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FORMAL SEMANTICS OF TELEGRAPHIC SPEECH

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When small children begin concatenating words, they frequently use only content words, such as Verbs, nouns and adjectives. Numerous investigators of language acquisition have conducted research into the course of development from telegraphic speech through the acquisition of a number of function words and affixes (see, among others, Brown 1973, DeVilliers & DeVilliers 1973, Bloom, Lightbown and Hood 1975). In this paper, I put forth a formal analysis of the semantics of telegraphic speech, focusing on the distribution of prepositions in a twelve-hour data sample.¹

One of the striking manifestations of telegraphic speech in the corpus is a set of cases where the child leaves out a preposition required in the adult grammar, as here:

- | | |
|--------------------------------|-------------|
| 1. we colored crayons | (Clark 2) |
| 2. I went party | (Jessica 3) |
| 3. Richard bring snack Shirley | (Shirley 3) |
| 4. I cut it a knife | (Charlie 3) |

This might not seem so striking, in view of the observation that children at this age leave out function words. However, it is important to note that at the same time when utterances such as 1-4 occur, the

child also uses expressions with prepositions, such as those in 5-8.

- | | |
|-----------------------------|-------------|
| 5. yeah, I played with Joan | (Clark 2) |
| 6. Jim was at Cooperstown | (Jessica 3) |
| 7. putting daddy in wagon | (Shirley 3) |
| 8. mommy on sheep | (Charlie 3) |

Notice that the prepositional phrases in 5 and 7 are arguments of the verb, while those in 6 and 8 are predicates taking the subject NP as argument. The number of PPs used post-verbally, post-nominally² and in isolation appears as Table 1.

While the distribution of PPs as complements to some verbs appeared to be random, with others it was quite regular: the PP never showed up, the complement appearing instead as an NP. 9-11 exemplify this class. The relevant complement is underlined.

- | | |
|-----------------------------|------------------------|
| 9. @ crying @ Joan's house | (Clark 3) ³ |
| 10. save some <u>later</u> | (Shirley 3) |
| 11. Shirley cut <u>fork</u> | (Shirley 2) |

Table 2 lists the verbs in the corpus which appeared with a PP complement or an NP complement where the adult grammar requires a PP. Also listed there are the percentages of times the relevant complement appeared in its canonical PP form.

In the adult grammar, the underlined complements in 9-11 are adjuncts,⁴ while the PPs in 5-8 are either arguments of the verb or the main predicate of the sentence. For three of the four children studied, it held true that adjuncts never surfaced as PPs whereas the distribution of prepositions in argument position was haphazard. This can be seen easily on Table 2, comparing 1-14 with 15-24.⁵

In what follows, I explain the unequal distribution of PPs in adjunct vs. argument and predicate positions seen in table 3, as a consequence of a limitation on the semantic complexity of the grammar at this stage of acquisition. In short, the hypothesis is that the child's grammar when MLU = 1.5 has the semantics of a first-order logic. This hypothesis has two sides: it strongly predicts the absence of higher-order predicates and functors (adjunct PPs, adverbs, determiners and inflection), and it leaves the way open for standard first-order predicates (verbs, common nouns, predicate PPs and

adjectives⁶) to be used in the standard way in the child's grammar.

In Section 1, I report the results for the use of determiners, inflection and adverbs in the corpus, and discuss the use of PPs in more detail. In Section 2, we see that these results are incompatible with both the informal hypothesis that unstressed function words are left out and a more formal syntactic hypothesis based on Case Theory in a Government and Binding framework. In Section 3, I present a more fleshed-out version of the first-order logic hypothesis, seeing the strong prediction of absence of higher-order predicates and functors borne out, and then broadening the analysis with a formalization of first-order predication in the grammar of telegraphic speech. We end up with a formal peg on which to hang telegraphic speech and a plausible candidate for a grammar provided by UG.

Lack of Higher Order Categories

1.1. Inflection and determiners

Tables 4 and 5 report the number of inflectional morphemes and determiners found in the corpus. Included there, for comparison, are the number of uninflected verbs and the number of common nouns appearing without determiners.

Notice that Table 4 includes in the class of inflected verbs uses of the copula, negated modals, aspectual morphemes and irregular past tense forms. Even given this broad construal of inflection, the children use uninflected forms of the verb in 76% of the utterances in which they use a verb at all. This percentage is even higher (86%) if we exclude the copula on the grounds that it is rarely modelled in its infinitival form, and higher again if we exclude aspectual morphemes which have been independently shown to be, in early acquisition, part of the stem rather than bound morphemes (Bloom, Lifter and Hafitz 1980). Brown (1973) and DeVilliers & DeVilliers (1973) report that children do not reach a criterion of 90% canonically required uses of any inflectional morpheme until after MLU exceeds 2.0 morphemes (Brown's Stage II). By Brown's Stage IV, children on average have reached this criterion only for the following inflectional forms: present progressive, uncontractible copula and irregular past.

The results for determiners (Table 5) resemble those for inflection. Overall, common nouns that canonically appear with determiners were used without them 79% of the time. Furthermore, in a number of instances, the child's use of a determiner fails to reflect the mass/count, singular/plural agreement restrictions of the adult grammar. 12-15 are examples of these mismatches.⁷

- | | |
|-------------------------|-------------|
| 12. a tails | (Charlie 3) |
| 13. give my baby a milk | (Clark 2) |
| 14. a french toast | (Clark 2) |
| 15. a more peas | (Jessica 1) |

In the same studies cited above, Brown and DeVilliers & DeVilliers report that children do not reach the 90% criterion for use of the definite determiner the or the indefinite a before Brown's Stage III, and sometimes not until Stage V. Karmiloff-Smith (1979) argues on the basis of French data that children use and understand determiners as indexical, and hence indiscriminately definite, expressions through age four, suggesting that they have no control of the inherently quantificational properties of the adult semantic category.

1.2. Adverbs

Adverbials in the adult grammar are inherently complex semantically: as predicate modifiers, they have to be at least second-order functions; almost all subclasses of adverbials serve as evidence that the semantics is intensional.⁸ Given this, it would be very surprising if we found them productive at the period being studied.

The literature on the acquisition of adverbials is rather sparse. Most attention has been paid to temporal adverbial connectives, such as before and after (Clark 1971, Crain 1982, Stevenson and Pollitt 1987). The earliest age at which children have been argued to comprehend these temporal connectives is 3 and a half years (Stevenson and Pollitt 1987). In a study of PP adverbials in the speech of three children learning Spanish, Peronard (1985) finds their earliest use when the MLU is around 2.0, later than the stage studied here.

Taking (i) adverbial use in the adult language and (ii) co-occurrence with a verb as criteria for what in the corpus counts as an adverbial, only three

independent lexical items and three prepositional phrases qualify. As noted in Table 2, these three PPs were all produced by one of the four children; I'll discuss them below. The lexical items that qualify are again (Shirley 2 and 3), now (Jessica 3), and today (Jessica 2 and 3); 16-21 are examples of their use.

- | | |
|-------------------------------|-------------|
| 16. baby eat again | (Shirley 2) |
| 17. feed the baby again | (Shirley 3) |
| 18. have candy now | (Jessica 3) |
| 19. I want zuchinni bread now | " |
| 20. I wan' Chinefood today | (Jessica 2) |
| 21. want today | (Jessica 3) |

The total number of tokens of these words in the speech of the two children is very small: Shirley uses again four times in the corpus; Jessica uses now five times and today three times.

Each of these three canonical adverbs is highly context-dependent for use and interpretation. In the adult grammar, and presumably in the child's, today and now are interpreted strictly relative to speech time, regardless of syntactic position, and in this respect differ markedly from non-deictic adverbials; whether formalized as operators or predicates, they have to take a contextually given interval as their argument (see Kamp 1970, Dowty 1982).

Again, in the adult grammar, is ambiguous between VP and S scope (Dowty 1979). In either case, its semantics require that the event or state of affairs (corresponding to the expression over which it takes scope) hold at the reference time and at some earlier time (with an intervening period at which it does not hold.) Pragmatically, use of again is restricted to contexts of which the earlier occurrence forms a part; intuitively, this restriction is in full force in the child's grammar.

Any analysis of these three canonical adverbs in telegraphic speech has to give the context a central role. Roughly speaking, again, today and now predicate something of the event that corresponds to the rest of the utterance. This will be formalized in Section 3, where deictic referents play a central role. For now, it is enough to say that again today and now are all two-place (first-order) predicates relating the context and an event variable. (See Section 3.3.3 for the analysis.)

1.3. PP Adverbials

We saw in the introduction that PPs appear in argument and predicate positions in the corpus, but in general not in adjunct position. It is important to note that the representation of prepositions in the data is systematic in a way that the occasional use of determiners and inflection is not. Referring to Table 1, you will note that there were 28 instances of post-verbal PPs, 21 instances of post-nominal PPs and 42 instances of PPs uttered in isolation. This compares with a total of 35 utterances in which a preposition, canonical in the adult language, is left out (see Table 3). Clearly, prepositions are not predominately missing the way inflection and determiners are, and the phenomenon to be explained is their distribution, not their absence.

Table 3 charts the distribution of PPs in argument, predicate and adjunct position.⁹ The important observation is that the preposition was missing from argument position only half the time while it was missing from adjunct position 75% of the time, and 100% of the time for three children.

All the children used canonical PP arguments with verbs; all except one (Charlie) alternated between using a given verb with and without the preposition, as is illustrated by 22-27.

- | | |
|---------------------------------|-------------|
| 22. play with toy | (Clark 2) |
| 23. @ play the balls | " |
| 24. I sleep in a big bed | (Jessica 3) |
| 25. I sleep big bed | " |
| 26. baby bring some to baby | (Shirley 3) |
| 27. Richard bring snack Shirley | " |

These alternations and the overall chance rate of finding a preposition in a canonical PP argument position suggest that, for PP arguments, subcategorization is gradually acquired on a word by word basis.

The three children who never produced PP adverbials each produced utterances where such a PP is canonical, as is illustrated by 28-31 (and 9-11, above).

- | | |
|---------------------------|-------------|
| 28. we colored crayons | (Clark 2) |
| 29. feed baby fork | (Shirley 3) |
| 30. Shirl get meat dinner | (Shirley 3) |

31. I cut it a knife (Charlie 3)

The three adjunct PPs in the corpus are given in 32- 34.

32. drink with glass (Jessica 2)

33. I had a worm in a park "

34. I had fun at Cooperstown (Jessica 3)

In utterances 11, 28, 29 and 31, the preposition is missing from an instrumental adjunct; in 10 and 30, from a purpose adjunct; in 9, from a locative adjunct. Yet in 32, we find an instrumental adjunct and in 33 and 34, we find locative adjuncts. My explanation for this is that Jessica is more linguistically advanced than the other three children, despite the fact that her MLU is the same as theirs. The independent evidence for this is that she has the highest percentage of inflected verbs and the highest percentage of common nouns used with determiners, as can be seen on Tables 4 and 5. Furthermore, as can also be seen on Tables 4 and 5, there is a curious asymmetry between Jessica's overall production and the overall production of the other children: she produces markedly fewer common nouns and verbs in three hours than any of the other three. Without suggesting that low overall production will consistently correlate with few morphemes per utterance, I would like to suggest such a correlation in the speech of this child and in this way explain the low MLU for a child with a relatively sophisticated grammar.

This explanation of Jessica's use of adjunct PPs suggests that we should expect their onset at a stage of acquisition only slightly later than the one studied here, and this prediction finds independent confirmation in the acquisition literature. In her study of the acquisition of prepositions introducing adverbial constructions in Spanish, Peronard found the first use of such prepositions when MLU = 1.94 (Peronard 1985).¹⁰ In a diary study of one child's acquisition of prepositions in English, Tomasello found that comitative with was first used at 20 mos. while instrumental with was first used at 23 mos., and that dative for was first used at 22 mos. while benefactive for was first used at 24 mos. (Tomasello 1987). These results are consistent with those of the present study.

1.4. Overall results

We have seen evidence that inflection and determiners are predominantly missing at the stage studied, that all but highly context-dependent adverbs are missing, and that the distribution of PPs correlates with their syntactic and semantic function. In Section 3, I will discuss and pursue the idea that these gaps in the corpus are a result of the grammar's limitation to first-order predication. In Section 2, I present arguments that neither a syntactic explanation based on Case Theory (following Lebeaux 1988) nor a pre-formal explanation of the lack of unstressed function words suffices to account for the data we have just reviewed.

Syntax and stress: two hypotheses

2.1. The no case representation hypothesis

The Case Filter of Government and Binding theory standardly (Chomsky 1981) requires that lexical NPs receive abstract case from a member of a defined set of case-markers under the structural relation of government. Among the members of the set of case-markers are prepositions and lexical material in INFL. We have already seen that prepositions are frequently missing in the corpus and that verbal inflection is even more sparsely represented. One might suppose, given this, that the Case Filter is not yet operative in the grammar.

An explicit proposal that lack of case representation is the distinguishing feature of telegraphic speech appears in Lebeaux (1988).¹¹ Lebeaux argues for dual representations of sentences in the standard (adult) grammar, one for elements entering into thematic relations and the other for elements that take part in case assignment. In the standard grammar, these representations merge to form the fully articulated tree of the sentence. In the grammar of telegraphic speech, by hypothesis, there is no level of case representation.

I will assume with Lebeaux that determiners, rather than the NP or the head noun, receive case, and that the case assigning features of transitive verbs should be represented separately from the verb itself. Then, determiners, prepositions and lexical elements in INFL, being the categories that appear on the level of case representation of Lebeaux's analysis, are the

categories we predict will be missing from the corpus. Even if we weaken this to allow for acquisition of these elements without their case properties, however, the No Case Representation (NCR) hypothesis fails to predict the range of data found in Section 1, as we will see immediately below.

In its strong form, the NCR hypothesis is immediately falsified by the occurrence of any determiners, inflection or prepositions and so is simply untenable in light of the data just reviewed. It makes sense, though, to suppose that these elements might enter the lexicon before the grammar sorts out their ultimate representation as assigners or recipients of case and we will pursue this idea for a few moments here, specifically considering how the acquisition of prepositions would be accounted for.

Since we want to account for the distribution of prepositions in the corpus independent of their case marking properties, we need a subsidiary hypothesis. Three such hypotheses are these:

(i) Children acquire prepositions on a word by word basis. If a particular preposition has lexical semantic content in the child's grammar, she will use it in environments where it is canonically required.

(ii) The child gradually learns the subcategorization properties of predicates. If the child's grammar specifies that a predicate subcategorizes for a PP, she uses a PP for the appropriate argument with that predicate.

(iii) The Case Filter is just entering the grammar at the stage studied. The use of recipients and assigners of case will be sub-canonical, and their distribution unpredictable.

The strongest evidence against hypothesis (i) was presented in Section 1. The alternations between using and not using a particular preposition seen in 22-27 are incompatible with the prediction that once the child knows the meaning of a preposition in construction with a particular verb, she will use it to mark that argument. Notice that each of the pairs in 22-27 is produced by a single child during a single hour, with the same verb and the same relevant argument in both members of the pair.

Hypothesis (ii) correctly fails to predict the appearance of prepositions in adjunct position. In light of the alternations in 22-27, a proponent of this hypothesis might argue that subcategorization for a PP rather than an NP is, in the case of many verbs, an idiosyncratic and ultimately unpredictable property that must be learned gradually for each verb. That the child sometimes produces a PP and sometimes an NP with a particular verb is evidence of this gradual learning. Granting this, hypothesis (ii) still fails to predict the range of data we have reviewed, however, since in predicative constructions, such as 35 and 36, nothing subcategorizes for the PP.

- | | |
|-------------------------|-------------|
| 35. a dog at Gami house | (Jessica 2) |
| 36. Mommy in playroom | (Shirley 3) |

As we saw on Table 3, there are 21 instances of such constructions in the corpus.

Hypothesis (iii) fails primarily on theoretical grounds. It portrays the Case Filter not as an all-or-nothing grammatical principle but as a lexicalized restriction acquired gradually upon repeated exposure to various constructions. This is the kind of account that seems necessary in the case of many subcategorization features, since verbs actually do differ in this respect in unprincipled ways, but one that is quite unmotivated for the Case Filter which holds good regardless of the particular verb or NPs in a sentence.

In sum, the NCR hypothesis fails to accurately predict the distribution of PPs in the corpus studied. Note also that it has nothing to say about the lack of adverbs. After briefly considering a less formal hypothesis below, we will turn in Section 3 to the main argument of the paper.

2.2. Unstressed function words

It has frequently been noted, with an emphasis on the naturalness of the phenomenon, that many linguistic elements missing in telegraphic speech are function words that bear no phonological stress. As DeVilliers & DeVilliers (1978) point out, these function words (determiners, inflection and (some) prepositions) are parasitic on content words for their interpretation while nouns, verbs and adjectives have a certain independent referential value; this might well facilitate the early acquisition of content words. Furthermore, the function words normally bear little

phonological stress, making them less salient for the child.

Valid as these ideas may be, they do not predict the delay in the acquisition of a semantic or syntactic subclass of prepositions that we have seen in the data studied. I have seen no evidence suggesting that prepositions in adjunct PPs are less stressed than prepositions in argument or predicate PPs, and none that suggests prepositions in argument or predicate position have more independent semantic value than those in adjunct position; lacking such evidence, the distribution of prepositions in the corpus does not follow from the idea that unstressed function words are acquired late. In addition, we find not only a fairly broad class of prepositions productive at this stage, but also conjunctions, which are simple semantically but certainly qualify as unstressed function words.

Since they both fail to predict the absence of adverbs in the corpus and both predict too strongly the absence of prepositions, the hypotheses considered in this section fail in two directions. By exploiting the more fine-grained classification of PPs in their semantic interpretation, we correctly predict the absence of adverbs and of prepositions in adjunct position in Section 3.

First-order predication and telegraphic speech

The analysis given below makes crucial use of semantic distinctions among prepositional phrases in different environments. Interpretively, adjunct PPs form a natural class with other adverbials, argument PPs with NPs, and PPs in predicate position with intransitive verb phrases, predicate nominals and predicate adjectives. Using a simple type-theory as a way of formalizing these interpretive distinctions, I propose in this section a semantic hypothesis to account for the range of data laid out in Section 1.

3.1. A simple type-theory¹²

The aim of this section is to categorize expressions of telegraphic speech in a way compatible with standard categorizations of expressions in the adult grammar. The systematic gaps in the corpus that were discussed in Section 1 should fall out as an explanatory consequence of this categorization. I chose to use types as the names of categories because higher-order types can be recursively defined out of

the simple ones, so the representation given here allows telegraphic speech to blossom into a more complex language in a natural way.

I assume, in the usual manner for an extensional semantics, two basic types: **e** (for **entity**) and **t** (for **truth value**). The basic expressions of type **e** are names and pronouns;¹³ these expressions denote individuals in the domain of discourse. The basic expressions of type **t** are formulas; sentences are of type **t** and they denote truth values. First-order predicates combine with (one or more) expressions of type **e** to form expressions of type **t**. One-place predicates are of type $\langle e, t \rangle$, two-place predicates of type $\langle e, \langle e, t \rangle \rangle$, and so on, adding **e**'s as the valence of the predicate requires. Basic expressions of category $\langle e, t \rangle$ are common nouns, adjectives, and intransitive verbs. Basic expressions of category $\langle e, \langle e, t \rangle \rangle$ are transitive verbs and prepositions in predicate position.

Predicates have functions as their value.¹⁴ The intuition behind this should become clear with an example. Consider the combination of the term John and the one-place predicate boy in the following sentence (leaving aside treatment of the copula, tense and determiner for the sake of discussion):

John is a boy. The semantic value of the predicate boy is a function from individuals to truth values (type $\langle e, t \rangle$). It maps each individual in the domain to the value **true** or the value **false**. The given sentence is true just in case the function corresponding to boy maps the individual denoted by John to the value **true**. The set of individuals which are mapped to **true** by the predicate in the present example, is the set of boys in the domain of discourse. In what follows, I will feel free to talk about such a set as the denotation of a predicate.

Predicate modifiers, which we found missing in telegraphic speech, also take functions as their semantic value. However, predicate modifier functions are of a higher type than simple predicate functions since they take other functions, rather than individuals, as their argument. Formally, predicate modifiers are expressions which combine with a predicate of category **X**, **X** arbitrary, to form a new predicate of category **X**.

For example, the predicate modifier quickly in the following sentence combines with the one-place predicate walked to form a new one-place predicate:

John walked quickly.

Since quickly is a restrictive modifier, the denotation of walked quickly is a subset of the denotation of walked. The type assigned to predicate modifiers here is $\langle\langle e, t \rangle, \langle e, t \rangle\rangle$. Since the adverb in the example takes a first-order function as its argument, it is a second-order function.¹⁵

We now have an inventory of five types, represented on Diagram 1, and we should stop here to consider the place of PPs in this system.

type	category	example
$\langle e \rangle$	name, pronoun	Joan, she
$\langle t \rangle$	sentence	Joan ran
$\langle e, t \rangle$	intransitive verb, predicate nominal, predicate adjective,	ran mammals red
$\langle e, \langle e, t \rangle \rangle$	transitive verb,	touch
$\langle \langle e, t \rangle, \langle e, t \rangle \rangle$	adverbial	quickly

DIAGRAM 1

Prepositional phrases do not uniformly map to any one of these types. Depending upon their syntactic position and the verb with which they are in construction, they may be interpreted as case-marked entity-denoting expressions ((a)), as first-order predicates ((b)) or as predicate modifiers ((c)).¹⁶

- (a) Joan gave a porcupine to the zoo
- (b) Joan is at work
- (c) Joan was crying in the church

Crucially for the analysis being developed here, only the PP in (c), the adjunct, is a higher-order function. It was from this position that the preposition was consistently missing in the data discussed in Section 1.

Determiners, like predicate modifiers, are higher-order functions. This is because a determiner combines with a predicate (a common noun) to form a new expression. The simplest type that can be assigned to

determiners is $\langle \langle e, t \rangle, e \rangle$ ¹⁷. Roughly speaking, in the NP the boy the determiner operates on the predicate boy to pick out a particular member of its denotation.

Following Bach (1980) and Janssen (1983), I treat inflection for tense and aspect as verb phrase modifiers. Semantically, tenses and aspects are operators which combine with a VP to form a new VP with a more restricted denotation. As VP-modifiers, these inflectional categories are functions taking other functions as their arguments and therefore are beyond the pale of a first-order semantics.¹⁸

3.2. A semantic account of telegraphic speech

Using the framework just outlined, we are now in a position to state formally the semantic hypothesis that accounts for the data presented in Section 1. It is: the grammar of telegraphic speech is restricted to first-order predicates and entity-denoting expressions. This hypothesis correctly predicts the absence from canonical positions of predicate modifiers, inflection and determiners which was seen in Section 1. The positive prediction is that we can expect the major first-order predicates of the adult grammar to function predicatively in telegraphic speech, and we turn to that prediction in Section 4.

The particular focus of the present study, the distribution of prepositions in the corpus, from the constraint to first-order predication in this way: predicate PPs are first-order functions taking the subject NP as their argument; the NP object of a PP in argument position is the argument of the verb, this argument being marked for thematic case by the preposition; adjunct PPs, as predicate modifiers, are higher-order functions and the constraint rules them out from the grammar of telegraphic speech.

Two questions about this treatment of PPs in telegraphic speech naturally arise. (i) Why do NPs show up where the adult would use an adjunct PP and how are these NPs interpreted in the grammar? (ii) Why do argument PPs show up with chance frequency rather than all the time? We will return to these questions in Section 3.5.

3.3. The syntax and semantics of word combination

We have come a long way in correctly predicting which categories of words will occur in telegraphic speech, but we need to go further to account for how these words are combined into well-formed expressions of the language being studied, and doing that is the goal of this section. We will find that the fulcrum of composition in telegraphic speech, as in the adult grammar, is the predicate, with arguments freely supplied by context.

Implicit in the above categorization of basic expressions into types is the assumption that the valence of the predicate is given in the lexicon. The justification for this assumption should be spelled out. First of all, the valence of a predicate is part of its lexical semantics. The verb touch is inherently a two-place relation between individuals, for example; just as inherently, the verb cry is a one-place predicate attributing a property to an individual. It would be difficult to say what these words meant, for the child or the adult, without reference to their valences.

Secondly, the use of predicates in the corpus studied agrees with respect to valence with the adult usage. In the case of non-verbal predication, the children consistently use the appropriate number of arguments, as they do in the examples of nominal, adjectival and PP predication in 37-42.¹⁹

- | | |
|-----------------------|-------------|
| 37. this a pony | (Charlie 3) |
| 38. I Santa Claus | (Jessica 3) |
| 39. peas hot | (Jessica 1) |
| 40. baby hungry | (Clark 3) |
| 41. mommy in playroom | (Shirley 3) |
| 42. cow cow in here | (Charlie 1) |

In the case of verbal predication, the children use anywhere from all to none of the canonically required arguments, as can be seen in the paradigms below.

- | | |
|-------------------------|-------------|
| 43. ride | (Charlie 3) |
| 44. they ride | |
| 45. ride horsies | |
| 46. they ride the horse | |
| 47. fix | (Shirley 2) |
| 48. Shirl fix | |
| 49. Shirl fix it | |

50. bring (Shirley 3)
 51. bring you a yellow one
 52. baby bring some to baby
53. me open (Clark 2)
 54. open it
55. eat (Jessica 1)
 56. I eat banana

The crucial observations are that (i) predicates are not used with more than the canonical number of arguments, and (ii) in general, the children use any given verb with each of its canonical arguments in one utterance or another. If we are to give any formal account of the structure of early word combinations, these facts require that the valence of the predicate be represented in the lexicon.

We are now in a position to give (preliminary) syntactic rules for combining predicates with their arguments.

Subject-predicate rule

A one-place predicate, **a**, is conjoined with an entity-denoting expression, **b**, to form a sentence, **ba**.

Internal argument(s) rule

An *i*+1-place predicate, **a**, combines with ordered *i*-tuples of entity-denoting expressions, **b**, to form a one-place predicate, **ab**.

These rules give us the syntax of the core semantic operation of telegraphic speech, which is simply function application. The rules suffice to give a structural account of utterances such as 57-60.

57. he slide (Charlie 2)
 58. Rory hide (Shirley 2)
 59. Mommy do it (Clark 3)
 60. I want this (Jessica 3)

We still have to say more, however, if function application is to account for the well-formedness with respect to the grammar of telegraphic speech of many other utterances in the corpus. In particular, we need an account of argument-drop and an account of common nouns and adjectives in argument position which is compatible with their use as predicates.

3.3.1. Argument-drop

The grammar developed so far will fail to produce utterances where canonical arguments are missing since predicates are marked for valence and the rules of function application make reference to these valences. A predicate is a function that takes a certain number of arguments; without a complete set of arguments, the function cannot be computed. Yet we saw in 43-56 that children frequently omit arguments at this stage and so the correct grammar must actually count such utterances as well-formed. In order to allow for this, we can assign contextually-given referents a formal role in the grammar.

Deictic gestures (including gaze), prior linguistic reference and indexical pronouns each intuitively suffice to fill in missing arguments in interpretation. We can formalize this intuition as a principle of interpretation in the grammar.

Principle of definite reference

Given sufficient contextual support, an indexical of type <e>, restricted by the context, may be introduced to fill any argument position of a predicate.

For purposes of exposition, I will represent restricted arguments introduced by this principle with indexical pronouns in solid capitals when the occasion arises.²⁰

As it stands, the Principle of Definite Reference is a stipulation. However, we need something like this principle anyway to account for the semantic value of indexical pronouns such as those used in 61-63. Furthermore, we need it in the adult grammar where argument-drop is possible, if more restricted than in telegraphic speech.

- | | |
|------------------------------|-------------|
| 61. I wanna eat <u>that</u> | (Jessica 1) |
| 62. <u>here</u> 's a orange | (Clark 2) |
| 63. <u>this</u> is big truck | (Charlie 3) |

In adult production, we find argument-drop only in casual conversation. These conversational situations provide immense contextual support which licenses utterances such as Don't touch, with an understood object, and Sat talking to John all through the presentation, with an understood subject. We will need a principle of definite reference to account for

this usage in the adult grammar, a fact that lends further support to its incorporation in the grammar of telegraphic speech.²¹

3.3.2. Non-verbal-predication

The data abundantly support treating common nouns, adjectives and PPs (in the right position) as predicates in the grammar of telegraphic speech, just as in the adult grammar.²² Some examples of predicative uses of words in these categories are:

- | | |
|------------------------|-------------|
| 64. that coffee | (Clark 1) |
| 65. this is top | (Jessica 1) |
| 66. this is green | (Charlie 2) |
| 67. I cold | (Jessica 3) |
| 68. do ba mommy in cup | (Shirley 3) |
| 69. @ fork in @ juicey | (Clark 3) |

However, treating common nouns as predicates leads to the problem of mis-matched types, mentioned above. Consider 70.

- | | |
|------------------|-------------|
| 70. I eat banana | (Jessica 1) |
|------------------|-------------|

If we take banana to be the internal argument of eat, and yet assign it the predicate type $\langle e, t \rangle$, then the verb has to be of a still higher type. Assigning predicates ever higher types depending upon the type of their arguments is not only a disadvantage for the account being developed here, but is undesirable in general since the higher type for the verb is quite unmotivated when proper names, pronouns or full NPs appear in argument position.²³ In a simplified Montague grammar with determiners, this problem is easily avoided by making the determiner a function from predicates to terms, which are of the appropriate type $\langle e \rangle$ (see discussion in Dowty 1979), an option not available here since telegraphic speech lacks determiners.

We could solve this problem by a rule of type-shifting, proposed for the adult grammar in Chierchia (1984), Partee and Rooth (1983), and Partee (1984). However, the corpus studied doesn't contain morphologically marked nominalizations or other independent evidence for such rules in the child's grammar, while the context of utterance obviously plays a big role.

We might take a cue instead from the treatment of indefinites in the discourse semantics of Kamp (1981) and Heim (1982) and say that, in the logical form of the proposition, a variable fills the argument position and that the value for this variable has to satisfy the conditions imposed by the common noun and any modifiers. In Heim's work, the open sentences resulting from this formalization get closed either by the quantifier associated with some lexical item or syntactic rule, or by a default rule of existential closure.

Something like this should work for the child's grammar, but we do not need to assume a quantificational structure. Instead of filling argument positions with variables, we can generalize our use of the Principle of Definite Reference and fill argument positions across the board with indexicals, which may or may not be represented linguistically. Then, common nouns can be treated as restrictions on the value of the indexical, generated syntactically by the following rule for forming NPs.

NP Rule

n -tuples of common nouns (CN_0, \dots, CN_n) taking the same indexical as argument may be conjoined to form a phrase of type $\langle e \rangle$. The conjunction is an NP and the indexical is its head.

To see how this works, consider 70-73.

70. I eat that cake	(Jessica 1)
71. I eat that	"
72. eat	"
73. this my cake	"

In 70-72, the verb is the main predicate. In each of them, the kernel logical form for the verb phrase is eat(THAT); in 70, a restrictive conjunct is added: & cake(THAT). Since the rule allows for 0-tuples of common noun modifiers, in all three cases, the indexical is the head of the object NP. This gets a term into the argument position of the verb without changing the category of the common noun. In 73, the common noun is the main predicate; its logical form is: my cake(THIS). Here, the NP subject is the indexical this.

This treatment should be generalized to cover adjectives as well as common nouns. Doing this will

mean that a sentence like **a gets a fully first-order treatment while also ensuring that the adjective is part of the subject NP.**²⁴

a. Little horse fall down

little(THAT) & horse(THAT) & fall down(THAT) This treatment of adjectives also reflects the fact that the line between adjectives and nouns is fuzzy for the children, as is evident in 74-77.

- | | |
|---------------------------|-------------|
| 74. mommy have handle cup | (Shirley) |
| 75. bring mom yellow | (Shirley 3) |
| 76. table chair | (Shirley 2) |
| 77. orange through | (Charlie 1) |

We could generalize the NP Rule to adjectives simply by saying that n-tuples of common nouns and/or adjectives taking the same indexical as argument form an NP. Alternatively, we could divide the class of predicates by assigning the feature +N to common nouns and adjectives and -N to verbs and PPs, and then state the NP rule in terms of +N predicates. We have already seen one reason for preferring the second option in noticing that the children use common nouns in adjective position and adjectives in positions canonically reserved for common nouns. There are two others.

First, into the adult grammar, -N predicates specify the nature of the relation in which their arguments stand, while nominal predicates, demonstrably, do not and we have no reason to say that adjectives do. Genitive determiners and noun compounds both serve to show that nominal predicates leave the relation borne to their argument under-specified.²⁵

Consider the phrase Joan's team. Without contextual support, we only know that Joan bears some relation to the team and not what one. She might be the coach, a fan, a player, the manager; the point is that the structure doesn't fix the relation. The facts are similar in the case of noun compounds. In a-c below, pragmatic knowledge steps in to fix the relation left under-specified by the structure itself. Notice how the interpretation of the relation changes with each new head noun.

- a. a gasoline engine
- b. a gasoline refinery
- c. a gasoline soup

This stands in contrast to -N predication found in phrases such as the team on/from/near/with the field where the preposition chosen fixes the nature of the relation between the team and the field. Verbs also strictly fix the nature of the relation among their arguments, assigning each argument a thematic role.

Another reason to suppose that the class of predicates is bifurcated by the features +/-N in the child's grammar is that the children show a marked tendency to use indexical pronouns as subjects of +N predicates and not with -N predicates. PP predicates in the corpus always take fully nominal subjects rather than indexicals whereas predicate adjectives and nominals are split between the two. It is as if definite referents are characterized directly by the latter kinds of properties, which are typically of an enduring nature, but not by the thematic roles conferred by PPs and verbs.

The NP rule generalized via the feature +N to cover adjectival modifiers is as follows.

NP Rule

n-tuples of +N predicates (+N₀, ..., +N_n) taking the same indexical as argument may be conjoined to form a phrase of type <e>. The conjunction is an NP and the indexical is its head.

Notice that an unbounded NP rule such as this allows two (or more) common nouns in a row to form an NP. This is by design since such combinations are ambiguous between an interpretation in which the rightmost common noun is a sentential predicate (pragmatically favored in 78) and a referential one (pragmatically favored in 79) in which the common nouns and implicit indexical together form an NP. The syntax ought to produce both structures.²⁶

- | | |
|---------------------|-------------|
| 78. @ baby no teeth | (Clark 3) |
| 79. table chair | (Shirley 2) |

The grammar proposed here captures this ambiguity by allowing sequences of +N predicates to be produced by either the Subject-Predicate Rule or the NP Rule.

3.5. Open questions

The chance frequency of argument PPs at this stage of acquisition is hardly surprising given the idiosyncracies of many English verbs in their subcategorization. Consider the verb pairs happen/affect and look/watch.

- a. That happened to Joan/*Joan.
- b. That affected *to Joan/Joan.
- c. Joan looked at the snake/*the snake.
- d. Joan watched *at the snake/the snake.

Although they have similar lexical semantics, happen subcategorizes for a PP and affect for an NP theme; similarly, look requires a PP where watch takes an NP.

I take it as a premise that the child can know the valence of a predicate before knowing the syntactic category for which each argument slot is specified.²⁷ She will come to know the subcategorization features of particular verbs gradually, by repeated exposure to the verb's canonical use, not by a principled change in her grammar.²⁸

We turn now to the question of why NPs show up where the adult would use an adjunct PP (refer to 9-11 and 28-31 for examples.) In addressing this question, we have to separate the theory-internal stricture that these NPs not be functioning adverbially from the question of how they are to be integrated into the semantics being proposed. For the first, we need independent evidence that the NPs are non-adverbial.

The most weighty indication that the NPs are non-adverbial in telegraphic speech is that the children use no other adverbial expressions, in particular no lexical adverbs, as we saw above. If the NPs were functioning adverbially, this lack of a large open class of lexical items with similar semantic value would go unexplained.

Importantly, NPs do not function adverbially in the adult grammar, as can be seen in the contrasts below.

- a. During winter, it rains in Louisiana.
- *b. Winter, it rains in Louisiana.
- c. We saved the sandwiches for lunch.
- d. We saved the sandwiches to have at lunch.

- *e. We saved sandwiches lunch.
- f. Pioneers opened tin cans with chisels.
- g. Using chisels, the pioneers opened tin cans.
- *h. Pioneers opened tin cans chisels.
- *i. Chisels, the pioneers opened tin cans.
- j. She had lunch on the fairgrounds.
- *k. She had lunch the fairgrounds.

These examples show that in each of the temporal, purpose, instrumental and locative adverbial cases, the adult grammar requires a lexical item that narrows down just what (adverbial) relation holds between the NP in the adjunct and the main predicate of the sentence. These were the very lexical items that we found absent in the corpus studied, indicating that the adverbial construction itself is beyond the capacity of the grammar at this stage.

In order to say that the NPs in 9-11 and 28-31 were functioning adverbially, we would have to say that the only instance of adverbial predication in the child's grammar is one that is not grammatical in the adult grammar, and presumably is not modeled in the input. Conversely, adverbial expressions grammatical in the adult language do not show up in the corpus, and were the NPs in question adverbial we would need an independent explanation of that. The clearer course is to say that adverbials play no part in the grammar of telegraphic speech and that the problematic NPs are either simple predicates or entity-denoting expressions.

If the NPs in question are simply entity-denoting expressions, then we need to say how they are to be integrated into the structure of the rest of the utterance. In the case of argument NPs, this integration was a simple matter: the verb denotes a function and combines with one or more NPs denoting entities to form a sentence. If we said that the verbs in 9-11 and 28-31 had extra argument places for the purpose, instrument and location NPs, then we could give the same account of structural composition in these cases. However, this kind of step is misguided in an acquisition analysis since it would lead to grave learnability problems: assuming the child misanalyses the valence of predicates in an upward direction, we incorporate into her grammar wrong information that cannot be unlearned on the basis of positive evidence.

The alternative is to treat the NPs under discussion as first-order predicates, and then the question is what they take as their argument. There are only a few options: one of the arguments of the verb, a contextually given argument, or the event associated with the rest of the utterance might be serving as the argument of the predicative NP. To sort out which of these alternatives is most true to the interpretation, we should look more closely at the utterances.

From the point of view of the listener, the interpretation of 9-11 and 28-31 presents very little problem. When a child holds an object and runs a knife over it, saying I cut it a knife (Charlie 3), we understand that a knife refers to the instrument used in the cutting. When she says Shirl get meat dinner (Shirley 3), we infer that she means to get the meat for dinner, giving the NP a purpose role. In neither the purpose nor the instrument cases, do we interpret the ADJUNCT NP as predicating a property of the other NPs in the sentence or of referents from context; instead, the referent of the ADJUNCT NP is understood to bear some relation to the event the child is talking about.

In a context where a child is talking about an object crying and about a place, as in 84-86 below, we might infer that Joan's house in 86 is the location of the event or that it is the location of the object itself.

- 84. @ head crying
- 85. @ Joan's house
- 86. @ crying @ Joan's house

In the locative case, then, the interpretation is underdetermined not only with respect to what relation the ADJUNCT NP stands in with respect to the rest of the clause, but also with respect to whether it is related to the event or the referent of an NP.

From the point of view of the child, it may or may not be that the adult's interpretation is the intended one. Given context, it is easy to infer a particular relation between the NP and the rest of the utterance, but the blatant fact is that the child leaves this relation linguistically unencoded. Even if the child does mean what we suppose, she is apparently either unable to put it in words or finds it unnecessary (as adults find it unnecessary to specify

the nature of the relation in genitive NPs and noun compounds.)

What we are left to infer in each case is a relation between two entities. The missing link in the logical form is a predicate that will relate the ADJUNCT NP and the event variable or subject-NP. The interpretive rule for the ADJUNCT NPs must leave the nature of this relation under-determined just as the interpretive rules for genitive NPs and compound nouns in the adult grammar are under-determined.

The syntactic position of the ADJUNCT NPs will be fixed by the following rule.

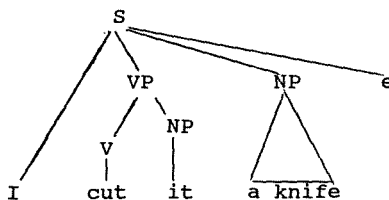
Default attachment

Attach unanalyzeable NPs to the topmost node of the existing tree.

Definition: an NP is unanalyzeable if it occurs in an utterance with a predicate but fills no argument position.

A rule of this sort was first proposed in the acquisition literature by Tavakolian (1978) in her analysis of children's interpretations of control structures; Lebeaux (1988) makes use of a similar rule in his analysis of the syntactic structure of telegraphic speech.

The rule of interpretation associated with Default Attachment plays on its syntax. I assume, on the basis of its intuitive value, that the event variable is attached to the sentence node. Together, the Subject-Predicate Rule and the Internal-Arguments Rule ensure that there is a constituent, corresponding to the adult's VP, separate from the Subject-NP, and that both of these constituents are daughters of S. The tree for sentence 31, then, looks like this:



We can now give the rule of interpretation for Default Attachment.

Default interpretation

An entity-denoting expression introduced into the structure by Default Attachment stands in relation X, X free, to a sister entity-denoting expression.

This rule entails that an ADJUNCT NP can only be related by X to the subject NP or the event variable, which are the two interpretations available for this construction. (Notice that the implicit predicate, X, is entirely context-dependent, in keeping with my earlier position that predicates taking e as argument must be context-dependent.) The constraint to sisterhood also has a theoretical advantage: by requiring that the ADJUNCT NP be a sister to its co-argument, we get the result that all instances of predication in the grammar of telegraphic speech involve sister-hood. This is significant in view of Williams' (1980) compelling arguments that predication can only occur under the relation of sister-hood. Since, there is no overt predicate in cases of Default Attachment, it is the arguments that are required to be sisters.

The short answer to the first question posed at the beginning of this section is this: the ADJUNCT NPs are entity-denoting expressions related by a semantically under-determined rule of interpretation to some other element of type <e> in the structure. This treatment reflects the fact that their interpretation with respect to the rest of the clause is not fully determined by the grammar but requires inference. We saw reason to think that the ADJUNCT NPs cannot be adverbials, and failed to find any theoretical or empirical reason to think them predicates.

4. Conclusions

The grammar of telegraphic speech presented here successfully accounts for why certain classes of words are missing and for the syntactic and semantic structure of the utterances that do occur. The fundamental semantic operation of telegraphic speech is function application. The major predicate categories of the adult grammar all function as predicates in the earliest word combinations in the course of acquisition. The learnability problem is pared down if we assume, on these grounds, that expressions of these

categories are recognized as predicates by Universal Grammar and that the syntax and semantics of function application are part of UG.

Aknowlegements

The data on which this analysis is based come from a research project conducted by Lois Bloom and her research assistants at Teachers College. I gratefully acknowledge the opportunity to work as a research assistant on the project from 1983-5, and the opportunity to use data from it for this study. The data is not yet publicly available.

Endnotes

1. The corpus is made up of twelve hour-long transcripts, three hours for each of four children, two girls and two boys. The transcripts were taken from video-tapes of play sessions at Teachers College at which the child, her mother and a research assistant were present. On the middle tape for each of the three children, the Mean Length of Utterance (MLU) is 1.5 morphemes. In the course of the paper, I'll refer to the tapes by the child's name and the number 1, 2 or 3 for the first, middle and last tapes, respectively. The ages of the children when recorded range from 16-28 months. I include age range for each child here for reference.

Shirley: 16 - 18 months

Clark: 21 - 23 months

Charlie: 24 - 26 months

Jessica: 26 - 28 months

2. There were instances of quasi-partitives found in the speech of two children (e.g. lamb lamb on top of a moo (Clark 1). These are not included in the post-nominal PP count.

3. The Teachers College research project used the diacritic @ to stand for unanalyzeable grunts. Its distribution in the corpus is not predicatable from general principles.

4. Formally, I assume that adjuncts are semantic modifiers in the sense of Marantz (1983); modifiers are functions which map the denotations of expressions of category X to denotations of expressions of category Y. I do not assume that all cases of syntactic adjunction are modifiers. To keep these two senses of the word distinct, I will refer to syntactic adjuncts which are not modifiers as ADJUNCTs.

5. The classification of a complement as an adjunct or an argument is a result of applying the following syntactic tests, familiar in the literature at least since Williams (1975) and Jackendoff (1978), to adult usage: (i) grammaticality as the subject in passive and raising constructions, (ii) grammaticality outside the range of a do so anaphor, (iii) freedom to iterate, (iv) preposing, (v) preposing when a manner adverbial is left in the VP, (vi) order with respect

to manner adverbials, (vii) acceptability in verbal compounds, (viii) whether interpretation of an adverb as a V or VP adverb is affected by the presence of the complement, (ix) appearance as an argument of a nominal form of the verb, (x) whether any NPs are acceptable substitutes for the PP.

Since some arguments are more direct than others, the behavior of PP arguments on these tests is not uniform; instead they fall on a continuum of directness. At the same time, considering the whole battery of tests and taking (i) - (v) as the most significant, we get a clean empirical break between the arguments and the adjuncts.

6. For arguments that adjectives are best treated as first-order predicates, see Kamp (1975).

7. The acquisition of such agreement features is itself a large topic. For discussion of experimental results, see Gathercole (1985), Karmiloff-Smith (1979), and Maratsos (1974, 1976). I'm claiming here that lack of agreement between the determiner and the common noun supports the notion that determiners are not a productive part of the grammar at the stage studied.

8. Keenan and Faltz (1985) argue that only locatives can be treated extensionally. For extensional treatments of some other adverbials, see McConnell-Ginet (1982) and Parsons (1988). It should be noted that successive NP utterances were never included in counts of missing prepositions. This explains why there is no count for prepositions missing from predicate position on Table 3. Some successive NP utterances (such as (a)-(d)) intuitively suggest a predicative ((a)-(b)) or adverbial ((C)-(d)) interpretation canonically mediated by a preposition in the adult grammar.

(a) I bridge	(Charlie 1)
(b) mama home	(Jessica 1)
(c) juicy baby	(Clark 3)
(d) cookie a baby	(Clark 2)

Had these been included, the number of prepositions missing from adjunct position would have been higher than is reported on Table 3.

9. 1.94 is the average MLU for the three children in Peronard's study. The MLU when an adverbial

preposition was first used is very close for all three:

MLU at first use of adverbial PP	age
Alvaro 2.0	28 mos.
Soledad 1.87	21 mos.
Patricio 1.96	34 mos.

10. Note also that Jessica is the oldest of the four children studied.

11. Treating telegraphic speech is one among several goals of Lebeaux's analysis of how the grammar is organized, and he does not treat acquisition data in any detail, assuming instead that telegraphic speech is pure content words. For that reason alone, the very specific empirical facts used here to refute a Case filter hypothesis are not *prima facie* counter-evidence to his analysis.

I would like to note that Lebeaux's notion of a level of Theta Representation was a starting point for me in developing the hypothesis presented in Sections 3 and 4.

12. Readers familiar with type-theoretic semantics need only skim 3.1.

13. Pronouns, on this account, are represented as individual variables the value of which is specified by linguistic and extra-linguistic context.

14. I assume here and throughout that each lexical predicate has a unique denotation and so I freely refer to their values as functions.

15. A higher-order treatment of adverbials is crucial in an intensional logic because of the failure of inferences like the following.

- a. John walked quickly.
- b. Everyone who walks at a time t , talks at t .
-
- c. John talked quickly.

Inferring c from a and b would be valid without an intensional interpretation of the verbs. The semantics I present for telegraphic speech, however, is entirely extensional and it is conceivable that

adverbials could be given a first-order interpretation in such a semantics.

Parsons (1980, 1988) argues for such an interpretation of VP-adverbials, analyzing them as one-place predicates of events, a sortally distinct type of individual. If his analysis is right, mine would not predict the absence of VP adverbials from telegraphic speech. However, there are several disadvantages of his approach, the first two from the point of view of semantic principle and the second two empirical:

(i) the semantic representation in Parsons' system reflects none of the syntactic structure of the sentence;

(ii) only a fairly restricted class of adverbials are treated in his system (subject-oriented adverbials and S-adverbials, for example, are not treated);

(iii) Parsons' semantics, in which the events are meant to represent real-world entities, does not extend to a treatment of habitual or generic sentences. To see this, consider (a).

(a) John closes windows carefully.

The only way I see to interpret this in Parsons' system is with a universal quantifier (or genericity operator) binding the event variable. The truth conditions will be like this: For all events, if the event is a window-closing with John as its agent, then the event is careful. And yet this is not the result we want, since it will be true if John never closes windows at all.

(iv) Angelika Kratzer (class lectures, 1986) has pointed out that certain VP-adverbs, such as those in a and b, cannot reasonably be analyzed as predicates of an event variable, bringing into question whether there is a definable class of adverbs to which Parson's analysis does apply.

- a. John chopped the onion **coarsely**.
- b. Mary wrapped the present **nicely**.

16. Obviously, if NPs are interpreted as generalized quantifiers determiners do not become first-order functions. In that case, their type is

<<e, t>, <<e, t>, t>>. For simplicity's sake, I leave this more widely accepted classification out of the discussion in the text.

17. The semantics of tense and aspect in English is an area of great debate. Montague's (1973) analysis requires a higher-order semantics, as do those cited in the text. Enç (1985, 1986) argues that tense is a referential expression, and Parsons (1988) that tense and aspect should both be analyzed as predicates of events. The questions arising from Parsons' analysis, discussed in note 17 apply here as well.

18. There are different approaches to getting PPs in argument position to be interpreted as arguments rather than predicates. I assume here, following Marantz (1984), that the preposition assigns case (thematic and abstract) to its object, but that it is the NP which is taken as an argument by the verb. For an alternative approach see Colban (1987).

The big disadvantage to giving a uniform interpretation to PPs in type theory is that it would entail massive duplication of entries for individual verbs. Intransitive walk for example, need only be a first-order predicate, but walk with a directional adverbial PP would need a much higher type, since the PP argument would itself be a function.

19. For a precise analysis of the interactions of semantic selection and syntactic subcategorization, both to a degree idiosyncratic from verb to verb, in determining the category of complements, see Grimshaw (1979).

20. The semantic bootstrapping hypothesis, proposed by Grimshaw (1979), under which children make the leap to syntactic subcategorization on the strength of semantic generalizations about the denotation of expressions in argument position, draws its strength from the fact that there are typical categorial realizations of, for example, entity-denoting expressions. In this light, the PP arguments discussed in the text are seen as exceptions to the rule and would have to be learned as such, on a verb by verb basis, as I am arguing.

21. In NPs with relational head nouns, such as Joan's father, the head noun fixes the relation left unspecified by genitive case. The links to underspecification in the adult grammar which are

discussed in the text were pointed out to me by Barbara Partee.

22. I am allowing here for intransitive prepositions in the lexicon, as one-place locative predicates. This is independently motivated by similar usage in adult speech and accounts for examples such as these:

orange through	(Charlie 1)
this up	(Jessica 2)
boy under	(Shirley 2)

23. Reference to Martin Davies in Journal of Philosophical Logic from Barbara Partee.

24. Note that although the practical distinction between the adult and child production with respect to argument drop is privative (the children exploiting the Principle of Definite Reference more freely than adults), there is no syntactic distinction between the grammars in what we have said. This leaves us free of the learnability problems that would arise (on the basis of the Subset Principle) if the adult grammar were in principle smaller than the child's.

25. The PP predicates in the data are almost all locatives (one benefactive). With them, as with verbs, there is no ambiguity about the intended relation to the subject. Nominal predicates, on the other hand, are underspecified with respect to the relation borne to the subject.

It is also interesting to note that PP predicates always take fully nominal rather than indexical subjects in the corpus, whereas predicate adjectives and nominals are split between the two. It is as if definite referents are characterized directly by the latter kinds of properties, which are typically of an enduring nature, but not by the thematic roles conferred by PPs and verbs.

26. See Chierchia (1984) and Rooth and Partee (1983) for discussion of this problem. Chierchia gives a type-theoretic treatment of the adult grammar in which second-order functions are the highest. In full agreement with the argument I present in the text, inflection, determiners and adverbials are the categories requiring second-order treatment.

27. Matthei (1979) reports experimental evidence showing that children between the ages of 4 and 6

years show a marked preference for giving an intersective interpretation to sequences of nominal modifiers, where the adult assigns a non-intersective interpretation. For example, the children interpret the expression the second green ball as referring to a ball which is both second and green, even in a situation where the first ball is red. This is precisely the interpretation that would be assigned by the grammar being developed in the test, where modifiers taking the indexical as argument are conjoined.

28. Barbara Partee pointed out these observations to me.

29. Bloom (1971) in arguing for rich interpretation was the first to systematically discuss the ambiguity of nominal combinations in early grammar.

Number of PPs

	post-verbal PP	post-nominal PP	PP alone	TOTAL
Jessica				
1	0	0	2	2
2	3	6	2	11
3	3	1	4	8
Shirley				
1	0	0	3	3
2	1	1	1	3
3	9	2	12	23
Charlie				
1	0	1	6	7
2	0	0	4	4
3	3	1	0	4
Clark				
1	0	0	2	2
2	3	3	3	9
3	5	4	4	13
TOTALS	28	21	42	87

TABLE 1

% of Occurrences of Relevant Complement as PP

verb	n of relevant utterances *	% of n where prep. occurs before Y
1. <u>put</u> X at Y	3	100
2. <u>look</u> at Y	4	25
3. <u>bring</u> X to Y	2	50
4. <u>happen</u> to Y	5	0
5. <u>go</u> to Y	15	53
6. <u>move</u> (X) to Y	1	100
7. <u>fly</u> in Y	1	100
8. <u>hide</u> in Y	1	100
9. <u>roll</u> X to Y	1	100
10. <u>play</u> with/at Y	8	37.7
11. <u>sit</u> on Y	3	33
12. <u>lie down</u> on Y	1	0
13. <u>help</u> (X) with	3	33
14. <u>sleep</u> in Y	3	33
15. <u>color</u> (X) with Y	2	0
16. <u>eat</u> (X) with Y	1	0
17. <u>cut</u> X with Y	2	0
18. <u>feed</u> X with Y	1	0
19. <u>cry</u> at Y	1	0
20. <u>get</u> X for Y	1	0
21. <u>save</u> X for Y	1	0
22. <u>drink</u> X with Y	1**	100
23. <u>have fun</u> at Y	1**	100
24. <u>have</u> X at Y	1**	100

* An utterance was judged relevant if the verb was used with a complement which would be realized canonically as a PP.

** Jessica is the speaker in these cases; see discussion in Section 1.

TABLE 2

Prepositions Present and Absent

Prepositions	Number of Instances
PP in argument position PP in PRED position PP in adjunct position	25 21 3
Missing Prepositions	
argument position adjunct position	26 9

TABLE 3

Inflection, modality and aspect:
total n for utterances with verbs

	Jessica	Shirley	Charlie	Clark	Tot.
copula	26	2	17	12	57
present -s	2	4	1	5	12
-ed	0	0	9	3	12
-ing	7	16	16	10	49
past participle	6	4	13	3	26
-ing with form of <u>to be</u>	0	0	1	5	6
irregular past	8	3	8	7	26
future modal/ semi-modal	10	2	5	5	22
negation	10	0	8	7	25
total n of verb use with inflection	69	31	78	57	235
total n of verb use without inflection	97	222	157	276	752
total n of verb use	166	253	235	333	987
% verb use with inflection	41.5%	12%	33%	17%	24%

TABLE 4

Determiners

	Jessica	Shirley	Charlie	Clark	Tot.
a	25	15	39	83	162
the	9	14	28	23	74
poss. pronoun	28	0	1	10	39
one	0	0	13	2	15
demon- strative	16	0	2	7	25
another	0	1	0	4	5
some	0	1	0	1	2
cardinal numbers	1	0	0	3	4
total CN use with determiner	79	31	83	133	326
total CN use w/o determiner	220	490	371	475	1566
total CN use	299	521	454	608	1892
% CN uses with determiner	28%	6%	18%	22%	21%

TABLE 5

References

- Bach, Emmon. 1980. Tenses and aspects as functions on verb phrases. Time, tense and quantifiers. (Proceedings of the Stuttgart Conference), ed. by C. Rohrer. Tübingen: Max Niemeyer. Verlag
- Bloom, Lois. 1970. Language development: form and function in emerging grammars. Cambridge, MA: MIT Press.
- _____; Peggy Lightbown; and Lois Hood. 1975. Structure and variation in child language. Monographs of the society for research in child development, 40 (serial number 160). Chicago: University of Chicago Press.
- _____; Karen Lifter; and Jeremie Hafitz. 1980. Semantics of verbs and the development of verb inflection in child language. *Lg.* 56.386-412.
- Brown, Roger. 1973. A first language: the early stages. Cambridge, MA: Harvard University Press.
- Chierchia, Gennaro. 1984. Topics in the syntax and semantics of infinitives and gerunds (University of Massachusetts dissertation). Amherst: GLSA.
- Chomsky, Noam. 1981. Lectures on government and binding. Dordrecht: Foris.
- Clark, Eve. 1971. On the acquisition of the meaning of before and after. *J. of verbal learning and verbal behavior* 10. 266-275.
- Colban, Erik. 1987. Prepositional phrases in situation schemata. Situations, language and logic, by Jens Erik Fenstad, *et al.* Dordrecht: Reidel.
- Crain, Stephen. 1982. Temporal terms: mastery by age five. Papers and reports on child language development 21. 33-38.
- Davidson, Donald. 1967. The logical form of action sentences. reprinted in *Essays on actions and events*, by Donald Davidson. 1980. Oxford: Clarendon.

- DeVilliers, Jill; and Peter DeVilliers. 1973. A cross-sectional study of the acquisition of grammatical morphemes. *J. of psycholinguistic research* 2. 267-278.
- _____. 1978. *Language acquisition*. Cambridge, MA: Harvard University Press.
- Dowty, David. 1979. *Word meaning and montague grammar*. Dordrecht: Reidel.
- _____. 1982. Tenses, time adverbs and compositional semantic theory. *Linguistics and philosophy* 5. 23-55.
- Enç, Muvet. 1985. *Temporal interpretation*. ms. University of Southern California, Los Angeles, CA.
- _____. 1986. Anchoring conditions for tense. *Linguistic Inquiry* 18. 633-657.
- Gathercole, V.C. 1985. 'He has too much hard questions': the acquisition of the linguistic mass-count distinction in much and many. *J. of Child Language* 12.
- Grimshaw, Jane. 1979. Complement selection and the lexicon. *Linguistic inquiry* 10. 279-326.
- _____. 1981. Form, function, and the language acquisition device. The logical problem of language acquisition, ed. by C.L. Baker and J.J. McCarthy. Cambridge, MA: MIT Press...
- Heim, Irene. 1982. *The semantics of definite and indefinite noun phrases* (University of Massachusetts dissertation). Amherst, MA: GLSA.
- Hinrichs, Erhard. 1986. Temporal anaphora in discourses of English. *Linguistics and Philosophy* 9. 63-82.
- Jackendoff, Ray. 1977. *X' syntax: a study of phrase structure*. Linguistic inquiry monograph. Cambridge, MA: MIT Press.

- Janssen, Theo M.V. 1983. Scope ambiguities of tense, aspect and negation. *Linguistic categories: auxiliaries and related puzzles*, vol. 2, ed. by Frank Heny and Barry Richards. Dordrecht: Reidel.
- Kamp, Hans. 1971. Formal properties of 'now'. *Theoria* 37. 227-273.
- _____. 1975. Two theories about adjectives. *Formal semantics of natural language*, ed. by Edward L. Keenan. Cambridge: University Press.
- _____. 1979. Events, instants and temporal reference. *Semantics from different points of view*, ed. by R. Bauerle, et al. Berlin: Springer Verlag.
- _____. 1981. A theory of truth and semantic representation. *Formal methods in the study of language*, ed. by J. Groenendijk, et al. Amsterdam: Mathematical Centre.
- Karmiloff-Smith, A. 1979. A functional approach to child language: a study of determiners and reference. Cambridge: University Press.
- Keenan, Edward L.; and Leonard M. Faltz. 1985. *Boolean semantics for natural language*. Dordrecht: Reidel.
- Kratzer, Angelika. 1988. Stage-level and individual-level predicates. ms. University of Massachusetts at Amherst.
- Krifka, Manfred. 1988. Nominal reference, temporal constitution, and thematic relations. ms. University of Tübingen.
- Lebeaux, David. 1988. *Language acquisition and the form of the grammar*. (University of Massachusetts dissertation). Amherst, MA: GLSA.
- Link, Godehard. 1987. Algebraic semantics for event structures. *Proceedings of the sixth Amsterdam colloquium*, ed. by J. Groenendijk, et al. University of Amsterdam, Institute for Language, Logic and Information.
- Marantz, Alec. 1984. On the nature of grammatical relations. *Linguistic inquiry monograph*. Cambridge, MA: MIT Press.

- Maratsos, Michael. 1976. The use of definite and indefinite reference in young children: an experimental study of semantic acquisition. Cambridge: University Press.
- Matthei, Edward H. 1979. The acquisition of pronominal modifier sequences: stalking the second green ball (University of Massachusetts dissertation). Amherst, MA: GLSA.
- McConnell-Ginet, Sally. 1982. Adverbs and logical form. *Lg.* 58. 144-184.
- Montague, Richard. 1973. The proper treatment of quantification in ordinary English. Formal philosophy: selected papers of Richard Montague, ed. and with an introduction by Richmond Thomason. New Haven: Yale University Press.
- Parsons, Terry. 1980. Modifiers and quantifiers in natural language. *Canadian journal of philosophy*, supplementary volume VI: 29-60.
- _____. 1987. Events in the semantics of English. ms. University of California at Irvine.
- Partee, Barbara H. 1984. Noun phrase interpretation and type-shifting principles. Information, interpretation, and inference: GRASS 7, ed. by J. Groenendijk, *et al.* Dordrecht: Foris.
- _____. 1985. Ambiguous pseudo-clefts with unambiguous *be* Proceedings of the North East Linguistic Society 16. 354-366.
- _____; and Mats Rooth. 1983. Generalized conjunction and type ambiguity. Meaning, use, and interpretation of language, ed. by R. Bauerle, *et al.* Berlin: Walter de Gruyter.
- Peronard, Marianne. 1985. Spanish prepositions introducing adverbial constructions. *J. of child language* 12. 95-108.
- Stevenson, R.J. and Caroline Pollitt. 1987. The acquisition of temporal terms. *J. of child language* 14. 533-545.

Tavakolian, S.L. 1978. The conjoined clause analysis of relative clauses and other structures. Papers in the structure and development of child language. University of Massachusetts Occasional Papers in Linguistics 4.

Tomasello, Michael. 1987. Learning to use prepositions: a case study. J. of child language 14. 79-98.

Williams, Edwin. 1975. Small clauses in English. Syntax and Semantics, vol. 4, ed. by J. Kimball. New York: Academic.

_____. 1980. Predication. Linguistic Inquiry 11. 203-238.