THE ACQUISITION OF TENSE-ASPECT MORPHOLOGY:  
A PROTOTYPE ACCOUNT

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This paper examines the acquisition of tense-aspect morphology in three children acquiring English. It was found that (1) children start using past inflections predominantly with achievement verbs, and progressive inflections with activity verbs; and (2) the same distributional bias is found in the speech by caretakers addressed to children. The result shows that despite claims to the contrary, early development of tense-aspect morphology is strongly influenced by the inherent aspect of the verbs, and suggests that the pattern of the development should be attributed to input and to prototype formation by children.*

We present a prototype-based account for first language acquisition of tense-aspect morphology to resolve some of the major disagreements in the literature. We review the studies on the acquisition of tense-aspect morphology and the issues that prompted this account, and then report on a study that addresses these issues. We argue for a prototype-based explanation for the acquisition of tense-aspect morphology that will account for existing data and resolve conflicting findings.

1. TENSE AND ASPECT. Tense locates a situation in relation to some other time (such as speech time); therefore, it is a category that signifies temporal deixis. Aspect, on the other hand, is not concerned with relating a situation with some other time (i.e. it is nondeictic), but rather characterizes ‘different ways of viewing the internal temporal constituency of a situation’ (Comrie 1976: 3). The difference between he is eating and he was eating is that of tense, since the is/was contrast signifies the difference between the two in relation to speech time. The difference between he ate bread and he was eating bread, however, is one of aspect, since the difference is about how the action of eating is viewed by the speaker; the former views the situation in its entirety (external view), while the latter views the situation as consisting of phases (internal view) (Comrie 1976).

2. GRAMMATICAL ASPECT VS. INHERENT LEXICAL ASPECT. Grammatical aspect (what Smith 1983 calls viewpoint aspect) refers to asopacity distinction

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marked explicitly by linguistic devices, usually auxiliaries or inflections, as in the English progressive and Spanish, Russian, or Greek perfective and imperfective. **Inherent lexical aspect**, also called **situation aspect** (Smith 1983), refers to characteristics inherent in the lexical items which describe the situation. For example, *live* is inherently stative, while *jump* is inherently punctual.

Grammatical aspect and inherent lexical aspect are linguistic properties, and, as Smith (1983: 480) points out, should not be confused with ‘the properties of an actual situation.’ In referring to an actual situation out there in the real world (or in the conceptual world in the speaker’s mind), the speaker makes linguistic choices. The two levels of aspectual choice—inherent lexical aspect (situation aspect) and grammatical aspect (viewpoint aspect)—are both linguistic choices, even though the range of such choices is limited by the real world situation. The point here is that actual situations are distinct from language; they merely serve as bases for the linguistic choices made by the speaker.

Vendler (1967) proposed a four-way classification of the inherent semantics of verbs (i.e. inherent lexical aspect): **achievement**, **accomplishment**, **activity**, and **state**. This classification dates back to Aristotle and has been elaborated upon by philosophers and linguists such as Ryle (1949), Kenny (1963), Dowty (1979), and Mourelatos (1981). The four-way distinction, which is based on temporal properties of verbs (or verb phrases), can be expressed in the following way:

- **achievement**: that which takes place instantaneously, and is reducible to a single point in time (e.g. *recognize, die, reach the summit*, etc.).
- **accomplishment**: that which has some duration, but has a single clear inherent endpoint (e.g. *run a mile, make a chair, build a house*, etc.).
- **activity**: that which has duration, but with an arbitrary endpoint, and is homogeneous in its structure. For example, in *John is running*, at every moment the fact of his running has the same quality of running (e.g. *run, sing, play, dance*, etc.).
- **state**: that which has no dynamics, and continues without additional effort or energy being applied (e.g. *see, love, hate, want*, etc.).

Each of Vendler’s four categories of inherent semantic aspect can be characterized in terms of the semantic features **telic**, **punctual**, and **dynamic**. **Telic** denotes having an inherent endpoint, **punctual** denotes having no duration, and **dynamic** denotes that energy is required for the situation to exist or continue. Therefore, accomplishment and achievement are both telic, but only achievement is punctual. Activities are dynamic, as are accomplishments and achievements, but are atelic (i.e. nontelic) and nonpunctual. Finally, states have none of the three features. These characterizations are captured in Figure 1.

<table>
<thead>
<tr>
<th></th>
<th>state</th>
<th>activity</th>
<th>accomplishment</th>
<th>achievement</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>punctual</strong></td>
<td>−</td>
<td>−</td>
<td>−</td>
<td>+</td>
</tr>
<tr>
<td><strong>telic</strong></td>
<td>−</td>
<td>−</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td><strong>dynamic</strong></td>
<td>−</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
</tbody>
</table>

**Figure 1.** Feature analysis of the four verb classes.
3. The Aspect Hypothesis in First Language Acquisition. A consistent pattern of development has been observed in first language acquisition of tense-aspect morphology, as noted above. We tentatively call this the Aspect Hypothesis, summarized as follows:

1. Children first use past (or perfective) marking predominantly with achievement and accomplishment verbs, eventually extending their use to activity and finally to stative verbs.

2. In languages that have progressive aspect, children first use progressive marking mostly with activity verbs, then extending it to accomplishment and achievement verbs.

3. Children do not incorrectly overextend progressive markings to stative verbs.

In spite of the considerable research that has been done on the acquisition of tense-aspect morphology, and in spite of general agreement on its course of development, important disagreements still exist about the phenomenon, in terms of both description and explanation (see e.g. Ripsoli & Bloom 1985, Smith & Weist 1987, Bloom & Harner 1989). These disagreements are further aggravated by the complex nature of tense and aspect as linguistic categories, as well as by unnecessary confusion due to terminological differences (Bickerton 1989, Cziko 1989, Weist 1989a). For a comprehensive review of the issues, see Andersen & Shirai (1996).

Not all studies congruent with the Aspect Hypothesis report their results in such detail as summarized in 1–3 above. Some studies, for example, report only that past marking is only given to actions with clear end results (e.g. Antinucci & Miller 1976). Such findings, however can be interpreted to be consistent with the claims that are generalized from other studies. We summarize and discuss some of the major studies below, and at the same time point out the issues we will address.

Bronckart and Sinclair (1973) investigated the use of inflectional morphology by 74 French-speaking children (ages, 2:11 to 8:7) by using experimental elicitation of production data, and showed that the children tended to use present forms (présent) for inherently durative events, and perfective past forms (passé composé) for actions with clear end results (i.e. achievement and accomplishment verbs in Vendler’s schema). This tendency diminished as the children grew older, thus approximating adult use. Imperfective past (imparfait) was seldom used by the younger children; that is, its development is much slower than perfective past.

Antinucci and Miller (1976) found a similar tendency in longitudinal studies based on the conversational data of one English- and seven Italian-speaking children. Both Antinucci and Miller and Bronckart and Sinclair, following a Piagetian framework, attributed the children’s nonnormative use of past marking mainly to a cognitive limitation, suggesting that children at an early age have not developed the concept of temporal deixis. The claim, then, is that children use past-tense morphology to encode the notions that are more relevant to them, namely, events with observable end results.
Bloom et al. (1980) investigated the longitudinal development of verb inflection by four English-speaking children and found results similar to Bronckart and Sinclair’s and Antinucci and Miller’s: the children in their study used past inflections in their spontaneous speech production more often on accomplishment and achievement verbs (i.e. telic verbs), and the progressive mainly with activity verbs. Bloom et al., however, emphasized the aspecual contours of the actions (i.e. inherent aspect) rather than the end state of the actions, thus deemphasizing the cognitive-limitation explanation given by these earlier studies. Thus, the first issue that needs to be investigated is: Do children give past marking to verbs denoting observable results or verbs with a certain aspecual contour (inherent semantic aspect)?

Weist et al. (1984) took issue with Bronckart and Sinclair, Antinucci and Miller, and Bloom et al., labeling their claims ‘the Defective Tense Hypothesis.’ They analyzed experimental and naturalistic data on the acquisition of Polish, using Vendler’s four categories: state, activity, accomplishment, and achievement. They claimed that children marked both tense and aspect (both are grammaticalized in Polish) at early stages, thus providing counterexamples to the claim that in using verbal morphology, children are marking aspect or the end state resulting from an action.

Weist et al.’s study showed that the previous claims that children’s use of verbal morphology marks aspect or resultant state, not tense, are not necessarily tenable. Weist et al., however, appear to be criticizing what can be called the absolute defective tense hypothesis, which is a strong, all-or-nothing version of the hypothesis. According to the absolute version, only telic verbs receive past-tense inflection; tense distinctions will be redundant and will only accompany aspecual distinctions; only references to immediate past situations will be made (Weist et al. 1984:348). This claim is valid insofar as it criticizes this absolute version of the defective tense hypothesis. (See Behrens 1993 for additional evidence in favor of the claim.) A less stringent version, however, which we call the aspect hypothesis, may still hold true; namely, past inflections are predominantly attached to achievement and accomplishment verbs in the early stages (see Bloom & Harner 1989 and Andersen 1989). This paper is concerned only with this claim that, for example, a higher percentage of verbs with past or perfective inflections will be telic, not that all of the past-marked verbs will be telic, as is implied in the absolute version.

4. The Language Bioprogram Hypothesis. Bickerton (1981) attempted to account for the acquisition of tense-aspect morphology using his language bioprogram hypothesis. Central to his claims was the assertion that some linguistic structures must be bioprogrammed in children’s brains, since creole languages that have no genetic relations to one another have much in common. Children are assumed to create a new native language (i.e. a creole) based on the highly variable pidgin language spoken by their parents, which is not a fully

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1 The studies prior to Weist et al. 1984 did not use Vendler’s four-way classification per se, but they are interpreted to follow the Aspect Hypothesis.
viable language. The state-process distinction and the punctual-nonpunc-
tual distinction are argued to be part of the bioprogram.

To support his Language Bioprogram Hypothesis, Bickerton (1981) inter-
preted the Bronkart and Sinclair and Antinucci and Miller studies as evidence
for his punctual-nonpunctual distinction, claiming that children encode punctu-
ality rather than tense when they use past morphology. He also interpreted
studies by Brown (1973) and Kuczaj (1978) as evidence for his state-process
distinction. Brown’s and Kuczaj’s studies show that children who are very
prone to making overgeneralization errors (e.g. comed, goed) almost never
make the error of attaching progressive morphology to stative verbs, such as
see, want. This, Bickerton claimed, is because children are born with the state-
process distinction.

With respect to Bickerton’s claim of innateness, Li (1989), relying on Ste-
phany 1981 and de Lemos 1981, suggested that the observed phenomena can
be attributed to input from and interaction with the child’s caretaker(s). This
is in line with what Andersen (1988, 1993) has called the distributional bias
hypothesis, which says that adult native speakers will tend to use past or
perfective inflections more with accomplishments and achievements than with
states or activities, and progressive inflections primarily with activities. In other
words, proficient native speakers will exhibit in relative quantitative terms the
same distributional bias found in more nearly absolute terms in the acquisitional
data. The Distributional Bias Hypothesis claims that if adult native speakers’
use of verbal morphology is congruent with the Aspect Hypothesis, it would
not be surprising that children’s first use of verbal morphology would show a
similar trend. This is the major focus of investigation in the present study.

The idea of explaining language acquisition phenomena by the frequency of
particular linguistic items in the input is not new. (See Snow & Ferguson 1977,
Gallaway & Richards 1994 for reviews of studies on “caretaker speech/mother-
ese” or child-directed speech.) However, there have not been many such input
studies in the area of acquisition of tense and aspect morphology. Stephany’s
(1981) study of the acquisition of Greek is one exception. It compared both
child-directed and adult-directed speech of mothers with children’s speech in
relation to use of verbal morphology and verb semantics, and found close simi-
larities between adult speech and children’s speech.

5. The study. This study addresses two major research questions: (1) What
are the relationships between inherent semantic aspectual features of the verb
and tense-aspect morphology? In particular, do children give past marking to
verbs denoting observable results or verbs with a certain aspectual contour
(inherent semantic aspect)? (2) What is the relationship between caretaker
speech and the children’s acquisitional pattern? In order to address these ques-
tions, we looked at the early stages of longitudinal development of tense-aspect
morphology by children acquiring English, as well as at speech addressed to
them by their mothers.

5.1. Data. This study used data from CHILDES (Child Language Data Ex-
change System; MacWhinney & Snow 1990). The data consist of the transcribed
speech samples of three children acquiring English in their home environment: (1) Adam from age 2;3 to 4;10 and (2) Eve from age 1;6 to 2;3 (both from Brown 1973), and (3) Naomi (from Sachs 1983) from age 1;6 to 4;9. Among numerous English data sets available from CHILDES, these three were selected on two grounds. First, they extend over a long period of acquisition, which is necessary to see how the mother’s input and the child’s output change over time. Second, they include relatively early stages of development, which is necessary to see both the emergence and subsequent development of verbal morphology.\(^2\)

To see the change of input/output patterns, we chose groups of samples to represent different stages of development, based on three considerations: (1) obtaining the maximum differences between stages; (2) obtaining comparable data representing the same level of development (as measured by MLU) for the 3 children for each stage; and (3) obtaining a comparable amount of data for each stage for each subject. Table 1 lists the samples coded for this study.

<table>
<thead>
<tr>
<th>Stage</th>
<th>Adam</th>
<th>Eve</th>
<th>Naomi</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2;3–2;4</td>
<td>1;6–1;7</td>
<td>1;6–1;10</td>
</tr>
<tr>
<td>2</td>
<td>3;0–3;1</td>
<td>1;11–2;0</td>
<td>2;0–2;2</td>
</tr>
<tr>
<td>3</td>
<td>3;10–3;11</td>
<td>2;2–2;3</td>
<td>2;3–2;9</td>
</tr>
<tr>
<td>4</td>
<td>4;9–4;10</td>
<td>NA*</td>
<td>2;11–4;9</td>
</tr>
</tbody>
</table>

Table 1. Data samples coded.

* No data for Eve were available after 2;3.

In terms of linguistic development as measured by MLU, stage 1 in this study corresponds to Brown’s (1973) stage I (MLU = 1.75), stage 2 corresponds to stage III (MLU = 2.75), and stage 3 corresponds to stage V (MLU = 4.00). Stage 4 in this study does not have any corresponding stage in Brown’s analysis, since stage V was the last stage reported by Brown. Stage 4 data were not available for Eve, since the last transcript for Eve corresponds to Brown’s stage V, although Adam’s data were available beyond stage V. Samples from Naomi’s data were selected based on the MLUs calculated by the CLAN program (MacWhinney & Snow 1990).

5.2. Coding. All finite verb forms\(^3\) with past or progressive inflections were

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\(^2\) Although the study investigated the data from early stages as well as from later stages as part of the larger project (Shirai 1991), the focus of the present paper is on the early stages of development, and therefore the data from later stages are not reported extensively.

\(^3\) The following cases were excluded from analysis since they are irrelevant to the present study: 1) Unclear cases which are difficult to interpret. 2) I got + NP, which is the equivalent of I’ve got + NP (i.e. a colloquial form of I have...). 3) Periphrastic forms (e.g. had to V, be going to V). 4) Pro-forms such as I did it, It went like this. 5) Highly frozen idiomatic expressions, such as X is/was missing. The last category was determined based on whether other forms of inflection were possible with the same meaning. For example, X is missing is always in this form. The percentages of the items excluded for the above reasons from the children’s total uses of each morpheme are as follows: progressive [stage I], Adam (9.5%), Eve (0%), Naomi (16.1%); stage 2, Adam (2.9%), Eve (5.7%), Naomi (3.7%); stage 3, Adam (6.3%), Eve (2.8%), Naomi (8%); stage 4, Adam (4%), Naomi (6.5%); past [stage I], Adam (0%), Eve (0%), Naomi (0%); stage 2, Adam (8.4%), Eve (2.1%), Naomi (5.7%); stage 3, Adam (4.5%), Eve (2.5%), Naomi (7.1%); stage 4, Adam (3%), Naomi (4.2%).
coded both for form (past or progressive)\(^4\), and for inherent aspect (state, activity, accomplishment, or achievement). The steps taken to code for inherent aspect were as follows: (1) read a small subset of discourse until you are reasonably sure about the interpretation of the sentence(s) being coded; (2) determine if repetition is involved, and code as either unitary, iterative, habitual, or iterative-habitual;\(^5\) (3) remove grammatical aspect/tense (i.e. -ing and Past) from the sentence (for example, he is jumping and he jumped should both be [he jump]); and (4) apply steps 1–3 of the following tests to determine the sentence’s inherent aspect:

**Step 1:** State or nonstate

Does it have a habitual interpretation in simple present tense?
- If no → State (e.g. I love you)
- If yes → Nonstate (e.g. I eat bread) → Go to Step 2

**Step 2:** Activity or nonactivity

Does ‘X is Ving’ entail ‘X has Ved’ without an iterative/habitual meaning? In other words, if you stop in the middle of Ving, have you done the act of V?
- If yes → Activity (e.g. run)
- If no → Nonactivity (e.g. run a mile) → Go to Step 3

**Step 3:** Accomplishment or achievement

[If test (a) does not work, apply test (b), and possibly (c).]

a) ‘X Ved in Y time (e.g. 10 minutes)’, then ‘X was Ving during that time.’
- If yes → Accomplishment (e.g. He painted a picture.)
- If no → Achievement (e.g. He noticed a picture)

b) Is there ambiguity with almost?
- If yes → Accomplishment (e.g. He almost painted a picture has two readings: he almost started to paint a picture/he almost finished painting a picture.)
- If no → Achievement (e.g. He almost noticed a picture has only one reading.)

c) ‘X will VP in Y time (e.g. 10 minutes)’ = ‘X will VP after Y time.’
- If no → Accomplishment (e.g. He will paint a picture in an hour is different from He will paint a picture after an hour, because the former can mean that he will spend an hour painting a picture, but the latter does not.)
- If yes → Achievement (e.g. He will start singing in two minutes can have only one reading, which is the same as in he will start singing after two minutes, with no other reading possible.)

One weakness of previous studies is the lack of precise descriptions of the procedures for determining inherent lexical aspect. Only four studies include

\(^4\) No distinction was made in this study whether a tensed auxiliary (i.e. is/was/were) was present in the children’s use of the progressive.

\(^5\) This step was taken as part of a larger project (Shirai 1991) to answer additional research questions not addressed here.
operational tests for verb classifications (Weist et al. 1984, Robison 1990, Shirai 1993, 1994), and only two report intrarater reliability (Cziko & Koda 1987 and Shirai 1994). A precise description of the procedure, however, is particularly important in that researchers often use different criteria, which may be a cause of disagreement. The operational tests used in this study rely on a number of studies on inherent-aspectual classification: Brinton 1988, Comrie 1976, Dowty 1979, Mourelatos 1981, Robison 1990, and Vendler 1967, among others. Dowty’s Table 1 (1979: 60) was especially informative.6

It is necessary to first read and interpret a segment of the transcription before coding for inherent aspect (Step 1). The appropriate interpretation is very difficult without information provided by the discourse context and, in this study, comments on extralinguistic contexts provided by researchers who gathered the original data, although they are quite limited, especially in the case of Adam and Eve. Consideration of both linguistic and extralinguistic information is essential for classification because some tokens with the same form can be classified in more than one way. For example, for open the box, if the box is one that can be opened instantaneously, it is an achievement; if it is carefully wrapped and takes time to open, then it is an accomplishment.7

Intrarater reliability of the coding was calculated two years after the original coding was done. One hundred randomly selected verb tokens were recoded by the same coder (the first author) into one of four classes: achievement, accomplishment, activity, and state. Out of the 100 tokens, 93 were given the same coding as the original coding, yielding a reliability of 93%.8

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6 Dowty’s (1979) Table 1 is a list of various linguistic tests for verb classification, and does not necessarily represent Dowty’s proposal. Dowty’s aspectual classes are defined based on the operators DO, BECOME, and CAUSE, and does not treat duration (i.e. punctuality) as an essential feature. The classification system used in the present study, on the other hand, relies on duration/ punctuality to distinguish achievement from accomplishment, and is similar to Smith’s (1991) proposal. The comparison of the two systems (or other proposals) is beyond the scope of this paper. We chose the present schema because most of the previous acquisition studies are based on this classification system. (See Clark 1996 for an example of a study using Dowty’s system.)

7 This does not mean that what is coded in this study is the actual situation: we coded inherent aspect that describes actual situations. We do not claim that situational information is always needed for classification of verbs for inherent aspect, and in fact, many verbs can be classified without any additional information. For example, run to the store is always accomplishment since the operational tests invariably classify the predicate as accomplishment.

8 A reviewer pointed out that the kind of linguistic tests employed here assumes that the child already has the same semantics for the verb stem as the adult. This is not necessarily the case, however. The linguistic tests are simply a tool used to analyze both adult and child language. Since these features are important in the organization of tense/aspect systems in adult language, children also have to find these features in the language to organize their own (albeit limited) tense/aspect system, by paying attention to these features. We do not mean to imply that children must have the same semantics of the verbs as adults.

It should also be pointed out that this is a major point of contention in the debate between Weist (Weist et al. 1984, Smith & Weist 1987) and Bloom (Rispoli & Bloom 1985, Bloom & Harner 1989). Weist criticized Bloom et al. (1980) for using idiosyncratic categories that do not go beyond their own study, while Bloom criticized Weist et al.’s classification scheme as an imposition of an adult norm on children’s language, claiming that the categories should arise from children’s language. An interesting twist is that the present study, which is methodologically similar to Weist et al.,
Finally, it should be noted that even though Vendler’s proposal was for verb classification, the classification cannot be done just by focusing on the verb alone; its arguments and/or adjuncts also are an important part of the classification (e.g. the contrast between run vs. run a mile; walk vs. walk to the store). In the following, however, we will use the terms state verbs, activity verbs, and so forth, for lack of better terms.

6. Results

6.1. Distributional Bias in Maternal Speech. We coded 3,370 verb tokens based on the operational tests and quantitatively analyzed them using the CLAN program. Table 2 displays the distribution of progressive and past inflections with respect to inherent aspect for all stages combined. All three mothers used past inflections most frequently (58–64% of the time) with achievements, and progressive inflections most frequently (53–61%) with activities. This supports the Distributional Bias Hypothesis. The mothers’ use of inflections on different verb classes is apparently biased in the direction predicted by the Aspect Hypothesis. We thus cannot rule out the strong possibility that the distribution of past and progressive inflections in young children’s speech is at least partly determined by their distribution in the mothers’ speech.

<table>
<thead>
<tr>
<th></th>
<th>State</th>
<th>Activity</th>
<th>Accomplishment</th>
<th>Achievement</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Adam’s mother</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>past</td>
<td>17%</td>
<td>8%</td>
<td>11%</td>
<td>64%</td>
</tr>
<tr>
<td>-ing</td>
<td>0%</td>
<td>56%</td>
<td>11%</td>
<td>33%</td>
</tr>
<tr>
<td><strong>Eve’s mother</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>past</td>
<td>13%</td>
<td>7%</td>
<td>21%</td>
<td>59%</td>
</tr>
<tr>
<td>-ing</td>
<td>0%</td>
<td>53%</td>
<td>14%</td>
<td>33%</td>
</tr>
<tr>
<td><strong>Naomi’s mother</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>past</td>
<td>12%</td>
<td>18%</td>
<td>12%</td>
<td>58%</td>
</tr>
<tr>
<td>-ing</td>
<td>4%</td>
<td>61%</td>
<td>12%</td>
<td>23%</td>
</tr>
</tbody>
</table>

Table 2. Inherent aspect with past and progressive inflections in mother’s speech.

Also noteworthy is the absence of the progressive inflection used with state verbs by two of the mothers, in contrast to Naomi’s mother who used 3.8% of progressive inflections with state verbs (see Table 3). It should be noted here that Naomi used the stative progressive, including incorrect uses such as seeing and needing, in her speech. It appears that the state-process distinction in first-language acquisition claimed by Bickerton as part of the bioprogram can also be explained by the distribution in motherese (see Shirai 1994 for more details).

replicated the findings in Bloom et al.: children’s use of past and progressive inflections are guided by inherent aspect of the verbs. This suggests that the problem of the classification scheme is not a major source of the difference between Bloom’s and Weist’s findings.

9 For Tables 2 and 3, the percentages for each speaker are not based on the total sum of the raw token frequencies for each stage, but rather are averages of the percentages calculated for each stage. We chose this procedure since it is inappropriate to collapse raw frequencies from different stages, given the fact that at early stages children produce many fewer tokens than at later stages.
<table>
<thead>
<tr>
<th></th>
<th>CHILD</th>
<th>MOTHER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adam</td>
<td>0.2% (1)&quot;</td>
<td>0% (0)</td>
</tr>
<tr>
<td>Eve</td>
<td>1.7% (5)</td>
<td>0% (0)</td>
</tr>
<tr>
<td>Naomi</td>
<td>3.4% (23)</td>
<td>3.8% (20)</td>
</tr>
</tbody>
</table>

Table 3. Stative progressives used.

"Raw token frequencies in parentheses.

6.2. Developmental patterns in the children’s use of tense/aspect morphology. The overall acquisition patterns for past morphology support the Aspect Hypothesis, while the progressive results are less clear. Figure 2 shows the trend for past morphology, and Figure 3 for progressive morphology, as used by the three children over four stages (three stages in the case of Eve).

Figure 2 shows that all three children follow the predicted pattern: children’s initial use of past is predominantly with achievements, later extended to other verb types. In fact at stage 1, 94–100% (94.1% for Adam; 100% for Eve and Naomi) of their past forms are with achievements. This gradually decreases as the child matures linguistically.

![Figure 2. Past morphology used with achievement verbs.](image)

Conversely the use of progressive morphology with activity verbs is not as dominant as is past morphology with achievement verbs (Fig. 3). Even at stage 1, there is variation among the children (57.9% for Adam, 75% for Eve, 68.4% for Naomi), and the pattern of change over time is mixed, Naomi basically following the predicted pattern, and Adam going somewhat against it. These figures, however, do not truly reflect how progressive marking emerged in the three children, as we shall see.

6.3. Emergence of progressive inflections. To further test the Aspect Hypothesis, stage 1 uses of progressive and past inflections were investigated in more detail. Table 4 displays the distribution of progressive inflections at stage 1. The similarity between mother and child in the distribution of the
progressive across the four verb classes gives the impression that even at this early stage the children have full command of the progressive and use it as their mothers do. However, a more detailed analysis of -ing forms used by the three children at the earliest, emergent, stage of the progressive revealed that almost all uses (except for coming) are with activity verbs and with achievement verbs used iteratively denoting action in progress. For example, Naomi’s first use of -ing was at 1;8, and -ing was used exclusively with activity verbs or with achievement verbs used iteratively (i.e. jumping). Then, at 1;10, an interesting change in her use was observed. The sample for age 1;10 is large, stretching from April 11 to May 6 (see Table 5). In the earliest recording (April 11) Naomi used the progressive marker exclusively on activity verbs (all 12 uses), and for April 11 and 18 combined, 84.1% of the -ing inflections were on activity verbs. Beginning with the next sample (April 19) and continuing on, Naomi used -ing with verbs other than activity verbs much more frequently, and the percentage for activity verbs dropped to 55% for the April 19–May 6 samples.
Table 5. Distribution of inherent aspect with progressive inflections: Naomi age 1:10 (end of stage 1).

For the other children, too, initial use of -ing was quite similar to Naomi’s. Nine of Eve’s 12 uses of progressive marking were on activities. The rest (3 tokens) were achievements, of which 2 were iterative achievement (banging), and 1 was coming. With Adam, the pattern is more mixed, in that only one of the six progressive markers used with achievement verbs was iterative. Notably, however, the first 6 uses of -ing by Adam were with activity verbs, and then coming appeared twice. In fact, the first 13 uses (out of 19 uses of progressive at stage 1) were either activity (10 tokens), iterative achievement (one token = turning), or coming (2 tokens). Only towards the end of stage 1 did Adam start to use -ing with accomplishment verbs, and noniterative achievement verbs (e.g. turning windmill on, putting it back).

From these data, we can conclude that the initial use of progressive inflections was mostly restricted to activity verbs and iterative achievement verbs, both of which have an action-in-progress meaning when combined with the progressive inflection.

10 Come was classified as achievement because tests (a) and (c) in step 3 do not work, and, according to test (b), it is achievement, since there is no ambiguity with almost (e.g. He almost came to the party.)

11 Mothers at stage 1 used the following achievement verbs with -ing: Adam’s mother: go, turn, happen, fall down, put; Eve’s mother: come, turn, spill, happen, go, get, bang, call, say; Naomi’s mother: squeak, jump, get, go, bang, brush, bark, ask, say, fall, come. The fact that they use verbs other than come and iterative achievements suggests that children are not simply imitating their mothers’ use of progressive.

12 In §7 we argue that activities and iterative achievements denoting action-in-progress constitute the prototype for progressive.
6.4. Emergence of past inflections. Table 6 shows that at stage 1 there is close to absolute use of past inflections with achievement verbs, while the mothers’ past inflections, although showing the tendency predicted by the Distributional Bias Hypothesis (with 56%, 59%, and 66% on achievement verbs), are used also with state, activity and accomplishment verbs quite often. This difference between the progressive and past is understandable since the progressive develops much earlier than the past in the acquisition of English (Brown 1973). The entire stage 1 was probably the initial stage for past inflections, and the inflections were practically limited to achievement verbs. On the other hand, the emergent stage for the progressive appears to be over early in stage 1, and progressive inflections were used with all of the four verb types, as seen in the overall pattern of distribution in stage 1, as already discussed in §6.3. Therefore, we may conclude that the results for progressive and past inflections are basically the same: both inflections are initially restricted to verbs of a particular inherent aspect. The only difference is that the stage of this restriction ends earlier for the progressive than for the past.

We conducted a more detailed analysis of the longitudinal pattern of development of the past inflection in relation to the question: What semantic features are most strongly correlated with the children’s use of past inflections?

<table>
<thead>
<tr>
<th></th>
<th>State</th>
<th>Activity</th>
<th>Accomplishment</th>
<th>Achievement</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Adam</strong></td>
<td>(2;3–2;4)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mother</td>
<td>17% (10)*</td>
<td>7% (4)</td>
<td>10% (6)</td>
<td>66% (38)</td>
</tr>
<tr>
<td>Child</td>
<td>0% (0)</td>
<td>6% (12)</td>
<td>0% (0)</td>
<td>94% (16)</td>
</tr>
<tr>
<td><strong>Eve</strong></td>
<td>(1;6–1;7)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mother</td>
<td>23% (9)</td>
<td>5% (2)</td>
<td>13% (5)</td>
<td>59% (23)</td>
</tr>
<tr>
<td>Child</td>
<td>0% (0)</td>
<td>0% (0)</td>
<td>0% (0)</td>
<td>100% (4)</td>
</tr>
<tr>
<td><strong>Naomi</strong></td>
<td>(1;6–1;10)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mother</td>
<td>11% (4)</td>
<td>17% (6)</td>
<td>17% (6)</td>
<td>55% (20)</td>
</tr>
<tr>
<td>Child</td>
<td>0% (0)</td>
<td>0% (0)</td>
<td>0% (0)</td>
<td>100% (10)</td>
</tr>
</tbody>
</table>

**Table 6.** Distribution of inherent aspect with past inflections at stage 1.

* Raw token frequencies in parentheses.

<table>
<thead>
<tr>
<th></th>
<th>Adam (2;3–2;4)</th>
<th>Eve (1;6–1;7)</th>
<th>Naomi (1;6–1;10)</th>
</tr>
</thead>
<tbody>
<tr>
<td>broke</td>
<td>1</td>
<td>1</td>
<td>fell (down/out)</td>
</tr>
<tr>
<td>sat wall*</td>
<td>1</td>
<td>1</td>
<td>threwed**</td>
</tr>
<tr>
<td>went to school</td>
<td>2</td>
<td>2</td>
<td>found</td>
</tr>
<tr>
<td>fell (down)</td>
<td>10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>lost shoe</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>brought</td>
<td>1</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Table 7.** Past morphology used at stage 1.

* The only verb coded as activity.
** Overgeneralization of -ed (including throwed)

Table 7 shows that almost all of the verbs with past marking at stage 1 (except for *sat wall*) are [+ result, + punctual, + telic]. In other words, it appears

[^13]: We argue in §7 that [+telic, +punctual, +result] constitutes the prototype for both past and perfective.
that initially children only use past morphology when commenting on a past event if it has all three features.¹⁴

To investigate the relative importance of the three variables (telicity, punctuality, and result-state), the later development of past morphology was checked. Naomi was chosen for further analysis because her stage 1 ends at age 1;10 and stage 2 starts at age 2;0; therefore, by coding the sample of 1;11 as well, the longitudinal development of past marking could be captured.

At stage 2 (including the additional sample of age 1;11), Naomi used past forms 103 times. Additional coding was given to the verbs based on whether they have an end-result or not (+ / − R) as shown in Table 8, which lists the verbs

<table>
<thead>
<tr>
<th>ACHIEVEMENT</th>
<th>91</th>
<th>ACCOMPLISHMENT</th>
<th>6</th>
<th>ACTIVITY/STATE</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>pushed it/that</td>
<td>6</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>dropped</td>
<td>15</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>finished</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>closed</td>
<td>7</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>broke</td>
<td>26</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>snapped</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>bumped</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>turned on</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>threwed*</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>crashed*</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>said (-R)</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>fell down</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>happened</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>scored</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>cooled (off)</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>told (-R)</td>
<td>6</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>found</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>had a baby</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>made a face (-R)</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>fixed</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>falled down*</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>had gum (state) (-R)</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>had orange juice (-R)</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 8. Past morphology: Naomi, stage 2. (Listed in the order of appearance from top to bottom.)

Note: − R stands for [− result]

* Overregularization of -ed

¹⁴ One might wonder why it is necessary to code telicity and result as two separate features. Indeed, it has been argued that one of the defining features of telicity is having a change of state that has a result (Smith 1991). However, the result here refers to observable outcomes salient to the child; such outcomes, it has been argued, are important for past marking, but need not be identified with linguistic telicity.
in the order of appearance. Table 8 shows that most of the past morphology used at stage 2 was still for achievements, but we also find the beginning of past marking for accomplishments, activities and states. However, there was only one state term (*had gum*). Thus, Naomi’s past morphology at stage 2 follows the pattern predicted by the Aspect Hypothesis: state is the least likely to be given past marking.

We found no conspicuous differences among the three variables [+punctual], [+telic], and [+result]. First, the majority of past forms at this point seem to have all three features. Eighty-four of the 103 past forms coded (81.6%) have all three features (see Table 8). Six of the deviations from this pattern are [-telic], that is, without an inherent endpoint (activity/state), 12 are [-punctual], that is, durative (accomplishment, activity, state), and 14 are [-result], that is, without an observable resultant-state.

There is no empirical basis in Table 8 for determining which (if any) of the features [+punctual], [+telic], or [+result] is most important in causing the child to mark a verb as past. The six tokens of activity/state verbs in column 3 of Table 8 are all [-telic], but also [-result]. It appears that [-telic] verbs and [-result] verbs gradually begin to show past marking around the same time. To conclude that the [+punctual] requirement begins to weaken first would be difficult to justify on the basis of only one expression—*eaten it*. At any rate, by stage 2 the restriction of past marking to verbs with [+punctual, +telic, +result] features begins to weaken.

Note also that earlier in stage 2, those classes of verbs deviating from the prototypical past (i.e. [+punctual], [+telic], or [+result]) are not often given past marking. An early exception is *eat it*. The later period of stage 2, on the other hand, shows many past markings on verb types deviating from the prototypical past. This change across stage 2 from the prototypical past marking of achievements typical of stage 1 to include more and more nonprototypical past-reference verbs follows naturally from the Aspect Hypothesis.

To summarize, a common pattern of morphological development was found for both past and progressive inflections: they are initially restricted to particular semantic classes of verbs (activity and iterative achievements for the progressive, and telic, punctual, and resultant-state for the past), and then expanded later to cases that differ semantically from the prototype. It was also found that mothers’ speech addressed to children also had a pattern congruent with such a pattern of development: the majority (more than 50%) of inflections are used with the semantic classes of verbs (activity and achievement) that are first given progressive and past marking, respectively, by children. This supports the Distributional Bias Hypothesis.

7. A prototype account. In this section we discuss the findings of the study in relation to the issues presented earlier, and in so doing propose an account that resolves conflicting claims. The most persuasive explanation for the findings discussed here is the prototype account that has been advanced in research on the development of lexical semantics (Bowerman 1978, Barrett 1982, 1986, Greenberg & Kuczaj 1982) and morphology (Slobin 1981, 1985) and, especially relevant here, on the acquisition of past morphology (Sachs 1983, Taylor 1989).
Prototype theory was developed in cognitive psychology by Eleanor Rosch (e.g. Rosch 1973, 1978, Rosch & Mervis 1975) to account for human categorization. In contrast to the classical theory of categorization, which assumes an all-or-nothing membership in a category based on criterial definitional features, prototype theory assumes a graded category membership. A category has its best exemplar(s)—the prototype(s)—and peripheral members, which do not necessarily share much with the best exemplars. Applied to language acquisition, the claim is that children acquire a linguistic category starting with the prototype of the category, and later expand its application to less prototypical cases. This is what was observed in the present study. The three children first marked as past instances of [+punctual], [+telic], and [+result] verbs, and used the progressive with activities and iterative achievements, and then gradually extended use of both inflections to other verbs.

7.1. Past. We conclude that the three semantic features that have been argued to be important for past marking are all initially relevant from the young child’s perspective. The fact that punctual verbs that do not have an inherent endpoint or a result state (e.g. jump) have no association with perfective marking in Li (1989), and the fact that such verbs are associated rather with progressive inflections in the present study, show that punctuality of the verb by itself does not trigger past perfective marking. Telicity is probably more important than punctuality at the early stage, since verbs that are atelic and punctual (such as jump) are not associated with past/perfective marking. Nevertheless, punctuality is still a major contributing factor. This at least would explain why the early past inflections are not only telic but also punctual.

Resultant-state is central to the ‘cognitive deficiency’ explanation advocated by the early studies (e.g. Antinucci & Miller 1976) and strongly criticized by Weist et al. The present study shows that earliest past markings are given to verbs that are not only [+result], but also [+punctual], [+telic]. Therefore, it is difficult to conclude that resultant-state is the only feature to be given past marking early in the acquisition of verbal morphology. Furthermore, the cognitive deficiency explanation cannot explain the similar observations in adult second-language acquisition (Andersen 1989), in which adolescents and adults, who clearly have the concept of deictic past, follow the tendency predicted by the Aspect Hypothesis (Robison 1990, Andersen 1991). Therefore, we conclude that all three features contribute to early past marking by children.

7.2. Progressive. The prototype account also nicely explains the development of the progressive in this study. The three children initially started to use progressive morphology to refer to action-in-progress, which, we claim, is the prototype of the progressive category. This form was limited mostly to activity verbs and iterative achievement verbs (jumping, hanging), which to the children are probably the same as activity verbs. Although we categorized jump, bang, etc. as achievement, this group of verbs differs from the rest of the achievement class in that they do not have an inherent endpoint, and are thus atelic. Lee (1991) and Smith (1991) categorize this class of achievement verbs as a separate category of verbs, called ‘punctual activities’ by Lee, and ‘semel-
fectives’ by Smith. Moreover, Smith, among others, claims that this class of verbs functions as an activity when repeated. For children, both of these action types (he is crying vs. he is jumping) may be the same in that they both have a succession of small elements that comprise the whole action of crying and jumping. It is not surprising, therefore, that children do not differentiate between them at the earliest stage. It should be noted that the three children at this stage never attached past morphology to these iterative achievements, which also argues for the possibility that the children treated them as part of the activity class. In sum, the prototypical features for progressive are [−telic] and [+durative] in contrast to prototypical past, which is [+telic] and [−durative] (i.e. [+punctual]).

Achievement verbs used very early with the progressive inflection include not only iterative achievements, but also coming, and going home. This goes against the prediction. Come and go, however, are not typical achievements, although they are coded as achievement based on the operational tests. In fact, come/go to X is a difficult item to code, since it can focus on the beginning point, the process, or on the endpoint, depending on the context. In view of these linguistic observations and acquisition data, it may be argued that come and go are very close to accomplishments even though they were classified as achievements in this study.

7.3. Aspect or Tense? The prototype account proposed here also resolves the conflicting claims about whether early past morphology encodes aspect or tense. Our view is that it would be difficult to claim one or the other. What children are doing is simply attaching early past inflection to the prototype of the category past (i.e. [+telic], [+punctual], [+result]). The reason children appear to be marking aspect is that the prototypes of past (tense) and perfective (aspect) are very similar. Dahl (1985:78), for example, characterizes the prototypical perfective as referring to a single punctual event that occurred in the past, with a clear result or end state.

Since the prototype of the category perfective is very similar to that of the category past, it appears as if, in the beginning, children are encoding perfective (grammatical) aspect, or perhaps the inherent aspectual value of telicity/punctuality. Depending on how one looks at the phenomena, two claims become possible: (1) Early past morphology encodes underextended past tense, that is, it is attached only to prototypical past; and (2) Early morphology encodes aspectual features such as completive, perfective, punctual, telic, and so forth.

7.4. Conclusion. In sum, we have proposed that initially children restrict their use of tense/aspect inflections to the prototype of the category, then gradually extend the category boundary, and eventually acquire the adult norm. Although the degree of this early restriction may differ depending on the language being acquired (see the discussion in Weist 1989b:66), this scenario appears to hold for most languages.

The acquisition of past and perfective markers shows similar properties cross-linguistically. The universality of this phenomenon must be related to a general theory of tense/aspect systems. Dahl’s (1985:78) characterization of the proto-
typical perfective based on his cross-linguistic survey is very similar to our characterization of the prototypical past in acquisition. Bybee & Dahl (1989), as well as Bybee et al. (1994), also claim that in language change, past tense and perfective morphology often develop out of aspect markers (resultative and perfect); this closely parallels what we observe in language acquisition. Prototypical past-perfective might thus be a cognitive axis for grammaticalization. Ontogenetic and phylogenetic underpinnings of these observations may be profound, and further explorations should be fruitful.

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