frequency or its frequency in AS-transitives.

Control verbs. The frequencies of two-argument utterances of with control verbs are given in Table 1.7. These uses accounted for 79% of the total coded uses of these verbs (n=783). Make (cause) was by far the most frequent of the object control verbs, and all three children who produced IS-transitives in the early data had some tokens with this verb. Overall, 32.1% of the transitive uses of make (cause) involved inanimate subjects. For the three object control verbs combined, 19.5% of the total transitive uses had inanimate subjects. Parents differed with respect to how much they used keep_x and help_x with inanimate subjects, and children only produced these verbs with animate subjects, though even these uses were infrequent.

Unlike with the transitive verbs, the combined early parent and child proportions of IS-transitives with object control verbs did not differ significantly (15.2% child, 19.2% parent, FET, p=.4), nor was there a significant difference in these proportions between the combined early and late data (FET, for the child-child comparison p=.44; for parent-parent p=.08). For the individual corpora, both speakers in the Kuczaj and Sachs corpora exhibited highly significant differences between proportions of IS-transitives with the two types of verbs (see Figure 1.4). In the Brown and Suppes corpora, however, there were no significant differences between these proportions.

3.2.2 Order of emergence results

Before considering the relative order of emergence for AS- and IS-transitives, an important caveat is in order. The present data do not reliably indicate when the children begin producing two-argument combinations. For example, Abe and Sarah were already producing such transitives at the start. These children may have been producing two-argument combinations months before recording began. For the present purposes, I will cautiously assume that order of emergence can be assessed from the point at which the children were first recorded.

Transitive verbs. Each child who produced IS-transitives in the early data, produced at least one verb with an IS-transitive before an AS-transitive (see Table 1.8). All three
children produced the verb *burn* in an IS-transitive first. The verbs differed by child and were not necessarily the verbs used most frequently with IS-transitives in the input. For the verbs that were first produced in AS-transitives, IS-transitives followed anywhere from later in the same recording session to approximately nine months later. The patterns of emergence for AS- and IS-transitives across verbs are given in Table 1.9. All of the children seemed to use AS-transitives before IS-transitives, but these data may not indicate a substantial or categorical delay in the onset of IS-transitives. For example, IS-transitives were absent Sarah’s early data and she produced only four in the later sample. The paucity of IS-transitives in the later data suggests that Sarah’s uses of IS-transitives were too infrequent for the sampling to accurately indicate when she acquired them, especially considering that her early data only included 179 transitives compared to 452 in her later data (see Table 1.4).

Similarly, although there was a gap of almost three months between Naomi’s first recorded AS- and IS-transitives, she only produced three IS-transitives (and only 114 AS-transitives). These sampling limitations could account for this gap as well. For the Kuczaj corpus, Abe’s first recorded IS-transitive occurred less than two months after his first recording. Some of his subsequent uses of IS-transitives were separated by over a month, and there was no apparent correlation between Abe’s age and the length of time until the next IS-transitive. Finally, Nina, who uses no two-argument combinations in her first recording and only a few in her second, produced her first recorded IS-transitive within the same month as her first AS-transitive, and subsequent recordings with IS-transitives were separated by an average of about 40 days.

*Control verbs.* Although IS-transitives with object control verbs were more frequent in child speech, they did not seem to emerge earlier than IS-transitives with canonical transitive verbs. For the children who produced IS-transitives with *make (cause)*, these uses emerged later than their first IS-transitives. IS-transitives with *make (cause)* also appeared from one to nine months after the first AS-uses with *make (cause)*, even though the latter were evidenced in some of the earliest recordings.
3.3 Discussion

Although the data on IS-transitives are sparse, the results of Study 1 provide a basis for evaluating the different theoretical perspectives discussed in Section 2. First of all, the results do not match predictions made by either version of the semantic mapping hypothesis. Even despite sampling limitations (cf. Rowland & Fletcher 2006), children were shown to use inanimate subjects in early transitives. This suggests that there is no early semantic rule categorically prohibiting inanimate subjects in early two-argument combinations. In fact, with object control verbs, children used inanimate subjects in up to 43% of their two-argument combinations (cf. Figure 1.4). Mapping principles based on an animacy hierarchy also make the wrong predictions. Children produce IA-transitives in addition to (and even more frequently than) II-transitives.

One might contest that Sarah’s and Naomi’s data provide some support for an animacy-based linking rule since these children produced only a few IS-transitives. Nevertheless, the reason for the near absence of child IS-transitives in these two corpora may be that there were simply too few tokens of the given verbs. Abe and Nina produced over twice as many analyzable utterances than Sarah and Naomi, and Sarah and Naomi’s data represent only 22.1% of all early child transitives. In essence, sampling limitations could easily account for the paucity of IS-transitives in the speech of these children. Importantly, once sampling limitations are considered, none of the corpora offer compelling evidence for the delay in IS-transitives relative to AS-transitives, and Nina apparently used IS-transitives as soon as her first two-argument combinations emerged. While the literature implies that even 4-year-olds might use an animacy-based mapping rule, all of the children in the present study produced at least some tokens IS-transitives before the age of five.

Reversible AS-transitives (those with two animate arguments) may also be more common in child and child-directed speech than previously thought (see §1). AA-transitives made up almost 30% of two-argument child utterances and sometimes even occurred significantly more often Nina’s speech than in her parent’s. Thus, linking based on a semantic rule that maps animates to subject position and inanimates to object position may leave a substantial amount of data unaccounted for (contra implications in Slobin & Bever 1982:234). These results should be interpreted with special caution,
however, since the coding criteria for animates were particularly generous. Taken together, the results from Study 1 show that linking patterns in early child transitives do not neatly accord with the predictions of an animacy-based mapping theory.

This research also suggests against the cognitive-based hypotheses that early child transitives are affected by an overly narrow concept of agency. Since the children spontaneously produced descriptions of two-participant events involving non-prototypical agents (i.e. inanimates), they apparently already understood that the category of agents is not categorically restricted to typical animate actors. Additionally, in the data for the four transitive sentence types, only II-transitives had a lower proportion in child data compared to parent data (see Figure 1.1), and this might be attributed to communicative goals rather than cognitive limitations. Many of the parent II-transitives involved behavior-mitigating utterances with the verb make (esp. make a mess). When II- and IA-transitives were collapsed into IS-transitives, none of the corpora showed clear differences between proportions of IS-transitives in parent versus child speech.

Not only was there no evidence for a predicate-general delay in the onset IS-transitives across predicates, but verb-by-verb comparisons indicated that some verbs appear with IS-transitives before AS-transitives (even when the predicate shows a majority of uses with AS-transitives). In essence, by the time two-argument combinations emerge, children already understand that actors/causers in two-participant events can be non-prototypical agents. Comparisons between early and late data again fail to show clear evidence for an expanding agent concept. The child proportions of IS-transitives in the early and late Brown data were very similar; and although Abe’s later proportions of IS-transitives was higher than his earlier proportion, neither is reliably different from the corresponding input proportion. Thus, this difference in Abe’s early and late data may be an effect of input frequency rather than cognitive development. The results also fail to support the alternative cognitive hypothesis that child transitives should show an overly general agent concept, since there is no indication that children use more IS-transitives than adults (see Study 2 for further discussion).

Importantly, the present findings support the hypothesis that children are sensitive to animacy patterns in the input. When verb-general comparisons are made, child and parent proportions of IS-transitives are quite similar, especially in the denser corpora.
Individual differences among the corpora also suggest that child uses of IS-transitives are closely tied to uses by the child’s respective parent. For example, in the later data, both Abe and his parents exhibited higher proportions of IS-transitives than Sarah and her parents, but the proportions for these children and their respective parents were nearly identical (cf. Figure 1.2). Similarly, the Kuczaj and Sachs corpora showed much higher percentages of inanimate subjects with object control verbs than with canonical transitive verbs for children and parents. On the other hand, these proportions did not differ for either speaker in the Suppes or Brown corpora (cf. Figure 1.3). Based on the limited data available, it seems that children show different behavior with these two types of verbs only when such a difference is salient in the input they receive. Also, although Sarah produces no IS-transitives for any of the verbs in the early data, her parents also use markedly fewer tokens of IS-transitives than the other parents for both types of verbs (Table 1.4).

Correspondences in child and parent utterances were also manifested on a verb-by-verb basis. For example, proportions of IS-transitives for individual verbs were very similar in child and adult speech. Additionally, all tests of correlations conducted for child and parent uses of the given verbs were positive. These observations cannot be a simple a matter of priming, because correlations between children and unrelated adults were also significantly higher than chance. Even though these correlations do not prove causation, they show that children use IS-transitives with similar frequency as their adult interlocutors. Ultimately, the results of Study 1 are best accounted for an item-based input approach to child language development. While children might potentially observe some soft constraints against inanimate subjects, there is no absolute restriction against IS-transitives in early child language, and input frequency appears to be a key factor in explaining the low frequency of IS-transitives in child speech.

4. Study 2

Study 1 established that children produce both II-and IA-transitives. Importantly, children were shown to use IS-transitives with a similar frequency as their parents, and there was no apparent delay in the onset of these transitives relative to canonical AS-transitives. Even so, several questions remain regarding the precise nature of IS-
transitives in child and parent speech. In particular, Study 1 addresses the relative frequencies of IS-transitives in child and child-directed speech, but does not indicate whether child IS-transitives represent a more restricted phenomenon than parent IS-transitives. A closer look at the characteristics of child and child-directed IS-transitives could reveal more subtle differences that might ultimately be attributable to discrepancies in cognitive abilities.

One question is whether the basic grammatical properties of IS-transitives are comparable in child and parent speech. For example, comparing verb tense in child and child-directed IS-transitives could reveal that children are limited in the extent to which they conceptualize non-prototypical agency. Do child IS-transitives only denote events in progress or recently completed events, whereas parent IS-transitives denote a wider range of events including future and hypothetical events? If so, one plausible interpretation would be that children, unlike parents, have difficulty recognizing the potential agency of inanimates unless they witness it directly. Also, Wagner (2002) argued that children understand progressive morphology as a marker of agent intentionality. Since children are unlikely to understand the agents of IS-transitives as intentional (see §3.2), Wagner’s claim leads to the prediction that none of the early IS-transitives should involve progressive morphology. On the other hand, if neither the child nor the parent uses progressive morphology with IS-transitives, an absence of –ing morphology in the child data should not necessarily be attributed to cognitive limitations.

Another important question is whether children use a more limited range of semantic types of subjects or objects in their IS-transitives. Children might recognize the agency of some types of inanimate entities (e.g. those with an internal power source) to the exclusion of others (such as entities with no internal power source), even though both occur in the parent data. On the other hand, the range of subjects in child IS-transitives might be broader than in the adult data as predicted by the cognitive hypothesis that children being with an overly general concept of agency. In other words, children might imbue agency to entities that cannot be used as agents in adult language. While the Study 1 provided no compelling evidence for the cognitive hypotheses, examining the range of subjects and objects that appear in child and child-directed IS-transitives may reveal more fine-grained developmental differences.
Given the high item-based correlations between child and parent frequencies of particular animacy combinations, Study 1 also raises the question of whether child IS-transitives are predominately repetitions of adult utterances. If they are, the presence of early IS-transitives is not necessarily a reflection of the child’s ability to independently conceive inanimates as agents in two-participant events. And even if child IS-transitives are not full repeats of adult utterances, the referent of the inanimate subject in child IS-transitives might always repeated from the interlocutor’s prior utterance. This finding might suggest that children need the inanimate entity to be especially salient in the discourse in order to recognize it as an agent.

In sum, Study 2 asks whether close comparisons of child and adult IS-transitives undermine the conclusions drawn from Study 1. In the following paragraphs, I consider the specific properties of IS-transitives, paying attention to their grammatical features, the types and combinations of arguments and predicates involved, and the influences of priming. Beyond providing an initial description of these types of sentences in child and child-directed speech, I will show that the range of grammatical and semantic properties exhibited in child and parents IS-transitives is extremely similar and that priming does not fully account for these similarities.

4.1 Methods

The primary focus of this study is on early IS-transitives with transitive verbs. Data from transitive verbs in the later corpora were included for comparison. Since the number of early child IS-transitives with object control verbs was rather small (n=17), I do not discuss comparisons made with these verbs. For this study, IS-transitives extracted from the corpora for Study 1 were coded according to a multi-faceted coding procedure. With respect to grammatical features, I coded the following properties: (1) the form of the subject and object (viz. full NP, demonstrative pronoun, pronoun (person), wh-form), (2) the tense/aspect of the verb (past, present, progressive, future, uninflected), (3) whether the object was raised out of object position, and (4) whether the utterance was a question (determined by the transcriber’s use of a question mark).

Inanimate subjects were grouped into the seven categories of inanimates mentioned in Study 1 (see Table 2.1 for summary). Inanimate subjects were then further
labeled with respect to the notion of ‘semantic potency’ (see Davidse 2002). Potents are inanimate entities able to act of their own power via some sort of internal energy source. Except for queried subjects, which are unspecified with regard to potency, all inanimate subjects were labeled as either potent or non-potent as shown in Table 2.1. The animacy coding for grammatical object diverged somewhat from Study 1. Here, objects denoting body parts were grouped together with nouns for whole animate entities since acting on a person’s body part is similar to acting on the person. With the exception of one parental use with the verb *break*, all of the IS-transitives with body part objects (n=17) occurred with the verbs *hurt*, *burn* and *cover* and would have been felicitous and similar in meaning if the whole animate entity had been mentioned instead. The coding schema for object animacy is summarized in Table 2.2.

Finally, I coded each IS-transitive for repetitions. The subject, verb and object were coded individually for whether they were repeated in the child’s, the parent’s, or an intervening speaker’s immediately prior utterance (skipping turns that only contained brief interjections). All repetitions were coded as self-repetitions or repetitions of another speaker. Noun repetition was based on shared referent. For example, if the object was *me*, it was counted as repeated in a prior utterance if either the speaker or an interlocutor made an overt reference to the speaker (e.g. *I/me/mine/name* or *you/your*, etc.). I also checked whether the subject-verb-object sequence was repeated in the five preceding turns (regardless of speaker).

4.2 Results
The results for this study are presented first for the IS-transitives in the early data. After briefly noting the grammatical features, I address the types of objects found in IS-transitives and then turn to the types of subjects and their patterns of co-occurrence with various verbs and objects. Comparisons with the later data are reserved until the end. As in Study 1, multiple comparisons made on a given dataset are adjusted with the Bonferroni correction (see note 4).

*Grammatical features of early IS-transitives.* Child and child-directed IS-transitives were generally very similar. Both children and adults produced subjects with demonstrative
pronouns (viz. that), impersonal pronouns (it & they) and full NPs. Overall, parents produced a higher proportion of full NPs in subject and object position than children, but the differences were not significant (for subjects: 18.9% child vs. 31.2% parent, FET, p=.1; for objects: 49% child, 62.4% parent, FET, p=.1). Almost all IS-transitives had the canonical subject-verb-object order. There was one child IS-transitive with a raised object (viz. that what they gonna carry in that one, Nina, 2;10.13) and only four in the adult data. A few IS-transitives in the child and parent data were used in a causal construction as exemplified in Abe’s utterances below.

(4) when you put the toothbrush in, it makes a circle (3;1.22)
(5) when you drink, that makes the sound in the throat (2;10.27)
(6) you help me take my shoes off so they don't hurt my feet (2;9.23)

One clear difference in the form of child and child-directed utterances, however, was that children produced very few questions (n=4), while just over half of the parent IS-transitives were interrogatives (n=64).

Finally, the most common verb tense for both child and parent IS-transitives was the simple present tense (ca. 34% child, 37% parent). This reflects the generic quality exhibited by several of the IS-transitives such as those in (4) and (5) above. Children and parents also used IS-transitives for past events as in (7) and future events as in (8). Progressive aspect was marked on 18.9% of early child IS-transitives (see 9) and 10.4% in the early adult data.

(7) it popped and it scared Bert (Abe, 3;2.26)
(8) the cars gonna run over them (Nina, 2;10.13)
(9) that car is making a noise, isn't it? (Nina, 2;0.3)

In most cases, verbs in child IS-transitives were correctly inflected, though there were some clear errors of omission (n=7).

Types of objects in early IS-transitives. IS-transitives with animate objects were more frequent than those with inanimate objects in the child data (69.8% IA vs. 30.2% II, FET, p<.001), but not in the parent data (46.4 % IA vs. 53.6% II, FET, p=.3). This child/adult difference is partly attributable to the disparity between child and adult uses of make in IS-transitives (cf. Study 1). Even so, this does not seem to be the only relevant factor.
When data for this verb are completely removed from the analysis, parents still use a higher percentage of II-transitives than children (13.7% child vs. 41.4% parent).

Objects referring to the child were the most common overall, though individual speakers differed in this regard and children generally produced more child-denoting objects than parents (see Table 2.3). When proportions of the 7 object types in the combined child and child-directed speech were compared using the Bonferroni adjustment, the difference in child and parent proportions of child-denoting objects came very close to significance (see Figure 2.1). Also, parents used a significantly higher proportion of objects denoting non-concrete inanmates than children used. The semantic range of non-concrete objects was fairly limited for both children and parents. The child uses referred exclusively to making noises. Adult uses referred mostly to making noises (n=22) and messes (n=9). In general, proportions among object types in the child and parent data were similar, and there was a high positive correlation in the frequency of use of an object type for a given child and his or her parents ([ε], \( r = .63 \), p<.001).

The different types of objects found in IS-transitives were unevenly distributed across the verbs. As shown in Table 2.4, the three most frequent verbs for both children and parents (viz. make, hurt, scare) exhibited the widest range of object types, though make only occurred with inanimate objects and the two psych-verbs with animate ones. Similarly, the most frequent object types (child and concrete objects) also occurred with the widest range of verbs, with the exception of non-concrete objects which only appeared with make. Finally, the number of verbs that children and parents used with IS-transitives with animate objects very similar (9 for children, 10 for adults), though the verbs did not entirely overlap. For IS-transitives with inanimate objects, parents used almost twice as many different verbs (13 vs. 6).

Types of subjects in early IS-transitives. Concrete objects and event denoting nominals were the most frequent types of inanimate subjects, though individuals again differed (see Table 2.5). In general, children produced fewer subjects denoting concrete entities and more subjects denoting events than the parents. When the proportions of the 7 subject types were compared with the Bonferroni adjustment, none of the proportions are significantly different (see Figure 2.2). Queried subjects, like queried objects, were
especially rare and were only found in the parent data, and there was only one use of a body part subject.\textsuperscript{6} As with object type, there was a high positive correlation between the child’s frequency of a given subject type and the frequency of that child’s parent ([f], \(r=.70, p<.001\)).

Subject types also showed a skewed distribution among the verbs (see Table 2.6). Event subjects primarily occurred with the frequent verbs \textit{make, hurt} and \textit{scare}. Natural force subjects occurred with the change of state verbs \textit{burn} and \textit{melt}, and with other verbs that involve some type of physical interaction between the subject and object (e.g. \textit{hit, knock_over/down}). Vehicle subjects were evidenced across a wider range of verbs, including several predicates that imply some sort of movement (e.g. \textit{carry, bring}). Frequent verbs also tended to occur with a wider range of subjects types and vise versa.

Of the subjects that can be classified as either potent or non-potent (cf. Table 2.1), the proportion of potents in the child data was higher than in the parent data (67.9\% child vs. 50\% parent, \textit{FET, p<.05}). This difference was driven by the fact that parents used a higher proportion of concrete inanimate subjects, especially for the verb \textit{make}. There were two tokens of child IS-transitives with concrete inanimates as subjects of this verb, but 27 parent tokens (cf. Table 2.6). As noted earlier, parents talk more about things making messes than children do. If these tokens (\(n=7\)) are removed from the data, the percentage of potents among potents and non-potents in child data is still higher but not reliably so (67\% child vs. 51.3\% parent, \textit{FET, p=.09})

IS-transitives with non-potent inanimate subjects are particularly noteworthy since the subject is not easily construable as a type of agent. In the child data, there were 17 such tokens, which are given in Appendix 2. Interestingly, all but three of the child uses of non-potent subjects (highlighted in Appendix 2) have objects denoting the child. In other words, 82.4\% of non-potent subjects in the early child data have the child as the object, compared with 30\% in the parent data and 45\% in the overall child data (cf. Table 2.3). In contrast to non-potents, potent subjects in the child data were fairly evenly

\textsuperscript{6}Although most child uses of IS-transitives were perfectly sensible, the status of this example (viz. \textit{arms wash the dolly}, Chi, Suppes, 2:0.3) is dubious. Nina made this statement after washing her doll with her mother, and Nina’s mother seems to reinterpret this statement to mean that Nina washed the doll. In the later datasets, however, there were reasonable IS-transitives with body part subjects.
distributed across object types and percentages closely paralleled those found in the adult data (see Figure 2.3).

The distribution of non-potents may be attributable to the verbs the children used with non-potent subjects (see Table 2.6). In the child data, 7 verbs appeared with non-potent subjects. The proportion of all child IS-uses of these verbs with self-referential objects (58%) was not significantly different from the proportion of non-potent subject transitives with self-referential objects (82.4%) \((FET, p=.13)\). By contrast, 10 verbs in the child data appeared with potent subjects, and only 48.9% of all child IS-transitives with these verbs had self-referential objects. This proportion was significantly lower than the proportion of child-object in non-potent subject transitives at the \(p<.05\) level.

In general, children used fewer non-potent subjects than potent subjects; and when they did use non-potent subjects, the range of verbs and objects that they co-occurred with was more restricted. In the parent data, by contrast, potent and non-potent subjects were fairly evenly distributed among IS-transitives with different types of objects (Figure 2.3), although parents (like children) also used a wider range of verbs with potent-subjects \((n=12)\) than with non-potent-subjects \((n=9)\).

Comparison with late data. Data for the later age range \((4;0-5;1)\) were only available for two corpora. For the Brown corpus, inanimate subject transitives were extremely rare for both the child and the parent (cf. Table 1.4). Overall, Sarah only produced four IS-transitives, all in the later dataset:

(10) then it [=cutting with scissors] won't hurt my eyes \((4;2.1)\)
(11) but the ribbon hurts me \((4;6.5)\)
(12) it [=piece of metal] hurts me \((4;6.24)\)
(13) it [=child’s eye] doesn't hurt me \((4;7.24)\)

These examples all denote events in which something hurts the child. Sarah’s parents only use eight IS-transitives. Although these were less formulaic than Sarah’s uses, most of them \((n=5)\) also involved the child as an affected object.

For the Kuczaj corpus, Abe produced about the same number of IS-transitives in both age ranges, though the later data contained less than half as many transitives overall (again cf. Table 1.4). Abe’s parents produced fewer IS-transitives in the later age range,
making comparisons difficult. The types of arguments found in the early and late Kuczaj data are summarized in Table 2.7. The child and parent uses of different argument types were fairly consistent at both stages. The correlations between the frequency of argument types in the early child versus parent data ([g], \( r = .84, p < .001 \)) and the late child versus parent data ([h], \( r = .67, p < .01 \)) were very high.

There were a few salient differences between Abe’s early and late data, however. For example, in the early data, Abe produced more event subjects (51.2% early vs. 8.3% late) and self-referential objects (63% early vs. 8.3% late, \( \text{fet} \)), and fewer objects denoting concrete inanimates (14.8% early vs. 58.5% late). These differences seem to be driven primarily by the verbs that were most frequent. In the early data, \( \text{hurt} \) (n=9) and \( \text{scare} \) (n=10) were the most frequent, and 12 of these 19 tokens occurred with subjects that denoted events. Furthermore, these two verbs only occurred with animate objects (mostly denoting the child). In the later data, however, the verbs \( \text{hit} \) (n=11) and \( \text{make} \) (n=7) were the most frequent, and there were only two uses of \( \text{hurt} \) and none of \( \text{scare} \). Abe’s late uses of \( \text{hit} \) and \( \text{make} \) involved no event-denoting subjects and predominately occurred with inanimate objects.

Finally, the proportion of non-potent subjects in the later data was higher than in the early data (83.3% late vs. 22% early). In the later data, non-potent subjects mostly co-occurred with concrete inanimate objects (four with the verb \( \text{hit} \) and one with \( \text{cut} \)), while they appeared almost exclusively with self-referential objects in the early data (mostly with \( \text{hurt} \)). Again because of the differences in the verbs used, it is difficult to compare the distribution of potent versus non-potent subjects. It may be that Abe was less restrictive at 4-years-old in his use of non-potent subjects, but the difference here may also be attributed to the different frequencies of the given verbs. Due to sampling limitations, it is also difficult to say whether the addition of verbs like \( \text{hit} \) to the set of verbs in IS-transitives shows any progress in development. Abe uses the same number of verbs (by type) in the early data as in the later data (n=6).
Priming effects. Priming was fairly common among IS-transitives in the early data. Many of the verbs and arguments were primed in the immediately prior utterance either of the speaker or the interlocutor (see Table 2.8 and examples in 14 below). For both children and parents, subjects were primed for the majority of IS-transitives and objects were primed in about half of the uses. There were no striking differences in the amount of subject or object priming in child versus parent productions. Priming of the verb was also common, though these percentages varied more widely. Full repeats were relatively rare for children and parents.

(14) Examples of priming in child IS-transitives

a. Subject: Mother: *yeah just a second I'll let you use it* [saw]
   Child: *okay it won't cut me* (Abe, 3;1.28)

b. Object: Mother: *can you put him* [=toy dog] *upright?*
   Child: *and that hurts him* (Nina, 3;0.3)

c. Verb: Father: *what happens to it* [=snow] *when it melts* *could you tell me?*
   Child: *water melts it* (Abe, 3;2.29)

d. Full repeat: Mother: *I don't think that it* [=brush] *hurt you*
   Child: *it did hurt me* (Abe, 2;10.20)

One important question is whether correlations between child and parent uses were high simply because children and parents repeated each other. While this possibility is difficult to test given data sparsity, a detailed look at IS-transitives in the early Kuczaj corpus suggests that priming of IS-transitives does not account for the strength of the correlations. Despite frequency limitations, when child and parent frequencies of IS-transitives were correlated by verb, the Kuczaj corpus showed a positive correlation ([i], $r=.6$, $p<.05$). If all child and parent IS-transitives that were primed by an IS-transitive (with the same verb) ($n=22$) are removed from the analysis, the correlation remains positive ([j], $r=.5$, $p<.05$).

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7 Because Sarah produced no IS-transitives in her early data, the results from the Brown corpus are not considered here.
8 The same correlation in the Suppes corpus is also positive, but only weakly so (Spearman’s $r=.34$, $n=18$, $p=.17$). Using the less conservative Pearson’s correlation test, however, does reveal a significant correlation (Pearson’s $r=.63$, $n=18$, $p<.01$), though the correlation no longer reaches significance when the primed data are removed (Pearson’s $r=.38$, $n=18$, $p=.14$).
4.3 Discussion

Like Study 1, Study 2 shows a strong correspondence between child and parent data. Except that parent IS-transitives are more commonly used as questions, the grammatical features of IS-transitives in the child and adult data were very similar. Not surprisingly, these features reflect general tendencies in child and child-directed speech rather than phenomena special to IS-transitives (cf. Cameron-Faulkner et al. 2003 for very similar results with the use of questions and pronouns, see also Dodson & Tomasello 1998). This is likely true of the priming data as well. For example, subjects are widely recognized to refer to background information and objects to new information, so it is not surprising that subjects in IS-transitives were repeated more often than objects.

Notably, the range of verb tenses used IS-transitives was the same for parents and children. Comparing verb morphology, therefore, gives no indication that children are more limited in their ability to conceptualize the potential agency of inanimates. The fact that children, like adults, use progressive morphology in their IS-transitives is also significant, since young children (ages 2- and 4-years-old) purportedly understand progressive morphology as a marker of intentionality (Wagner 2003). Wagner argued that children start out mapping intentional properties to progressive aspect markers, and eventually need to “re-analyze their grammatical aspect meanings, or at least to expand them to include non-agent oriented facets of the event” (p. 122). The present data cast doubt on Wagner’s position, showing that children younger than four already spontaneously use progressive aspect in describing events carried out by non-intentional actors.

The current data also yield no evidence that children have an overly-general notion of what types of inanimate entities can serve as actors in 2-participant events. Though the criteria for determining what types of inanimates are allowed in IS-transitives are complex and controversial (see references cited in §2), child uses of inanimate subjects fall within the set of acceptable combinations. Not only are the child IS-transitives for the current set of verbs overwhelmingly sensible, but an extensive search of nearly all transitives in the Suppes corpus (see note 2) failed to uncover any illicit uses of instrument subjects.
With respect to the types of arguments and predicates in IS-transitives, the present data again indicate that item-based input factors play an important role in acquisition. Child and parent uses of particular types of subjects and objects are highly correlated, and parents and children show considerable agreement in the verbs they most commonly use with IS-transitives as well as the range of verbs they use with the different categories of subjects and objects. Also, although some IS-uses are primed by previous utterances, these do not fully account for item-based correlations between child and parent frequencies for uses of a particular verb with IS-transitives.

Despite similarities between child and parent IS-transitives, a few child/parent differences deserve attention. For example, children used a higher percentage of potent subjects in their IS-transitives than parents. As noted above, however, this difference may primarily result from differences in what children and parents talk about (esp. with respect to uses of the verb *make*), rather than any real difference in linguistic or cognitive development (cf. Cameron-Faulkner *et al.* 2003). Although parent uses of *make* may also largely account for the disparity between child and parent uses of IS-transitives with inanimate objects, the data still seem to suggest a disproportionate bias in the child data toward IS-transitives with self-referential objects. In the corpora with very few uses of IS-transitives, all of the child IS-transitives have self-referential objects, and these objects account for the majority of child IS-transitives in the denser corpora.

The preponderance of child IS-transitives with self-referential object fits nicely with other research showing that subjects in early child speech are usually self-referential (see Huttenlocher, Smiley, and Charney 1983, Budwig 1989). Child-directed speech also evidences a high-percentage of child-denoting subjects (e.g. Laakso & Smith 2007), though presumably not as high as in child speech. Huttenlocher *et al.* (1983) found that 90% of utterances collected from children ages 1;11 to 2;2 (n=1066) described events in which the child was in some way participating in the action described by the verb. Though the present data are limited, they imply that children may gain an understanding of inanimate actors/causer by experiencing events in which personal affect is caused by an inanimate entity (cf. Dodson & Tomasello 1998 for similar arguments regarding self-referential subjects).
This theory is particularly intriguing in light of the data on non-potent subjects in early child IS-transitives. While potent inanimates are used in IS-transitives with a relatively even distribution of object types, non-potent subjects in the child data almost exclusively co-occur with child-denoting objects. If child objects were as common with potent inanimate subjects as non-potent subjects (as they are in the parent data), the primacy of child-denoting objects might simply be explained by appealing to theories that child utterances are ‘ego-anchored’ (see Budwig 1989). This tendency could be taken to chiefly reflect the child’s pragmatic goals in communication rather than any particular cognitive limitations. The present data indicate, however, that this may not be the case. Although item-based frequency effects may ultimately account for these data, they at least raise the question of whether initial IS-transitives essentially describe events in which either an inanimate actor is potent or in which a non-potent inanimate acts on the child. At present, this apparent tendency in the child data does not appear to be a consequence of input factors since both potent and non-potent subjects are fairly evenly distributed among object types in the parent data.

In essence, these findings may suggest a softer version of the cognitive hypothesis: 2-year-olds already recognize that potent inanimates can act on other entities by means of their internal power source (see discussion of vehicles in Braine & Wells 1978), but they may have some initial difficulty recognizing non-potent entities as actors unless personally affected by the action. The fact that non-potent subjects co-occur with mostly self-referential objects in Abe’s early data and mostly inanimate objects in Abe’s later data may also provide evidence for this developmental hypothesis. But with current data limitations, we cannot rule out the possibility that Abe’s two datasets vary only because of differences in conversation topics. Interpreted conservatively, the present data at least show that early child uses of IS-transitives correspond highly to parent uses and that these correspondences are not reducible to priming effects. More specifically, child IS-transitives demonstrate the same range of grammatical features and semantic types of subjects and objects as child-directed IS-transitives.
5. General discussion and conclusions

Child productions of two-argument transitives cast serious doubt on the semantic mapping approaches and the cognitive hypotheses outlined in Section 2. There is no categorical restriction against IS-transitives in early child speech. Some children produce IS-transitives as early as 2;0, suggesting at least that by the time two-argument combinations begin, they already accept inanines as potential subjects/agents in two-participant events. The present findings do, however, accord with the notion that children learn language by extracting statistical regularities from the input. Overall, child productions correspond strongly with parent productions, even on a verb-by-verb basis. Previous literature has demonstrated that such item-based correlations hold for syntactic constructions in general (e.g. Cameron-Faulkner et al. 2003), but to my knowledge this study is the first to indicate that children are sensitive to item-based animacy configurations in the input.

Even though input factors generally offer the most compelling explanation of the data, Study 2 raises the possibility that young children are limited in the extent to which they acknowledge the capacity of non-potent entities to serve as actors in two-participant events. In particular, this recognition may first develop from experience with events in which a non-potent entity affects the child in some salient way. Further research is necessary to determine whether children generalize to other IS-transitives based on such events. Regardless, pragmatic context is likely to play a key role in whether children use IS-transitives. For example, part of the reason parents are somewhat more likely to produce IS-transitives may be that such sentences (at least with the given verbs) are more suited to their communicative needs.

More generally, contexts that elicit IS-transitives may be quite rare in everyday settings; and even when an event could be described with an IS-transitive, other constructions might be favored instead. For example, the literature on passives indicates that adults and children use passives to describe events with non-prototypical agents (e.g. Budwig 1990). Along these lines, current research fits nicely with the body of work showing that children use linguistic devices to take different perspectives on an entity or event (e.g. Clark 1990, Budwig 1990, Gropen, Pinker, Hollander & Goldberg 1991). Beyond being capable of describing events from the perspective of an inanimate actor,
children, like adults (cf. 15), are apparently able to switch back and forth between IS-transitives and AS-transitives in describing the same event:

(14) Sample conversation from the Kuczaj corpus
Child (4;5.20): I'll show you some thing this could cut material
Father: those scissors?
Child: yeah I think so (ex)cept it might not it might not it did!
Father: uhhuh
Child: when I first cut it, it couldn't so I tried a different way and it worked

(15) Sample conversation from the Sachs corpus
Child (1;10.10): find flower
Mother: oh, good
Mother: that will make a beautiful shadow, honey
Mother: let's make a shadow with it
Mother: that will make a really nice shadow

Ultimately, further research on descriptions of events with inanimate actors may inform our understanding of how children employ linguistic devices to mark perspective.

The present research also has important implications for the comprehension studies discussed in Section 1. If two-year-old children spontaneously produce IS-transitives (and especially IA-transitives), why do they have difficulty understanding sentences of this sort even at the age of 5? One reason may be that children have very little experience interpreting IS-transitives, since such sentences are rare in the input. Another explanation may be that IS-transitives are generally less probable events and are, therefore, more difficult to understand. In fact, results from Chapman and Kohn (1978) suggest that event probability plays a more decisive role than participant animacy in sentence comprehension tasks. Additionally, children may also be particularly disadvantaged with IA-transitives in comprehension tasks if they have difficulty recognizing when certain types of inanimates act on third-party animates. In essence, a variety of factors may influence child performance on these tasks.

Taken together, the current studies indicate that children use IS-transitives quite early and that and the low frequency of IS-transitives in child speech is a function of low input frequencies, as well as independent contextual factors. Some soft constraints on cognition may also influence child productions, but there are no strict rules limiting transitive subjects animates. Perhaps most importantly, the present paper shows that research on child linguistic development must take input into account when assessing the
link between a child’s speech and his or her underlying cognitive or linguistic hypotheses.

References


