Interactions between Nouns and Verbs in Interpreting Events

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Abstract

Previous research shows that readers judge inherently unbounded actions to be bounded when (a) a verb describes the irreversible consumption of an object, and (b) the grammatical object is a count noun, rather than a mass noun. We seek to extend these findings by examining whether the mass/count distinction will affect readers' interpretations of verbs from additional aspectual classes. Participants read scenarios containing either an observation verb (e.g., *watching*) or a destruction verb with a temporal profile resembling one of three of Vendler's (1967) classes of lexical aspect: activities (e.g., *eating*), accomplishments (e.g., *destroying*), or achievements (e.g., *bursting*), and responded to questions designed to assess whether they interpreted the entire event as bounded or unbounded. Responses suggest that the presence of physical boundaries on objects will only affect the aspectual class of events in limited circumstances. Results also indicate that, in cases where a VP's characteristic temporal structure conflicts with its context, the VP's inherent lexical aspect is overridden, to bring its meaning into line with the context that surrounds it (aspectual coercion).

Introduction

The verb system of many languages contains a distinction between verbs that imply an endpoint and verbs with no inherent endpoint. *Telic* verbs (e.g., *deliver*) presuppose an endpoint, or temporal boundary, for the events they describe. Once an object has arrived at its destination, for example, delivering has ended and cannot logically continue. *Atelic* verbs (e.g., *sing*) do not presuppose an inherent boundary; the corresponding actions have the potential to go on without end. Several schemes have been proposed for dividing telic and atelic subclasses, based on further distinctions in temporal structure. One popular scheme, due to Vendler (1967) appears in Figure 1 and divides atelic verbs and verb phrases into *states* (e.g., *know*) and *activities* (e.g., *sing*). In this scheme, telic items divide into *accomplishments* (e.g., *deliver*) that occur over an interval of time and *achievements* (e.g., *explode*) that occur at a single time point. These distinctions among verbs or verb phrases are commonly referred to as *lexical aspect*.

English and many other natural languages also possess a distinction among nouns that is in some ways parallel to telic/atelic difference. Count nouns (e.g., *cat*) have plurals (*cats*) and occur with quantifiers such as *many*; mass nouns have no plural forms (**teas*) and occur with quantifiers such as *much*. Count nouns treat objects as countable entities with defined boundaries, while mass nouns treat them as noncountable substances, such as *mud* or *tea* (though mass nouns may also refer to aggregates, e.g., *cattle*; see Jackendoff, 1991).

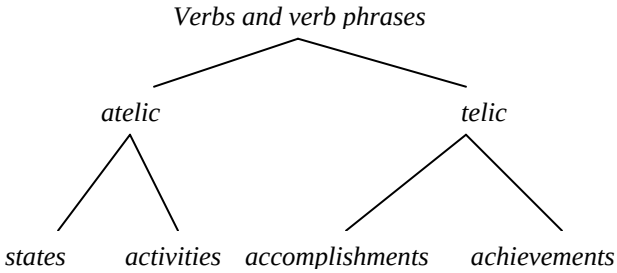


Figure 1. Vendler's taxonomy of verb types.

The current experiments explore how the distinction in verbs' aspect interacts with count/mass status of nouns to affect readers' interpretations of events in narratives.

Interactions between Nouns and Verbs

Count or mass nouns can sometimes influence the aspect of the verb phrases in which they occur. Several authors have noted that the telicity or boundedness of a verb phrase can depend on whether it has a mass or count noun as its object (e.g., Dowty, 1991; Filip, 1999; Garey, 1957; Krifka, 1992; Pustejovsky, 1991; Tenny, 1987; Verkuyl, 1993). This effect can be given a general formulation in terms of incremental themes, but for present purposes, the following Aspectual Composition principle is sufficient: When an activity verb is combined with a count NP, it will yield a telic verbal predicate, but when such a verb is combined with a mass NP, it will yield an atelic verbal predicate, provided the whole sentence expresses a statement about a single event. Consider, for example, an activity verb, such as *eating*, that describes the destruction or consumption of something. If the verb has a count noun object (e.g., *eating a candy bar*), the telicity of the entire verb phrase is telic. The resulting VP is no longer an activity, but an accomplishment, since the depletion of the object must end with the object itself. When such a verb takes a mass noun as its object (e.g., *eating chocolate sauce*), however, the VP

is atelic: Since the substance is unbounded, the depletion could potentially go on indefinitely.

The present studies determine how combining mass and count NPs with various types of verbs affect participants' interpretations of events in narratives. Earlier experiments support the idea that count or mass nouns influence the telicity of VPs with activity verbs of destruction (Proctor, Dickey, & Rips, 2004; Solomon, Proctor, & Rips, 2006, Experiment 2). In this paper, we explore the limits of this effect by comparing such verbs with verbs of other types. First, the influence of nouns on telicity should only occur with a subset of activity verbs—for example, certain consumption and destruction verbs—as these describe events as having an irreversible effect on their objects (Krifka, 1998). Activity verbs that do not entail an irreversible effect should not produce an aspectual shift. For example, whether a mass or count noun appears as the object of a verb of observation (e.g., *watch*) should not affect the VP's telicity (Krifka, 1992). The action of watching a mug should be just as unbounded as the action of watching soup. For expository convenience, we use "destruction verb" in what follows to apply to both verbs of consumption or destruction that have an irreversible effect, and we compare these to observation verbs.

Second, we contrast activity-type destruction verbs with destruction verbs with temporal profiles similar to two of Vendler's other classes: accomplishments and achievements. Since accomplishments and achievements are both telic, they possess a necessary and inherent endpoint—in the case of our destruction verbs, this endpoint corresponds to the complete destruction of the direct object. We therefore expected that, for both accomplishment-type and achievement-type verbs, the grammatical object would have no effect on participants' judgments. Since a temporal boundary was already present, a count noun could not add one, and a mass noun could not take it away. Accomplishment and achievement verbs differ, however, in the duration of the events they describe. While accomplishments (e.g., *dismantling a building*) may occur over an extended period of time, achievements (e.g., *exploding a building*) occur virtually instantaneously. We therefore expected participants to associate accomplishment-type destruction verbs with longer intervals than those involving achievement-type verbs.

In sum, if verbs and their objects are combined by Aspectual Composition, the aspect of VPs with activity-type destruction verbs will depend on the mass or count status of their objects. However, mass/count status will not affect activity-type observation verbs. Similarly (and with the same proviso), the mass/count distinction will not affect accomplishments or achievements. The reason for our proviso—that people use Aspectual Composition to interpret the VPs —will become clear in later discussion of the first experiment.

Experiment 1: Time Envelopes for VPs

We presented participants with scenarios describing characters either destroying or observing an object, where the object was either a count or mass NP. Table 1 contains an example involving an observation verb (*contemplating*) and a count NP (*chocolate bar*). After reading each story, participants saw a graphical timeline representing the time course of the narrative (see bottom of Table 1). They were asked to mark the timeline at two points: once where the character began his or her action, and again at the point where the character "has *X*ed" (e.g., has contemplated Hershey's chocolate bar).

The question of when the character "has *X*ed" provides evidence about whether participants interpreted the VP as telic or atelic. Atelic VPs obey the subinterval property (Bennett & Partee, 1978): a subpart (down to some lower limit) of the whole is qualitatively equivalent to the whole—any part of eating is itself eating. This subinterval property does not hold for telic events, however: any part of running a mile (e.g., running the first half of the mile) is not itself running a mile. If participants interpret a VP as atelic, then they should think that a character "has *X*ed" earlier than if they interpret the VP as telic.

We created four versions of each story so that, for each narrative, there were observation/mass, observation/count, destruction/mass, and destruction/count versions. We consulted Levin (1993) in selecting destruction and

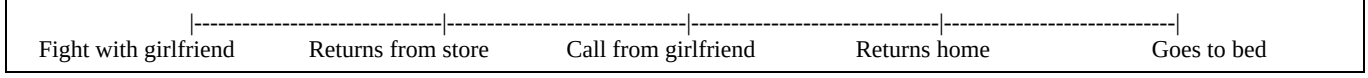
Table 1. Sample story, questions, and time line from Experiment 1.

Martin is a chocoholic. Every time he gets depressed, Martin eats lots of anything made of chocolate. Wednesday morning, his girlfriend broke up with him. Martin was devastated by the news, and went off in search of chocolate. Upon returning from the convenience store, where he had bought vast quantities of chocolate, he sat down and was contemplating Hershey's chocolate bar. A few moments later, his girlfriend called and wanted to talk. Martin had to stop contemplating the chocolate bar, and go over to his girlfriend's. The discussion didn't go very well, and Martin returned home and continued contemplating the chocolate bar.

Please mark the time line to indicate:

a) What time you think Martin started contemplating Hershey's chocolate bar. AND

b) What time you think it would be fair to say "Martin has contemplated Hershey's chocolate bar".



observation verbs—the majority of the destruction verbs were selected from the classes of *destroy verbs*, *break verbs*, and *verbs of ingesting*. The bulk of the observation verbs were drawn from the class of *verbs of perception*; others were drawn from the *psych verbs* class. The destruction verbs were subdivided into three classes based on their aspect, which we assessed by applying Dowty's (1979) linguistic tests. One third of the destruction verbs were activity-type destruction verbs (e.g., *eat*) that have no inherent temporal boundary. Verbs of this type describe homogeneous, unbounded processes in which the object is consumed over time. Events described by destruction activity verbs may be bounded, but in such cases, the presence of a temporal boundary depends on the object, as we noted earlier.

Another third of the destruction verbs were accomplishment-type (e.g., *annihilating*). These verbs describe actions that possess an inherent temporal boundary and occur over an extended period of time. The actions begin with a process of destruction but, in addition, have a qualitatively different endpoint.

The remaining destruction verbs were achievement-type. These describe actions that contain an inherent temporal boundary, but unlike the accomplishment destruction verbs, there is no process leading up to the endpoint. Verbs of this type describe actions that occur instantaneously (e.g., *bursting*) or over very brief intervals (e.g., *smashing*). The telicity of both achievement-type and accomplishment-type destruction verbs should be independent of the count/mass status of the NP. Because verbs of these types imply an inherent, temporal boundary (the point at which the NP is gone), actions involving these destruction verbs should be bounded, regardless of whether their grammatical object also implies a boundary.

Our main prediction was that there would be an interaction between verb and noun in the responses to the "has *X*ed" question—mass/count status should affect responses for activity-type destruction verbs, but have no effect for the other verb types. We expected no differences in responses to the "started" questions.

Method

In this study, participants read through a series of scenarios and gave their judgments about the time course of the events described. Participants received a booklet containing 36 brief scenarios. Each participant saw the scenarios and their associated follow-up questions in a different random order.

Materials Thirty-six base stories were written, all with the same abstract structure: A character begins destroying or observing some object or substance, is interrupted mid-action, and after a pause resumes his or her action. Four versions of each of the 36 base stories were generated by crossing verb type (destruction vs. observation) with NP type (mass vs. count), yielding a set of 144 experimental texts (a sample story is presented in Table 1). The 36 destruction verbs were equally divided among the three types: activities, accomplishments, and achievements. We classified the destruction verbs by applying Dowty's (1979, p. 60) linguistic tests, as noted earlier.

The 144 experimental texts were separated into four lists, such that each of the four variations of any given base scenario was assigned to a different list, and each list contained 18 observation verb stories (nine with mass and nine with count nouns), and six of each type of destruction verb stories (three mass and three count nouns each). Thus, participants saw only one version of each scenario, and an equal number of mass and count versions for each verb type. Two questions and a timeline representing the course of events in the scenario appeared after the stories (see Table 1 for sample questions and timeline). The first question assessed when, in the course of the narrative, participants felt that the character had started performing the action. The second question assessed when participants felt it would be fair to conclude that the critical event could be said to have taken place. Each timeline was labeled with five points corresponding to different moments in the narrative. For each story, the five time points corresponded to a moment: 1) before the action would have started, 2) the earliest point at which the action could have begun, 3) the point at which the character was interrupted, 4) the point at which the action resumed, and 5) a point after the action was complete. Note that valid responses to either question could not fall within the first interval on the timeline (between points 1 and 2), as the entire interval occurs prior to the action's start. This leaves three valid intervals.

Participants Twenty-eight undergraduate students at Northwestern University participated in this experiment. Participation was part of a course requirement in an introductory psychology course. All participants were native English speakers.

Results and Discussion

We present the data in terms of how far along the timeline participants made their marks, taking the *second* marked timepoint as the beginning of the timeline (as noted earlier, this is the earliest possible point at which the event could begin). Position is reported in percentage form (i.e., a mark made on the second timepoint would be entered as a 0; one made at the very end of the line would be 100). Average position of "started" and "has *X*ed" marks for each verb/NP combination appear in Figure 2. The position of the beginning of each bar represents the average position of the "started" mark, and the position of the end of each bar represents the average position of the "has *X*ed" mark.

Statistical analyses were computed separately using participants and items as random factors.

Analyses of "Started" Marks The participants analysis supported our expectation that no differences would be observed in the position of the "start" mark. There was, however, an effect of verb in the items analysis. A mixed-model ANOVA revealed that actions involving observation

verbs began reliably later than actions involving destructions verbs ($F_I(1,33) = 7.53$, $p < .05$) however, this difference was very small (12.41% vs. 10.80%, respectively).

Analyses of "Has *X*ed" Marks Responses to the question of when it would be fair to say that a character "has *X*ed" largely supported the prediction that the time course of events in narratives is sensitive to both verb type and noun type. As Figure 2 suggests, the noun affected judgments for only one type of verb: the activity-type destruction verbs. This difference replicates the results of previous studies, and shows that for these verbs, the mass/count difference is what determines whether the VP as a whole is telic or atelic.

The effect of nouns on activity verbs (but not other verbs) produced a significant verb by noun interaction ($F_P(3,81) = 3.25$, $p < .05$). The structure of the items analysis is more complex than that of the participants analysis because of the way particular nouns (e.g., chocolate bar/sauce) were paired with observation and destruction verbs. For this reason, the participants analysis contained factors for noun (mass vs. count), verb (observation vs. destruction), and verb subtype (activity destruction verbs plus the observations verbs with which they were paired, accomplishment destruction verbs plus the observations verbs with which they were paired, etc.). This ANOVA revealed a significant verb by noun interaction and a marginally significant verb by noun by subtype interaction ($F_I(1,33) = 4.27$, $p < .05$ and $F_I(2,33) = 2.96$, $p < .07$). Planned comparisons showed that these interactions were due to the fact that activities with mass nouns occurred significantly later than activities with count nouns ($t_P(27) = 3.57$, $p = .001$; $t_I(11) = 2.91$, $p < .05$). No other verb type produced such a difference.

As Figure 2 also shows, there was also a main effect of verb on participants' judgments of when the character has "*X*ed" ($F_P(3,81) = 29.43$, $p < .001$; $F_I(1,33) = 137.46$, $p < .001$). Tukey's HSD tests reveal that this reflects the fact that "has *X*ed" marks for observation events occurred earlier on the timeline than marks for any other type of verb. This finding is not surprising: Since the observation events are atelic, they obey the subinterval property, and the character can be said to "have *X*ed" almost as soon as he or she has begun.

Stories involving accomplishment-type destruction verbs produced marks significantly further along the timeline than stories involving either activity-type or achievement-type destruction verbs. In the items analysis, main effect of destruction verb type ($F_I(2,33) = 22.10$, $p <. 001$) and subsequent HSD analyses confirmed this pattern. This finding, too, is explainable with reference to the subinterval property: Since accomplishment-type destruction verbs imply the complete elimination of the NP, it would not be appropriate to say that a character "has *X*ed" until near the end of the scenario, when the narrative implies that the NP has been completely consumed.

Finally, and unexpectedly, achievement-type destruction verbs (e.g., *shatter*) elicited marks that were intermediate between those of observation and accomplishment-type destruction verbs. This suggests that aspectual coercion is taking place in these cases. Aspectual coercion occurs when a verb's inherent aspect is inconsistent with the temporal characteristics of the context in which it appears. In the present case, events that typically occur instantaneously (e.g., *shattering*) were suspended and then resumed. Under aspectual coercion, the verb's inherent lexical aspect is reinterpreted to bring it into line with the context. In this case, the achievement-type destruction verbs might take on an iterative reading (e.g., *repeatedly shattered*). Such a reading would allow the event as a whole to continue for long enough to be suspended and resumed. We address this issue more directly in the second study.

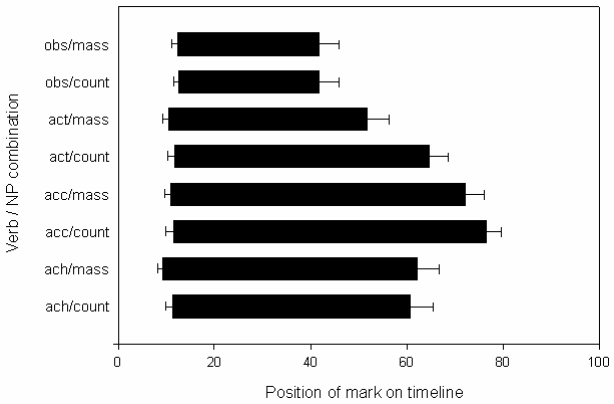


Figure 2. Mean start and stop responses, Experiment 1.

Experiment 2: Composition and Coercion

To confirm our intuition that participants were interpreting the achievement events as iterated, we asked participants in a second study how many iterations they believed the character to have performed. We anticipate that this number will be larger for achievements than for other verb types.

In addition, participants in the present study received a bulleted list with precise times from the stories to guide their responses rather than a timeline. Table 2 shows an example of such a list and the associated questions. Participants were asked to write down a time (e.g., 9:07) in response to the questions. In the previous study, the size of the interval between marked points on the timeline was equal, regardless of how long a described event might take in reality. It is conceivable that this unrealistic representation misled or confused participants. In the second study, participants were given time information that was tailored to each event (e.g., a coffee break might last 15 minutes, and a trip to a friend's house an hour), providing a more realistic time frame for the stories.

Method

Procedure The procedure for the second study was nearly identical to that of the first. Participants were told that they would be reading a series of scenarios and would be asked

for their intuitions about the time course of the events described. Participants received a booklet containing 36 brief scenarios. Three questions appeared beneath each story, and participants were asked to respond by writing their answers in the spaces provided.

Each participant saw the scenarios and their associated questions in a different random order.

Materials The second study used the same materials as the first study, except for the following changes. Rather than a timeline, participants saw a bulleted list indicating the precise times at which four events in the story had taken place. The bulleted events were the same events that served as the final four labels on the timeline in the previous study. (Table 2 provides the bulleted list which appeared with the story of Martin, for comparison with Table 1). In addition to the "started" and "has *X*ed" questions, participants were asked whether or not they felt the character's action was iterated, and, if so, how many iterations they felt the character performed (see Table 2).

Participants Twenty-eight undergraduates participated in this experiment. Participation was part of a course requirement. All participants were native English speakers. None had been in Experiment 1.

Results and Discussion

Unlike the previous study, the intervals in the present stories were not of equal length. In order to make the data comparable to the previous experiment, each of the intervals for each of the stories is given 33% of the imaginary timeline of the story, regardless of how many minutes the bulleted list indicated it took. Responses are again reported in percentage form. The average point of "started" and "has *X*ed" judgments for each verb/NP combination are presented in Figure 3 (in the same manner as in Figure 2).

Analyses of "Started" Judgments As in Experiment 1, participants judged actions described by observation verbs to begin later than actions described by any other type of verb ($F_P(3,81) = 9.11$, $F_I(1,33) = 13.01$, $p < .01$ for both). Observation may require less in the way of preliminaries than destruction (which may entail acquiring tools and other materials), and hence observation can be initiated faster.

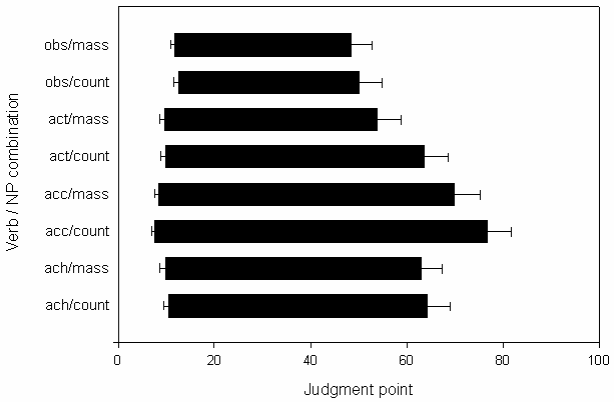


Figure 3. Mean start and stop responses, Experiment 2.

Analyses of "Has *X*ed" Judgments Judgments about when the character "has *X*ed" were again largely consistent with predictions. Though the verb by noun interaction was not significant ($F_P(3,81) = 1.88$, $p > .10$), planned t tests revealed that the predicted mass/count difference for the activity-type destruction verbs was significant in the participants analysis, and marginal in the items analysis ($t_P(27) = 2.98$, $p < .01$; $t_I(11) = 1.97$, $p < .08$). No other verb types showed a significant mass/count difference, though the difference for accomplishment-type verbs was marginal in the participants analysis ($t_P(27) = 1.83$, $p < .10$)—this was largely due to a single participant's judgment that a character could be said to have incinerated waste paper after 0% of the story's time course had elapsed.

The analyses also revealed a main effect of verb ($F_P(3,81) = 14.66$; $F_I(1,33) = 70.11$, both $p < .001$). Events described by observation verbs were judged to have occurred earlier than those involving any type of destruction verb. In addition, activity-type destruction verbs elicited earlier judgments than accomplishment-type destruction verbs.

Analyses of Iteration Data Estimates of number of iterations varied greatly from participant to participant (means ranged from 1.41 to 52.03 iterations). We therefore transformed each participant's estimates into a set of z scores, and used these in our analyses. Figure 4 show these data and indicates that, as predicted, estimates of number of iterations were higher for achievement-type verbs than for any of the other types of verb ($F_P(3,108) = 20.55$, $F_I(3,68) = 26.51$, $p < .001$ for both).

Table 2. Response choices for Experiment 2.

- Martin got back from the store at 10:02.
- At 10:07, he left for his girlfriend's.
- He got back home at 11:23
- At 11:48, he left for work.

a) At what time do you think Martin started contemplating Hershey's chocolate bar? ___:___

b) At what time do you think it would be fair to say "Martin has contemplated Hershey's chocolate bar"? ___:___

c) Is Martin's contemplating iterated? Yes No If so, roughly how many iterations? _____

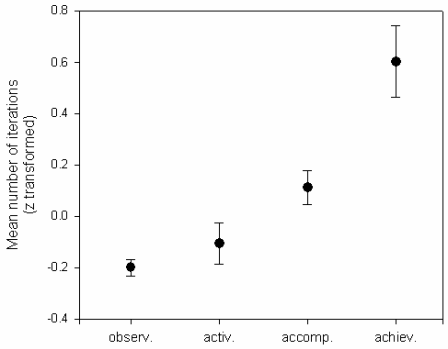


Figure 4. Mean number of estimated iterations.

General Discussion

Together, the two studies reported here replicate and extend previous findings about readers' inferences about the boundedness of events. As in previous work, we found that participants treated activity-type destruction verbs as unbounded events when their grammatical objects were mass nouns, but as bounded events when their grammatical objects were count nouns. The current studies further demonstrate that this difference affects participants' interpretations of the time course of events in brief narratives.

The present studies also show that the effect of noun on aspect is constrained in two important ways. First, we included two types of destruction verbs that possess inherently necessary endpoints. We expected, and found, that there would be no differences between mass and count versions of stories involving these types of destructions verbs. Since the verbs themselves possessed temporal boundaries, there was no way for the NP to impose a boundary or to remove one. Second, we found that there was no effect of noun when stories involved observation verbs. Because these verbs neither possess an inherent endpoint, nor imply an irreversible effect upon their grammatical object, they remained unbounded and atelic regardless of the mass/count status of the noun they were paired with.

Both studies further demonstrated the occurrence of aspectual coercion in cases where participants were faced with verbs whose lexical aspect is inconsistent with the context in which they appear. When verbs that typically occur instantaneously were involved in actions that were extended in time, the inherent lexical aspect of the verbs was overridden in order to bring the verbs' temporal structure into line with the narrative. The results of the second study demonstrate that this extension was made possible by iterative readings.

In short, our results suggest that readers understand the aspect of a described event by taking into account both internal semantic and external contextual cues. Aspect depends on the lexical class of the verb itself (e.g., the Vendler categories). However, in some, but not all cases, the count/mass status of the object noun can modify the verb's aspect. Precise conditions seem to govern when these noun-verb interactions take place. In the present case, the interaction occurred only when a verb implies that an event's length correlates with the decreasing amount of the object in question. In addition to these compositional effects, the context in which an event occurs seems to greatly influence inferred aspect. Knowledge about the overall duration of an event can sometimes contradict what the verb implies. Where the two are incompatible, aspect is reinterpreted.

Acknowledgments

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