

Understanding completion entailments in the absence of agency cues*

LAURA WAGNER

Harvard University

(Received 4 February 2000. Revised 21 January 2001)

ABSTRACT

This study investigated the role that agency information plays in children's early interpretations of grammatical aspect morphology, in particular, the progressive *-ing* and simple past forms. Fifty-nine children (two-, four- and five-year olds) were presented with a forced-choice sentence-to-scene matching task very similar to the one used by Weist and colleagues (Weist, 1991; Weist, Wysocka & Lyytinen, 1991; Weist, Lyytinen, Wysocka & Atanassova, 1997), except that here the scenes contained only information about the relative completion of the object of the event and no information about the state of the agent of the event. In contrast to previous research, the children here did not succeed at this object-oriented task until as late as age five; moreover, also contra previous work, when they did succeed, their performance tracked the formal entailments of grammatical aspect. Thus, subjects consistently matched the perfective sentence to the completed event (reflecting the perfective's entailment of completion) but never consistently matched the imperfective sentence to either scene (reflecting the imperfective's lack of entailments). It is argued that agent-oriented meaning, in particular, intentionality, has priority in the mapping process over object-oriented completion entailments.

INTRODUCTION

Although verbal morphology is among the earliest morphology productively used by children, researchers have long suspected that there is a disconnect between children's early use of morphology and their comprehension of its

[*] The research reported in this paper was supported by a fellowship from the Institute for Research in Cognitive Science at the University of Pennsylvania. My thanks go to IRCS, Lila Gleitman, Robin Clark, Henry Gleitman, Jesse Snedeker, Cristina Sorrentino, the Cheese group, the UMass developmental seminar and language acquisition lab, Dan Reynolds and the helpful comments of two anonymous reviewers. The results reported here are part of my dissertation and have been presented at the Boston University Conference on Language Development 24, November 1999.

Address for correspondence: Laura Wagner, Department of Psychology, 11th floor, William James Hall, Cambridge MA 02138, USA. e-mail: lwagner@wjh.harvard.edu

meaning. Consider, for example, the case of grammatical aspect. The morphemes marking grammatical aspect in English (the progressive *-ing* and simple past marking) are productively used by children as young as two years old (Brown, 1973; DeVilliers & DeVilliers, 1973). It will be argued in this paper, however, that the completion entailments of grammatical aspect are not actually understood until approximately age five.

Grammatical aspect refers to the perfective–imperfective distinction which provides information about the speaker’s temporal perspective on an event (cf. Comrie, 1976; Smith, 1991). Perfective aspect (marked in English by the simple past tense form) views an event from the outside-in, and for predicates which specify inherent end points (telic predicates), this perspective entails the completion of the event described. Thus, *The Ringlings built a house* is in the perfective aspect and entails that the event is complete and the house is finished. Imperfective aspect (marked in English with the progressive *be + -ing* construction) views an event from the inside out and entails nothing at all about the completion of the event. Thus, *The Ringlings were building a house* is in the imperfective aspect and makes no claims about the completion of the event; this sentence can even be sensibly continued with a statement asserting lack of completion, such as *but they moved to Florida and never finished it*.

For adults, perfective and imperfective aspect marking can each appear on both telic predicates (i.e. predicates which specify the inherent end point of an event, as in the previous examples) and atelic predicates (i.e. predicates describing events with no inherent end point, such as *Jenny Lind sang/was singing*). Children, however, initially appear to restrict their use of this morphology according to the type of predicate. For example, in English, children initially (younger than approximately age 2;6) restrict the perfective marker (either *-ed* or the irregular past) to verbs that describe events with inherent end points while they restrict the imperfective marker (the progressive *-ing*) to verbs that describe events without such inherent end points.¹ Thus, children say things like *riding* (atelic with the imperfective) and *broke* (telic with the perfective) and do not say things like *rode* (atelic with the perfective) or *breaking* (telic with the imperfective). This distribution of morphology according to the lexical type of the verb has been documented in a variety of languages, including English (Bloom, Lifter & Hafitz, 1980; Shirai & Andersen, 1995; Olsen, Weinberg, Lilly & Drury, 1998), Italian (Antinucci & Miller, 1976), French (Bronckart & Sinclair, 1973), Polish

[1] The children investigated in these studies generally produced very short sentences requiring the telicity classifications to be based in most cases on the verbs alone. This fact is an obvious inadequacy of these studies, as telicity is a property of complete predicates (cf. telic *Jumbo ate a peanut* and atelic *Jumbo ate*). However, this only underscores the need for controlled comprehension studies such as this one in which whole predicates are used as stimuli.

(Weist, Wysocka, Witkowska-Stadnik, Buczowska & Konieczna, 1984; Bloom & Harner, 1989), Turkish (Aksu-Koç, 1988), Japanese (Rispoli, 1981), German (Behrens, 1993), Portuguese (DeLemos, 1981), Hebrew (Berman, 1983) and Mandarin (Li, 1990).

One prominent analysis of this data pattern is that children are using the grammatical aspect morphology to code the telic/atelic distinction – a coding which is incorrect for these languages (see Bloom *et al.*, 1980 and Antinucci & Miller, 1973 for a clear articulation of this position; but see also Shirai & Andersen, 1995 for a notably different variant of this position). That is, early success with grammatical aspect forms does not translate into early success with their meanings; during the course of acquisition, then, children must change their semantic analysis of these forms.

In contrast to this analysis based solely on children's produced forms, Richard Weist and colleagues (Weist, 1991; Weist *et al.*, 1991, 1997) have used direct tests of children's comprehension and concluded that children's early understanding of the adult meanings of grammatical aspect forms is in fact quite good. Weist's experiments use a forced choice sentence-to-picture matching task. He presented children with two pictures: one picture in the pair portrays a completed event (e.g. a smiling girl next to a completed drawing of a flower) and the other picture portrays the same event in an incomplete state (e.g. a girl in the process of drawing a flower). Children were then given two sentences describing the pictures, one in the imperfective (*The girl was drawing a flower*) and one in the perfective (*The girl drew a flower*). After both sentences had been heard and both pictures examined, the child was asked to match the sentences to the pictures. Weist has found that children as young as 2;6 acquiring English reliably match the imperfective sentence (in the *-ing* form) to the picture of the incomplete event, and the perfective sentence (in the simple past form) to the picture of the completed event. Although this pattern of results is not completely consistent with the formal semantics of grammatical aspect (the consistent match for the imperfective sentence is at odds with the imperfective's open entailments), it seems to be a reasonable pattern given the pragmatics of the task – in particular, the fact that children know they had to match both sentences. Based on these results, Weist has argued that even at the very young age of 2;6, children do indeed understand the essential completion entailments conveyed by grammatical aspect morphology, and, therefore, they must not be misunderstanding this morphology as indicating telicity properties already inherent in the predicate.

However, a close examination of Weist's cross-linguistic results raises some doubts about this conclusion. Weist and colleagues (Weist *et al.*, 1991 and Weist *et al.*, 1997) translated the task into two languages very different from English, namely Polish and Finnish. Children acquiring Polish performed equivalently to the children acquiring English, succeeding at match-

ing the perfective and imperfective to the correct pictures by the age of 2;6. The children acquiring Finnish, however, showed a markedly different pattern, and did not show competence with grammatical aspect until sometime between age 4;6 and 6;6.² Finnish differs from the other languages Weist studied in the way it marks grammatical aspect. In particular, it does not mark grammatical aspect entailments through verbal morphology, but instead provides completion information through case marking on the object: sentences containing objects marked with partitive case receive imperfective interpretations while sentences containing objects marked with accusative case receive perfective interpretations. The sentences in (1) and (2) illustrate how objects in partitive and accusative case get interpreted as imperfective and perfective aspect respectively (examples are sentences 4b and 4c of Heinämäki, 1984).

- (1) *Maija luki kirjaa*
 M. read book-part.
 'Maija was reading a book'
- (2) *Maija luki kirjan*
 M read book-acc.
 'Maija read (all) the book'

These data suggest that when grammatical aspect information is marked on the sentence object (as in Finnish), it is much more difficult to understand than when it is marked on the verb (as in English and Polish). Properties of the sentence object (e.g. whether it is a mass or count noun) are well known to influence the lexical aspectual properties of the whole sentence (i.e. the telic/atelic distinction) and to determine how, or even if, the object of the event will measure out the event as a whole (*cf.* Dowty, 1992; Tenny, 1994). An investigation of children's early knowledge of how the sentence object influences aspectual interpretation by van Hout (1998) suggests that children acquiring English and Dutch have initial difficulties in this area as well. If it is hard for children to connect the object to the lexical aspect of the predicate, it is perhaps not surprising that Finnish children find it hard to connect the object of the sentence to the grammatical aspect of the sentence.

Alternatively, the problem may be more conceptual in nature: perhaps it is difficult to get grammatical aspect information from the objects of events themselves. Regardless of how one's language codes grammatical aspect

[2] Weist *et al.* 1991 ran two different versions of this task. In the first one (which children did not pass until age 6;6) the imperfective-perfective distinction was only marked through the object's case marking. In the second one, however, they highlighted the contrast using different periphrastic verb constructions in addition to the different case markings on the objects, and in this version, the children were able to pass by age 4;6. This is a great improvement, but even so, these Finnish children are still approximately two years behind their English and Polish acquiring counterparts.

information, it is hard to figure out how the completion entailments cash out on objects in the world. That is, it may be hard to translate between the relative completion of the event as a whole and the relative completion of an object within the event. Because Finnish happens to mark grammatical aspect through the sentence object, Finnish children are necessarily faced with this hard problem of calculating the object's completion entailments. Children acquiring English and Polish, however, may have another way to make sense of their grammatical aspect morphology: they can link this morphology to properties of the agent of the event instead.

Let us consider more closely the meaning of the imperfective, as represented by the progressive form in English. Researchers have long debated the relationship between progressive sentences and perfective ones such as *Mary was building a house* and *Mary built a house* (see Dowty, 1979 for an overview of the issues). There is general agreement that the progressive version removes the entailment of completion (as noted previously). The question that remains is how to characterize an event of possibly incomplete house-building. In answer to this question, two elements emerge. The first is ongoingness: the progressive indicates that the event described by the predicate is in ongoing, progressive change towards an end it may or may not reach. This characterization is helpful, but it leads to at least one well known problem. If the progressive doesn't entail the ending of the event, how do we know what the progressive change is actually towards? This leads to the second element: intentionality. When an event has an agent acting intentionally, the intentions of that agent determine what event is ongoing.³ Precisely because the progressive does not entail any actual ending to the event, the agent's intentions towards the event come to the fore.⁴

Moreover, there is a wealth of evidence from children's early cognitive development that suggests that children are very good from a very young age at assessing an agent's intentions. For example, before the age of 18 months, children will correctly act out an adult's intended action, even when they have only seen the adult model a failed attempt (Meltzoff, 1995); in addition, they expect agents to achieve their goals in a rational fashion (Gergely, Nadasdy, Csibra & Biro, 1995; Csibra, Gergely, Biro, Koos & Brockbank, 1999). Children's early cognitive competence with intentions combined with the fact that the progressive highlights an agent's intentions in an event raises

[3] Not all predicates contain an agent acting intentionally. Sentences like *The meteor was plunging to earth* (Asher's example 2b) and *Mary was falling down* are perfectly acceptable in the progressive. In these cases, physical forces such as gravity seem to substitute for intentions.

[4] One way of formalizing the role that intentions play can be found in the model-theoretic possible worlds analysis of Asher (1992). Intentions are incorporated in his analysis via the PERSPECTIVE function which can determine which sets of possible worlds are relevant to the model.

the distinct possibility that children may be relying exclusively on their assessment of the agent's intentions when comprehending grammatical aspect. This is not an incorrect approach *per se* but it is an incomplete one: whatever else the progressive does, it also removes the entailment of completion from a telic predicate.

Given that Weist's pictures portrayed the agents of the events as much as they did the objects of the events, children could indeed succeed in his task by making a judgment about the intentional stance of the agent towards the event as well as from the relative completion of the object. Thus, the imperfective sentence is matched to the picture portraying an incomplete event (the half-drawn flower), but this picture also portrays an agent intent on the event's action (the girl busily working on her drawing); by contrast, the perfective sentence is matched to the complete event (the completed flower picture), but this picture also portrays an agent apparently satisfied with her work (the girl sits back smiling at her work). With a language like Finnish, where the morphology difference being tested is directly on the sentential object, it is highly implausible that children would think to link the morphology to properties of the agent of the action; this may account for the delayed success of the Finnish children. Moreover, if children are focusing on agent-oriented information, it might provide an additional sort of explanation for why the children in Weist's studies consistently matched the imperfective to the incomplete event (contra a formal semantics analysis): these events illustrate a clear meaning dimension of the progressive, namely, the agent's intent.

The purpose of the current experiment is to investigate English-acquiring children's ability to understand the formal completion entailments of grammatical aspect. Can they understand the imperfective–perfective distinction when only given information about the relative completion of the object involved? The design of the experiment here is essentially the same as that used by Weist in his studies, but with one crucial difference: children are provided with no agent-oriented information at all. Instead of using pictures depicting whole events, the children here were presented with pairs of toys depicting the different versions of the event. Thus, the child was presented (for example) with a puzzle completely filled in and a puzzle partially filled in and asked to match these two toys to sentence descriptions in the perfective (*I filled in the puzzle*) and imperfective (*I was filling in the puzzle*). Because the agent information is absent from the scenes at the time of the test queries, children can solve this task only by computing the completion entailments of grammatical aspect. If indeed Weist's task was a valid one for grammatical aspect entailments, then we expect to find a simple replication: children should succeed on this task by the age of 2;6 and they should show the same pattern of responses. On the other hand, if the analysis suggested here is correct, and children in Weist's tasks are indeed using agent-oriented

information to solve his task, then we expect to find (1) an age delay comparable to the age at which Finnish children succeed at this task (at least age 4;6) and possibly (2) a different pattern of responses even from children succeeding at the task. If indeed the consistent matching of the imperfective sentence depends on matching it to agent-oriented information, the removal of the agent information may alter children's interpretation of the imperfective.

METHODS

Subjects

Subjects were children attending Philadelphia area day cares whose parents gave permission for them to be tested. Subjects were removed from analysis if they (1) failed the pre-test or (2) refused to cooperate on so many trials that they didn't complete one full counterbalanced set of stimuli; a total of 18 subjects were removed because of these criteria. According to parental report, all subjects had English as their primary (and in most cases, only) language.

Three groups of subjects were tested. The two-year-old group consisted of 27 subjects with a mean age of 2;8 (ranging in age from 1;11 to 3;2). The four-year-old group consisted of 20 subjects with a mean age of 3;11 (ranging from 3;3 to 4;5). The five-year-old group consisted of 12 subjects with a mean age of 5;0 (ranging from 4;6 to 5;7). In addition, 16 college age students participated in the adult study. They received course credit for their participation.

Stimuli

Four different events were used. The events all had salient end points and were all described with a telic predicate. Each event was presented in two versions, a complete version and a half-complete version. The ROLL A CAR TO SCHOOL event consisted of a small toy school-house and two toy cars which were rolled across the floor and into the school-house. The complete version had the car inside the school and the half-complete version had the car about a foot away from the school. The FILL IN A PUZZLE event consisted of two wooden puzzles that had cut-out slots for four pieces each; the slots had pictures in them that corresponded to the pictures on the pieces. The complete version had all four pieces in their slots and the half-complete version had two pieces in their slots and two pieces propped up against the puzzle. The EMPTY OUT A CUP event consisted of two plastic cups filled with a half-dozen wooden blocks each. The complete version had the cup empty of blocks and the half-complete version had the cup still containing two blocks. The DRAW A FACE event consisted of two crayon drawings. The

complete version showed a face and the half-complete version showed a circle with one eye and one ear.

To be matched with each set of events was a pair of sentences. The test sentences were all in the first person and in the past tense. The predicates used matched the descriptive labels of the events noted above. The perfective sentence was in the simple past tense (e.g. *I filled in a puzzle, I emptied out a cup*) and the imperfective sentence was in the past progressive (e.g. *I was filling in a puzzle, I was emptying out a cup*). For a match to be counted as correct, the same criterion was used here as in Weist's studies: the perfective sentence had to be matched to the completed event and the imperfective sentence to the incomplete event.

Procedure (for child subjects)

The subject was first introduced to two characters, either a bunny and an elephant or a dog and a duck. One of the two characters was portrayed consistently with a high, squeaky voice and the other with a low (somewhat silly) voice. Subjects were told that the characters were very shy and that when they did things, they didn't like to be watched. A screen covered with colourful stickers was placed between the child and the characters while the events were being set in place and the child's attention was directed to the screen. This forced the child to use what the characters said to determine which event-version belonged to which character.

At the beginning of each trial, the child was presented with the toys for the event and encouraged to perform the test event themselves. During this phase of the trial, the event would be described only in the infinitive form, in phrases such as *Will you show me how to VP* or *The animals want to VP*. Then, the screen was brought out and the characters, hidden from the child, engaged in the event. When the events were ready, the screen was removed, revealing two versions of the test event, one completed and one only half-completed. The child was told that now the characters would say whose puzzle/cup/picture/car was whose. The characters came forward one at a time to a neutral place above the events and uttered the test sentences; one uttered an imperfective sentence and the other a perfective sentence. Each sentence was repeated at least twice and the children were encouraged to repeat the sentences. The first sentence presented always corresponded to the first sentence the child would have to match, and that sentence was also repeated immediately before the child engaged in the match. In order to match, the child was handed one of the characters, who repeated her sentence, and was told to put it on top of/next to the character's X. The child was then asked to place the second character on top of/next to that character's X. The experimenter marked down which event version the subject chose for the first character and the subjects were uniformly praised for their performance.

Only the placement of the first character was scored because, given the forced-choice nature of this task, the placement of the first character determines the placement of the second character. This leads to the following terminological convention in describing the experiment: the IMPERFECTIVE CONDITIONS refer to those trials in which the imperfective sentence is to be matched first and the PERFECTIVE CONDITIONS refer to those trials in which the perfective sentence is to be matched first. Subjects received two perfective and two imperfective test trials.

The pre-test followed exactly the same procedure but used irrelevant test events. The pre-test had two trials: one used plastic grapes and plastic bananas, and, when the screen was removed, the characters told the child which one they liked; the second used a toy crib and a toy rug, and when the screen was removed, the characters told the child which one they sat on.

In addition, child subjects also received four control trials, which were identical to the regular test trials except that the test sentences included adverbials which directly specified the grammatical aspect information. The control versions of the test sentences added two components to their experimental counterparts: first, they included a phrase of the form, *I'm partly/all done* and second, they included another adverbial (*in the middle of* or *completely*). The control version of the perfective version contains within it the experimental perfective sentence (e.g. *I'm all done*; *I V'd completely*). The control version of the imperfective version does not quite contain within it the imperfective experimental sentence (e.g. *I'm partly done*; *I was in the middle of V'ing*), though it does contain the verb in the *-ing* form as it is in the experimental version. The control condition serves as a conceptual control and provides the children with the opportunity to demonstrate that they have the concepts encoded by the grammatical aspect morphology and the ability to compute their entailments over objects, even if they don't have those concepts actually assigned to the right morphology.

Procedure (for adult subjects)

Adult subjects were tested using the same events (plus two distracter events which did not have salient end points and which were described with the atelic predicates REST and SCRIBBLE) but without the subterfuge of the shy animals. Adults were presented with static tableaux of each event pair (e.g. the completed puzzle and the partially completed puzzle) with the two event versions (complete and incomplete) labelled as either 'A' or 'B'. Aside from these labels, the tableaux were identical to the scenes the children matched. Subjects were given booklets containing the test sentences and told to inspect each tableau in turn and to match the sentences to the event versions by marking an A or a B by the sentence. Adult subjects were tested in two parts. In the first part, they were given six trials (four telic predicates plus two atelic distracters) of a single sentence (either imperfective or perfective) and told to

match that one sentence to whichever version of the event (A or B) the sentence best described. Each test sentence was on a separate page of the booklet; whether an adult saw a perfective or imperfective description of an event was counterbalanced across subjects. In the second part, the subjects were re-tested on three of the events but now they were given both sentences to match (perfective and imperfective) just as the children were. Adults were tested only using the test sentences.

RESULTS

The mean percent correct (that is, perfective sentences matched to completed scenes and imperfective sentences matched to incomplete scenes) for each age group of children and also for adults (in the one-sentence condition) is plotted in Figure 1. There were no significant differences among the different

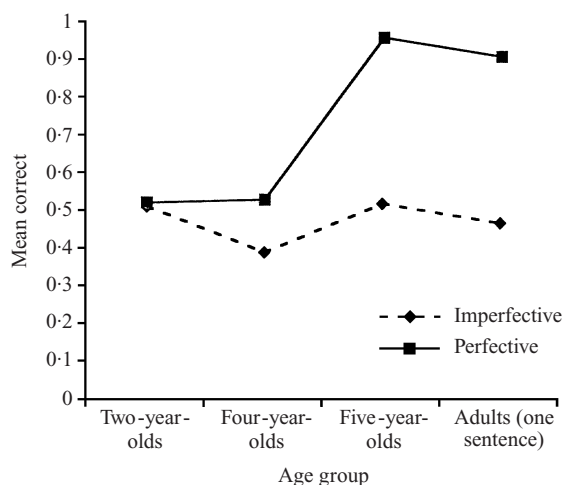


Fig. 1. Mean correct with test sentences.

event items, so this was eliminated as a factor in all analyses. Chance responding is 0.5; all t tests are 2-tailed. As can be seen in Figure 1, children in the two- and four-year-old age groups perform at chance with both perfective and imperfective sentences. The five-year-old group continues to perform at chance levels with the imperfective sentences, but is significantly above chance with perfective sentences ($t(11) = 11.0$, $p < 0.001$). A mixed design ANOVA with age group (two-, four-, and five-year-old) as a between subjects factor and sentence aspect (perfective and imperfective) as a within subjects factor confirmed a main effect for age ($F(2, 56) = 4.3$, $p < 0.02$) as well as for sentence aspect ($F(1, 56) = 7.4$, $p < 0.01$). The interaction of sentence aspect by age just misses significance ($F(2, 56) = 2.5$, $p < 0.09$),

however, if the two younger age groups are collapsed into a single group (the two are identical by t test: $t(46) = 1.87$, n.s.) and the analysis is re-run, the interaction is significant ($F(2, 56) = 4.9$, $p < 0.04$).

The five-year-olds' performance was difficult to interpret. Weist's studies had found children much younger than these succeeding at above-chance levels with both types of sentences; however, the formal entailments of the two sentence types track with the pattern of results the five-year-olds in fact give (see further discussion below). It was therefore helpful to compare the children's performance to adult performance in an equivalent task.

Recall that adults performed this task in two ways: in one version, they matched pairs of sentences, just as the children did, and in the other version, they matched single sentences. Given a pair of sentences, the adults perform essentially at ceiling (mean correct across both imperfective and perfective sentences = 0.87; $t(15) = 6.1$, $p < 0.0001$). However, when adults matched only single sentences, their scores were virtually indistinguishable from the five-year-olds (see Figure 1). Both the five-year-olds and the adult (one-sentence) group showed a significant difference between their performance on the perfective sentences compared to their imperfective sentences (five-year-olds, $t(11) = 2.21$, $p < 0.05$; adults, $t(15) = 2.23$, $p < 0.05$).

In the control condition, in which the children received adverbial cues to the completeness of the scene, the mean percent correct went up across the board. These scores are graphed in Figure 2. Given the perfective adverbial

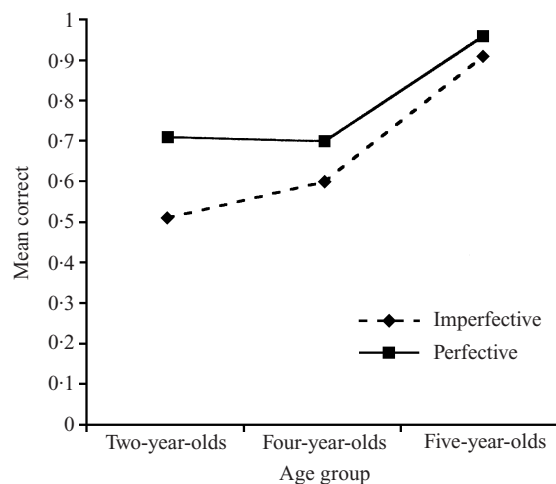


Fig. 2. Mean correct with control (adverbial) sentences.

sentences (containing *all done* and *completely*), all children performed above chance: two-year-olds $t(26) = 3.3$, $p < 0.01$; four-year-olds $t(19) = 2.9$,

$p < 0.01$; five-year-olds $t(11) = 11.0$, $p < 0.001$. This across age-group success is reassuring about the overall validity of the task. Performance with the imperfective adverbial sentences (containing *in the middle of* and *partly done*) was more similar to the test sentence performance. The two and four-year-olds both performed at chance levels (mean correct is 0.51 and 0.60 respectively), although the five-year-olds in this case did perform at well above chance (mean = 0.91, $t(11) = 7.4$, $p < 0.001$).

DISCUSSION

This experiment provided a strong test of children's ability to understand the completion entailments of grammatical aspect. It asked when children could compute those entailments using object information alone, instead of using both object and agent-oriented information as provided in Weist's earlier studies. There were two main findings from this study: first, that successful performance on this task (as indicated by the five-year-olds' behaviour) was more consistent with the formal entailments of grammatical aspect than was found in Weist's studies; and second, that given only object-oriented information, English-acquiring children did not succeed until approximately age five, making them equivalent to Weist's Finnish-acquiring children. These results support the claim that children do not understand the completion entailments of grammatical aspect until approximately age five, and they suggest that the analysis put forward in the introduction, that the children in Weist's tasks succeed by using agent-oriented information, is on the right track.

The first major finding of this experiment was that five-year-olds in this study behaved like junior formal semanticists, consistently matching the perfective sentence to the completed event (in accordance with the perfective's entailments), but remaining agnostic about where to match the imperfective sentence (in accordance with the imperfective's lack of entailments). This pattern was different from the one Weist found, as all the children in his studies consistently matched both the perfective sentence to the completed picture AND the imperfective sentence to the incomplete picture. The pattern found in Weist's studies seems perfectly reasonable. Strictly speaking, the imperfective sentence may be matched to either scene (the lack of an entailment of completion is not the same as entailing the lack of completion), but given the pragmatic contrast with the perfective (which can only be applied to the completed scene), and the fact that children hear both sentences before they do any matching, it is clear that the correct match for the imperfective sentence is with the incomplete scene. Nevertheless, in this study, the five-year-olds' behaviour tracked the strict formal entailments with no regard to the pragmatic dimension of the task.

Indeed, the five-year-olds' data strongly argues that the children's matching operates on a sentence-by-sentence basis. Despite hearing both sentences

before they engage in any matching, these children are not figuring out how best to match the test sentences by comparing across them. Had they been doing this, we would have seen consistent matching of the imperfective sentences to the incomplete scenes, in preparation for the matching of the companion perfective sentences which must be matched to the complete scenes. Instead, the children appeared to evaluate the entailments (and lack thereof) of each sentence independently. This analysis is reinforced by comparing the five-year-old data to the adult data: it matches adult performance when adults are given a single sentence.

Given object information alone, and considering only one sentence at a time, there is no way to consistently match the imperfective sentence to the incomplete picture. Assuming that the children in Weist's studies were equally subject to the constraint to consider the test sentences one at a time, we can wonder on what basis those children were able to consistently match the imperfective sentence to the incomplete picture. A plausible explanation for this behaviour is that the children in those studies were using some additional source of information, such as agent-oriented information.

The second finding from this study was that children did not succeed with this task until approximately age five; children younger than this age demonstrated nothing beyond chance performance with the test sentences. Compared to Weist's studies, this is a substantial age delay: English-acquiring children succeeded in his studies as young as age 2;6. There are many possible explanations for why the current study found an age delay: the use of toys instead of pictures might have been distracting for the younger children, the particular events portrayed here may have been more difficult to understand than those used by Weist, or the fact that there were fewer cues (regardless of type) may have made the matching more difficult. Nevertheless, the age delay found in this study is on a par with the age delay Weist and colleagues found with Finnish. Both age delays can be accounted for if, first, age five (roughly speaking) represents the true age at which grammatical aspect's completion entailments are understood, and secondly, if the earlier success found in Weist's studies reflects the use of an alternative strategy based on agent-oriented information. When judgments must depend on object information, either because it is the only information available (as in the current study) or because the relevant morphology is directly attached to the syntactic object (as in Finnish), an agent-oriented strategy is useless and we can therefore see children's true competence with the completion entailments.

In addition to the two main findings here, the results from the control condition (using adverbial cues) also provide some support for the idea that the linguistic expression of (lack of) completion poses some general difficulties for the child. Consider the difference between the perfective and imperfective results in the control condition reported here. The two-year-

olds were able to succeed with perfective adverbials (*all done, completely*), but with the imperfective adverbials (*in the middle of, partly done*), these children and, to an only slightly lesser extent, the four-year-olds, did not succeed. The imperfective adverbial sentences (unlike the imperfective test sentences) do have a clear correct match, but only the five-year-olds consistently chose the incomplete object to match to these sentences. It is possible that this result is a mere artifact of the particular adverbials used (despite the best efforts of pilot testing). However, ongoing follow-up investigations into children's use of adverbials in the CHILDES database (MacWhinney, 1995) suggest that, in fact, uses of imperfective adverbials are vanishingly rare in children's production, even compared to perfective adverbials. These results are tentative, but they suggest that the general linguistic expression of completion – or rather, lack of completion – is a relatively late development.

Putting together the data and analyses presented here we can begin to form a coherent story about how children acquire the semantics of grammatical aspect. Children's starting strategy is to give priority to mapping the concepts they understand well; in this case, they focus on intentional properties, reflecting their early cognitive competence with intentional action. For grammatical aspect, this kind of mapping will find a lot of support from the available evidence because in fact there is an intentional component to the progressive's meaning. However, this mapping will falter when the child is faced with such mundane counter-examples as *The water is boiling* (no intentional agent is present) and *Mommy was falling over* (the agent's intentions run counter to the event described). These kinds of examples will force the child to re-analyse their grammatical aspect meanings, or at least, to expand them to include non-agent oriented facets of the event such as object completion.

Note, however, that there is a strong claim hidden in this story, namely, that children are organizing the semantics of grammatical aspect in a systematic fashion. The data presented here show that children are at chance with both perfective and imperfective aspect in the absence of agency cues until the age of five years. The switch from reliance on an agent-oriented, intentional meaning for grammatical aspect to the addition of an object-oriented, completion meaning happens equally to both morphemes. The importance of intentionality to the progressive's semantics is well established in the semantics literature, but to my knowledge, there is no equivalent intentional analysis of the perfective. No one has argued that the perfective's meaning should include reference to an agent's satisfied intentions. Nevertheless, the fact that children's performance with the two morphemes is linked across these tasks suggests that there is a stage when children view the perfective as having primarily intentional meaning. This conclusion is unexpected, but does not strike me as totally implausible. After all, if *Mary built a house*, the house is the product of Mary's satisfied intentions and the

perfective's completion entailment could just as easily be seen as the entailment of Mary's satisfied intentions.

There are two objections that can be raised about this story given the data presented here. The first objection concerns this account's focus on intentionality. One reviewer suggested that children may be making an ongoing/terminative distinction with the grammatical aspect morphology. On this analysis, children would succeed on Weist's tasks because the agents provide cues to the ongoing/terminative properties. In the current study, the younger children perform at chance because the test scenes are both terminative: in both scenes, the agents have stopped working on them. Thus, the imperfective (perfective) applies equally badly (well) to both scenes. What develops on this account is children's knowledge of the perfective. In essence, children must learn that the perfective means not just that a telic event has stopped, but that it has completed.

I am sceptical of this account because it suggests that children are not using completion information to discriminate between the test scenes. Such a claim is strongly at odds with the finding in the current control condition, in which even the youngest children successfully identified the event described as being *all done*. More importantly, however, notice that an ongoing/terminative distinction depends on intentionality. If I am in the middle of drawing a picture of a flower and I pause – to drink a cup of tea or go to the bathroom – the only way to know if I have stopped drawing the picture or if I am instead still in the process of drawing it is to know my intentions. Am I intending to continue work on the picture? It's not clear therefore, that characterizing the children's semantics as ongoing/terminative is any different from saying they are coding the agent's intentional state.

The second objection concerns the interpretation of the Finnish data given the current analysis. Recall that the Finnish children failed on Weist's task until around age five (as in the current study) but that after approximately age five, they succeeded on both perfective and imperfective trials (contra the current study). The Finnish children could be taking advantage of the agency cues like the other children are in order to succeed on the imperfective trials, but there is still no plausible reason to expect them to link object case marking to the agent's intentions at age five any more than there was at the age of three. How can we reconcile the Finnish data with the current account? By recognizing that the partitive case in Finnish, although often functionally equivalent to the imperfective in English and Polish, isn't really the same. Analyses of the Finnish partitive (Heinämaa, 1984; Kiparsky, 1998) find that the partitive case is closely associated not only with imperfectivity, but also with atelicity, and can switch a telic predicate into an atelic one in much the way that changing a count noun object to a mass noun does in English (compare *I ate a cookie* to *I ate cake*). Moreover, although it isn't clear that the partitive case actually entails the lack of completion of an event, in many

cases it does indicate an unsuccessful result.⁵ In short, the partitive is a much stronger indicator of lack of completion than the imperfective is with its completely open entailments. Like their English counterparts, then, the Finnish children may be acting like junior formal semanticists, able to successfully compute object completion entailments at the age of five; it's just that in Finnish, the semantics the children is learning are different.

The results presented here are just one step toward establishing the process children go through in acquiring the semantics of grammatical aspect. Contra the previous findings of Weist and colleagues, this study did not find evidence for early adult-like competence with grammatical aspect morphology, but instead found the children to be largely ignorant of grammatical aspect's completion entailments until the age of five. On the other hand, the results do not support the idea that children's initial mappings are grossly off the mark (as marking a lexical property such as telicity would be). Instead, the suggestion made here is that the agent-oriented property of intentionality, which is a true part of the meaning of the progressive, has priority in the mapping process over the object-oriented completion information, which is necessary for truly understanding grammatical aspect's semantic entailments. Mapping intentionality information to this morphology is therefore not a wrong step for these children; it is merely an incomplete step. The process of mapping meanings onto morphemes may be a lengthy one, but it is one of forward progress.

REFERENCES

- Aksu-Koç, A. (1988). *The acquisition of aspect and modality*. Cambridge: C.U.P.
 Antinucci, F. & Miller, R. (1976). How children talk about what happened. *Journal of Child Language* 3, 167–89.
 Asher, N. (1992). A default, truth conditional semantics for the progressive. *Linguistics and Philosophy* 15 (5), 463–508.
 Behrens, H. (1993). The relationship between conceptual and linguistic development: the early encoding of past reference by German children. *CLS29, Parasession on conceptual representation*, Vol. 2, 63–75.
 Berman, R. (1983). Establishing schema: children's construals of verb-tense marking. *Language Sciences* 5, 61–78.
 Bloom, L. & Harner, L. (1989). On the developmental contour of child language: a reply to Smith and Weist. *Journal of Child Language* 16, 207–16.
 Bloom, L., Lifter, K. & Hafitz, J. (1980). Semantics of verbs and the development of verb inflection in child language. *Language* 56 (2), 386–412.

[5] A standard contrast is the following:

Metsästäjä ampui lehmän/lehmää
 hunter shot cow-acc/cow-part

When 'cow' is in accusative case, the sentence means the hunter shot the cow dead. When 'cow' is in partitive case, however, the verb may be glossed as 'shot at'. The shooting event itself may be completed, but when partitive case is used, the cow is apparently not dead. The example is adapted from Heinämäki's example 1 (see also Kiparsky's example 1).

- Bronckart, J. P. & Sinclair, H. (1973). Time, tense and aspect. *Cognition* 2 (1), 107–30.
- Brown, R. (1973). *A first language*. Cambridge: Harvard University Press.
- Comrie, B. (1976). *Aspect*. Cambridge: C.U.P.
- Csibra, G., Gergely, G., Biro, S., Koos, O. & Brockbank, M. (1999). Goal attribution without agency cues: the perception of 'pure reason' in infancy. *Cognition* 72, 237–67.
- DeLemos, C. (1981). Interactional processes in the child's construction of language. In Werner Deutsch (ed.), *The child's construction of language*. London: Academic Press.
- DeVilliers, J. G. & DeVilliers, P. (1973). A cross-sectional study of the acquisition of grammatical morphemes in child speech. *Journal of Psycholinguistic Research* 2 (3), 267–78.
- Dowty, D. (1992). Thematic proto-roles and argument selection. *Language* 67, 547–619.
- Dowty, D. (1979). *Word meaning and Montague grammar*. Dordrecht: Kluwer.
- Gergely, G., Nadasdy, Z., Csibra, G. & Biro, S. (1995). Taking the intentional stance at 12 months of age. *Cognition* 56, 165–93.
- Heinämäki, O. (1984). Aspect in Finnish. In Caspar de Groot & Hannu Tommola (eds), *Aspect bound*. Dordrecht: Foris.
- van Hout, A. (1998). On the role of direct objects and particles in learning telicity in Dutch and English. In the Proceedings of the 22nd Boston University Conference on Language Development. Cascadilla Press.
- Kiparsky, P. (1998). Partitive case and aspect. In Miriam Butt & Wilhelm Geuder (eds), *The projection of arguments*. Stanford: CSLI publications. 265–307.
- Li, P. (1990). *Aspect and aktionsarten in child Mandarin*. PhD dissertation, Leiden, The Netherlands.
- MacWhinney, B. (1995). *The CHILDES project: tools for analyzing talk. Second Edition*. Mahwah, NJ: Erlbaum.
- Meltzoff, A. N. (1995). Understanding the intentions of others: re-enactment of intended acts by 18-month-old children. *Developmental Psychology* 31 (5), 538–80.
- Olsen, M. B., Weinberg, A., Lilly, J. P. & Drury, J. E. (1998). Mapping innate lexical features to grammatical categories: acquisition of English *-ing* and *-ed*. In the Proceedings from COGSCI '98, Madison, WI.
- Rispoli, M. (1981). *The emergence of verb and adjective tense-aspect inflections in Japanese*. Masters thesis, University of Pennsylvania.
- Shirai, Y. & Andersen, R. (1995). The acquisition of tense-aspect morphology: a prototype account. *Language* 71 (4), 743–62.
- Smith, C. (1991). *The parameter of aspect*. Dordrecht: Kluwer.
- Tenny, C. (1994). *Aspectual roles and the syntax-semantics interface*. Dordrecht: Kluwer.
- Weist, R. (1991). Spatial and temporal location in child language. *First Language* 11, 253–67.
- Weist, R., Wysocka, H. & Lyytinen, P. (1991). A cross-linguistic perspective on the development of temporal systems. *Journal of Child Language* 18, 67–92.
- Weist, R., Lyytinen, P., Wysocka, J. & Atanassova, M. (1997). The interaction of language and thought in children's language acquisition: a crosslinguistic study. *Journal of Child Language* 24, 81–121.
- Weist, R., Wysocka, H., Witkowska-Stadnik, K., Buczowska, E. & Konieczna, E. (1984). The defective tense hypothesis: on the emergence of tense and aspect in child Polish. *Journal of Child Language* 11, 347–74.