The Development of a Sense of an Ending

Raymond Patt, Laura Wagner, and Sudha Arunachalam

1. Introduction

By 3 years of age, children use tense/aspect morphology to distinguish between completed and ongoing events. For example, children match a perfective form (*-ed*) to a completed version of an event (e.g., a video of a girl drawing a complete circle) and an imperfective form (*-ing*) to an ongoing version of an event (e.g., a girl engaged in drawing a circle throughout a video) (Wagner, Swensen, & Naigles, 2009). However, children are less skilled with events that come to an end but do not achieve the intended endstate (e.g., drawing part of a circle and then stopping). Preschool-aged children often accept perfective forms (e.g., *drew a circle*) for such events, effectively 'neglecting' the endstate of the event in their linguistic description (van Hout, 1998; Jeschull, 2007; Ogiela, 2007; Schulz & Wittek, 2003; Wittek, 2002; van Hout, 2018).

The cause of such neglect is unclear and more generally, at least three important dimensions of the phenomenon have been under-studied. First, since most previous studies involved children ages 3 to 5 years old, it is unclear how long endstate neglect lasts in development. Second, previous work has relied on fairly extreme contrasts in event completion (e.g. 50% complete vs. fully complete, or not complete at all vs. fully complete) making it unclear exactly what is being neglected in the event. It is possible that stark contrasts between completed and incomplete events are needed for young children to distinguish between them, but it is also possible that a more subtle contrast would highlight the fact that endings are important for the task. Third, most previous work with children has exclusively tested perfective forms (e.g. English *-ed*), making it unclear whether the neglect is a function of conceptual ability or linguistic ability. Perhaps children are unsure about the entailments of the particular markers that have been tested. In order to disambiguiate conceptual and linguistic ability in end-state neglect, a wider variety of forms is needed.

To address these issues, we presented adults and children (mean age 6.7 years) with sentences like those in (1) along with pictures of events that were either mostly complete (e.g., a box that is 75% closed) or fully complete (e.g., a

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closed box). We elicited graded judgments about the acceptability of each of these three sentence types in the context of both types of pictures.

1. a. The girl was closing the box.
   b. The girl closed the box.
   c. The girl has closed the box.

2. Method

2.1. Participants

Native English-speaking adults ($n = 77$) and children ($n = 134$) (ages 3 to 12 years; mean age 6.7 years) were included in the final sample. Participants were recruited from the Center of Science and Industry (COSI) in Columbus, OH under the auspices of the Language Sciences Research Lab (Wagner et al., 2015). Data from an additional 4 adults and 29 children were excluded because they did not pass the inclusion criterion set for "catch" trials (see below).

Participants self-reported their gender (114 female, 95 male, 2 other), race (7 Asian, 19 Black or African-American, 5 Hispanic, 165 White, and 15 Other/Did not report), and language background (207 English only, and 4 bilingual in English and another language). Data was not collected from non-English-speaking participants.

2.2. Materials and Design

Participants viewed images and accompanying sentences presented on a tablet. See Figure 1. During each of 3 practice trials, 3 catch trials, and 8 experimental trials, a single image was shown of an object along with a sentence describing an event related to that object.

For experimental trials, there were two versions of each item. On Fully Complete trials, the object was depicted as having fully undergone the target event (e.g., a closed box). On Mostly Complete trials, the object was depicted as satisfying a mostly-but-not-fully complete version of the target event (e.g., a box that is mostly closed but not completely closed). Assignment of each item (e.g., box) to a condition (i.e., Fully Complete or Mostly Complete) was randomized for each participant, but each participant viewed 4 Fully Complete trials and 4 Mostly Complete trials.

The image was accompanied by a target sentence (read by adult participants, read to child participants by researchers) in one of three conditions as in (1): imperfective (e.g., clos*ing*), perfective (e.g., clos*ed*), or perfect (e.g., *has* clos*ed*). See Appendix A for the materials for all 8 experimental trials. Participants were randomly assigned to one of the three linguistic conditions in a between-subject design; thus, each saw only one type of target sentence.

Practice and catch trials were similar to experimental trials except that the target sentence was designed to be either unambiguously true, unambiguously false, or ambiguous. The experiment began with one practice trial of each type; the catch trials occurred after every two experimental trials.

Below the sentence there was a sliding scale on which participants could provide a response about the accuracy of the dinosaur's sentence. The ends of the scale were labeled "inaccurate" and "accurate."

2.3. Procedure

Participants were recruited and run on the museum floor. The first screen of the experiment introduced the participant to a girl and a dinosaur. Researchers explained that the dinosaur would describe what the girl does based on the picture and that the participant's job was to rate how well the dinosaur did. Participants then performed three practice trials with an unambiguously true statement, an unambiguously false statement, and an ambiguous statement. Researchers emphasized that participants could move the button on the sliding scale to any degree along the scale to match the accuracy exactly. During the two unambiguous practice trials, feedback was given about which direction (but not what degree) to move the button.

Following the practice items, participants saw the 8 experimental and 3 catch trials, randomly ordered. No corrective feedback was given during the test phase and all responses were praised.

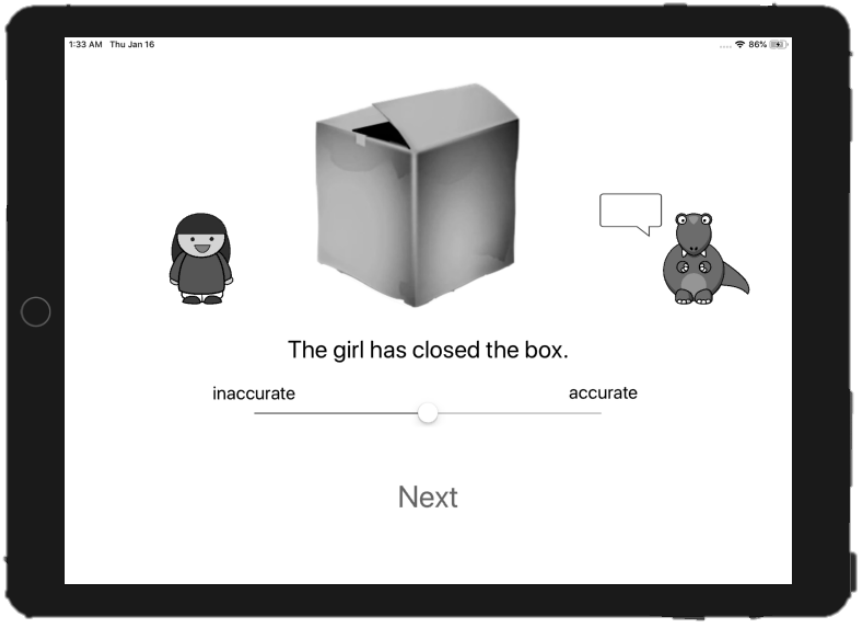


Figure 1. Image from one representative trial.

3. Results

Participants were excluded if they did not provide a higher mean rating for the unambiguously true catch trial than the unambiguously false catch trial, which suggested that they did not understand how to use the scale or were not taking the task seriously. All included participants contributed data for all 8 events.

Overall, children and adults showed different ratings among the three conditions, as predicted. See Figure 2 for adults and Figure 3 for children.

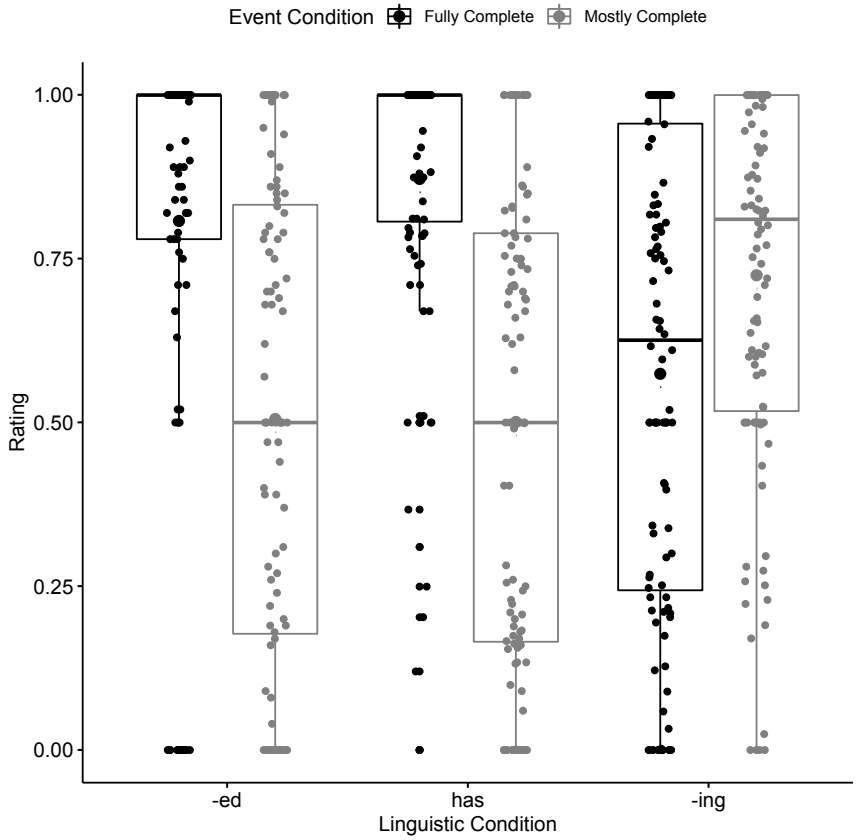


Figure 2. Adults' ratings by Linguistic condition (*-ed, has, -ing*) and Event condition (Fully Complete, Mostly Complete).

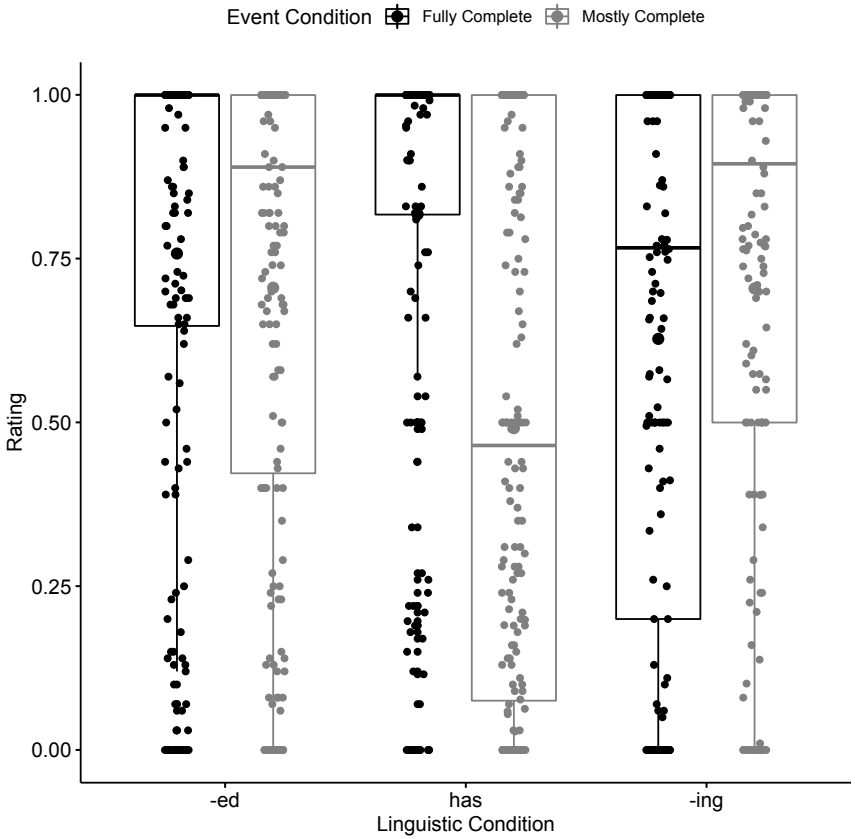


Figure 3. Children's ratings by Linguistic condition (*-ed, has, -ing*) and Event condition (Fully Complete, Mostly Complete).

To evaluate participants' ratings statistically, we submitted the data to a linear mixed-effects model with participant and item as random factors, and as fixed factors: Linguistic Condition (*-ed, has, -ing*; with *-ing* as the reference level), Event Condition (Fully Complete, Mostly Complete; with Fully Complete as the reference level), and age group (adult, child; with adult as the reference level) as well as the interactions among them. Parameter estimates for the main effects are listed in Table 1. Estimated marginal means were computed to evaluate the interactions. Estimates from the critical contrasts for our hypotheses are listed in Table 2. Overall, the results indicate no significant difference between adults and children, although there were some differences in which contrasts showed significant effects for children and which showed significant effects for adults. Notably, while adults showed differences between the two Event conditions for all three pairwise comparisons among the Linguistic conditions, children did not show a significant effect of Event condition for *-ing* or *-ed*. Adults also showed

differences between the imperfective and both the perfect and perfective forms (but not the perfect and perfective compared to each other), while children only showed a difference between *-ing* and *has.*

Table 1. Model parameters for main effects.

	Estimate	SE	*t*-value	*p*-value	
Intercept	0.58	0.050	11.61	<.001	*
Linguistic Condition *-ed*	0.24	0.056	4.22	<.001	*
Linguistic Condition has	0.30	0.055	5.49	<.001	*
Event Condition	0.15	0.044	3.33	<.001	*
Age Group	0.054	0.066	0.81	0.42	

Although there was no effect of age group (adults vs. children) in the analysis, because the age range of the children was quite large, we next looked at data from just the children in two ways. First, we repeated the same model as before with all of the children but adding age in years to the model instead of age group. Second, we repeated this analysis with only children aged 5 to 8 years, the range during which we would expect to see children beginning to shift away from endstate neglect, and for which we had the most data (25 5-year-olds, 29 6-year-olds, 21 7-year-olds, 22 8-year-olds). In both cases, there was no main effect of age (model with all ages: $\beta = 0.017$, SE = 0.015, *t*-value = 0.80, $p = 0.42$; model with only ages 5-8: $\beta = <.01$, SE = <.01, *t*-value = 0.048, $p = 0.96$).

Table 2. Estimated marginal means for critical contrasts.

Contrast	Estimate	SE	*t*-value	*p*-value	
Adults, Fully Complete vs. Mostly Complete					
-ing	-0.15	0.044	-3.33	0.042	*
-ed	0.32	0.047	6.71	<.0001	*
has	0.39	0.045	8.53	<.0001	*
Children, Fully Complete vs. Mostly Complete					
-ing	-0.073	0.036	-2.028	0.67	
-ed	0.067	0.034	1.99	0.70	
has	0.32	0.034	9.38	<.0001	*
Adults, Fully Complete, 3-way Linguistic Contrast					
-ing vs. *-ed*	-0.24	0.056	-4.22	0.0017	*
-ing vs. *has*	-0.30	0.055	-5.49	<.0001	*
-ed vs. *has*	-0.065	0.057	-1.15	0.99	
Children, Fully Complete, 3-way Linguistic Contrast					
-ing vs. *-ed*	-0.14	0.043	-3.15	0.074	
-ing vs. *has*	-0.18	0.043	-4.26	0.0015	*
-ed vs. *has*	-0.048	0.042	-1.16	0.99	
Adults, Mostly Complete, 3-way Linguistic Contrast					
-ing vs. *-ed*	0.22	0.056	3.97	0.0047	*
-ing vs. *has*	0.23	0.055	4.16	0.0023	*
-ed vs. *has*	0.0058	0.057	0.10	1.00	
Children, Mostly Complete, 3-way Linguistic Contrast					
-ing vs. *-ed*	0.0043	0.043	0.10	1.00	
-ing vs. has	0.21	0.043	4.79	0.0001	*
-ed vs. has	0.20	0.042	4.86	0.0001	*
Adult vs. Child, Fully Complete					
-ing	-0.054	0.066	-0.81	1.00	
-ed	0.049	0.067	0.73	1.00	
has	0.066	0.066	1.00	1.00	
Adult vs. Child, Mostly Complete					
-ing	0.020	0.066	0.31	1.00	
-ed	-0.20	0.067	-2.98	0.14	
has	-0.0025	0.066	-0.038	1.00	

4. General Discussion

Our results show, first, that English-speaking adults take both the perfective *-ed* and the perfect with *has* as better descriptions for fully completed events than mostly completed events; the opposite pattern occurs with the imperfective *-ing*. Thus, adults were sensitive to even the relatively small distinction between fully and mostly complete events, consistent with prior experimental work (Arunachalam & Kothari, 2011).

Second, children performed similarly to adults with the perfect *has*; they, too, gave higher ratings to fully completed events as compared to mostly completed events with this sentence type. Thus, despite the subtle distinction between the endstates in the fully and mostly complete events, children judged the perfect to be more appropriate for the former than the latter. Contrary to end-state neglect predictions, these participants were quite attentive to just how complete the event really was.

However, children were unlike adults with the other two linguistic conditions. Although in both cases, they trended in the same direction as adults, rating *-ed* more highly for fully completed events than mostly completed events and providing the opposite pattern for *-ing*, they also showed substantial variance and no significant differences between the two event types. There was no clear pattern with age; we did not find evidence that children's performance with the perfective or imperfective became more adult-like over the age range we tested. However, a limitation of our data set is that we did not have sufficient data from children older than age 8 to assess at what point they might begin performing similarly to adults with these two linguistic forms.

With respect to the perfective *-ed*, our results are consistent with the endstate neglect shown in prior work. This is perhaps not surprising given that the difference in the events we depicted was much more subtle than has often been tested, but perhaps it is surprising given that the children were older than those in most prior work. Interestingly, prior work on this issue in English has used the perfective *-ed* form rather than the perfect *has* form (with the exception of a study with only adults by Altmann and Kamide (2007)); studies of German and Dutch, by contrast, used the perfect (van Hout, 2018). Our results show a dissociation between these two forms: children were more adult-like with the perfect than the perfective. To our knowledge, this is the first study examining endstate neglect in children with the English perfect.

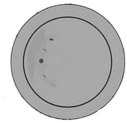
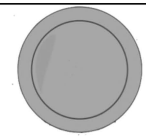
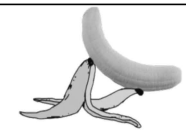
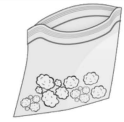
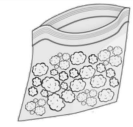
Why should children be more sensitive to the endstate information with the perfect *has* than the more frequent perfective *-ed*? One possibility is that the perfect form, precisely because it is less common, is more noticeable for children. The perfect may attract extra attention and thus encourage children to consider its semantic implications. A related possibility is that the perfect *has* is pragmatically marked; its lower frequency status might suggest that the speaker chose it to specially signal the importance of the completion entailment.

Children's performance with the imperfective could also be interpreted as a kind of endstate neglect since the children seemed not to care about the differences between mostly and fully complete events. An alternative explanation, however, may lie in children's developing understanding of pragmatics; while adults make the pragmatic inference that the speaker would use a (stronger) perfective form if intending to describe a fully completed event, children may not make this inference. Moreover, other studies have found pragmatic failures in children interpreting imperfective aspec similar to the result found here (Wagner, 2002; Papafragou, 2006). We do acknowledge that it is inconsistent to ascribe the failure

with the imperfective *-ing* to pragmatic difficulties while attributing the success with the perfect *has* to pragmatic skill; clearly more research is required.

In summary, by age 7 years, the children in this study demonstrated an adult-like appreciation of how the perfect *has* construction refers to endstates—even comparatively subtle differences in endstates. They still, however, showed endstate neglect with the perfective *-ed,* just as younger children did in previous work that used stark endstate contrasts. These results indicate that children do not mature out of endstate by the end of pre-school; linking the perfective *-ed* to strong completion entailments appears to involve protracted development. Moreover, these results further suggest that the difficulty does not lie in children's conceptual analysis of the events. All conditions here contrasted fully and mostly (~75%) completed events, but this subtle difference did not highlight the endings in a helpful way (children showed endstate neglect with the perfective *-ed*) nor did it make it impossible for children to properly identify the endings (children differentiated the two event versions with the perfect *has*). Instead, the results found that the specific linguistic implementation of perfectivity was important as children showed endstate neglect with the perfective *-ed* but not the perfect *has*. While it is premature to make strong claims based on these data, these results suggest that the acquisition bottleneck in this domain is a mapping difficulty: children command the conceptual and linguistic resources needed to make aspectual interpretations but take many years to learn how to properly map specific entailments to different constructions.

Appendix A. Stimuli from all experimental trials.

Target Sentences	Mostly Complete	Fully Complete
The girl was eating/ate/has eaten the cookie.		
The girl was covering/covered/has covered the pot.		
The girl was drinking/drank/has drank the juice.		
The girl was closing/closed/has closed the box.		
The girl was drawing/drew/has drawn the circle.		
The girl was opening/opened/has opened the book.		
The girl was peeling/peeled/has peeled the banana.		
The girl was filling/filled/has filled the bag.		

References

Altmann, Gerry T., & Kamide, Yuki. (2007). The real-time mediation of visual attention by language and world knowledge: Linking anticipatory (and other) eye movements to linguistic processing. *Journal of Memory and Language, 57*(4), 502-518.

Arunachalam, Sudha, & Kothari, Anubha. (2011). An experimental study of Hindi and English perfective interpretation. *Journal of South Asian Linguistics, 4*(1), 27-42.

Jeschull, Liane. (2007). The pragmatics of telicity and what children make of it. In *Proceedings of the 2nd conference on generative approaches to language acquisition North America* (pp. 180-187).

Ogiela, Diane A., Casby, Michael W. & Schmitt, Cristina. (2007). Are we done yet? Children's interpretation of verb phrase telicity. Poster presented at the American Speech-Language-Hearing Association Convention, November, San Diego, CA

Papafragou, Anna. (2006). From scalar semantics to implicature: Children's interpretation of aspectuals. *Journal of child language*, *33*(4), 721-757.

Schulz, Petra, & Wittek, Angelika. (2003) Opening doors and sweeping floors: What children with Specific Language Impairment know about telic and atelic verbs. In B. Beachley, A. Brown, & F. Colin (Eds.), *BUCLD 27: Proceedings of the 27th annual Boston University Conference on Language Development* (pp. 727–738). Somerville, MA: Cascadilla Press.

Wagner, Laura, Speer, Shari R., Moore, Leslie C., McCullough, Elizabeth A., Ito, Kiwako, Clopper, Cynthia G., & Campbell-Kibler, Kathryn. (2015). Linguistics in a science museum: Integrating research, teaching, and outreach at the Language Sciences Research Lab. *Language and Linguistics Compass, 9*(10)*,* 420-431.

Wagner, Laura. (2002). Understanding completion entailments in the absence of agency cues. *Journal of Child Language 29,* 109 - 125.

Wagner, Laura., Swensen, Lauren, & Naigles, Letitia. (2009). Children's early productivity with verbal morphology. *Cognitive Development 24*, 223 – 239

Wittek, Angelika. (2002). *Learning the meaning of change of state verbs: A case study of German child language*. Berlin: De Gruyter Mouton

van Hout, Angeliek. (2018). On the acquisition of event culmination. In K. Syrett & S. Arunachalam (Eds.), *Semantics in Language Acquisition* (pp. 95–122). Amsterdam: John Benjamins.

van Hout, Angeliek. (1998). On the role of direct objects and particles in learning telicity in Dutch and English. In *Proceedings of the 22nd Boston University Conference on Language Development* (Vol. 2, pp. 398-408). Cascadilla Press.

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