Accounting for the Stative Adverb Gap

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1.   Introduction

In this paper I will give an account of the distributional fact that there are no stative adverbs. We find any number of adverbs that combine with event verbs to the exclusion of state verbs, but we do not find the converse, adverbs that combine with state verbs to the exclusion of event verbs.[1] In other words, while contrasts such as that in (1) are common, a contrast such as that given schematically in (2) is unattested.

(1)   a. Peter kissed Sue gently/perfunctorily/slowly/on the front porch.
        b. ??Peter loved Sue gently/perfunctorily/slowly/on the front porch.

(2)   a. ??Peter kissed Sue ADVERB.
        b. Peter loved Sue ADVERB.

There are, of course, many adverbials that combine with both state verbs and event verbs: Temporal adverbials such as *last year*, modal adverbs such as *probably*, and speech act adverbs such as *frankly* all do. What we don't find are adverbs that modify exclusively state verbs. Let us call this lacuna in the space of possible adverbs the Stative Adverb Gap (SAG). Accounting for this gap is the subject of this paper. I suggest, furthermore, that any theory of adverbs worth its salt should account for it.

Such an account must answer two questions. The first question concerns the nature of verb-adverb selection in general: What is it? Why do certain adverbs appear to select for certain verbs to begin with? The second is the more specific question, why don't we find classes of adverbs that select only for state verbs. Modern neo-Davidsonian theories of adverbial modification such as those defended at length by Parsons (1990),

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[1] There are two exceptions, pointed out to me by a NELS reviewer, *still* and *no longer*, which will be discussed toward the end of the paper.

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Kamp and Reyle (1993) Wyner (1994) and others provide a framework within which the first question can be quite satisfactorily answered. Unfortunately they fail miserably when it comes to the second. In fact, I will argue, if the neo-Davidsonian account of sentence semantics were correct we would expect stative adverbs to be plentiful.

2.   Neo-Davidsonian Theory

Neo-Davidsonian approaches to sentence semantics have grown in popularity since the early work of Bach (1981) and Parsons (1985). Pretty much everybody adopts the neo-Davidsonian view these days, it seems. To review briefly, the fundamental neo-Davidsonian assumptions is the following:

• Verbs denote predicates of eventualities (states or events)

The beauty of this fundamental assumption about verbal meanings is, among other things, the simple analysis of adverbial modification it makes available, namely the following:

• Adverbs[2] denote predicates of eventualities
• Adverbial modification is (essentially) simple conjunction

An example derivation illustrates the main features of the approach.

(3)   a. John leave λ e [leaving(e) & Agent(e) = John]]

       b. slowly λ P λ e [P(e) & slow(e)]

       c. John left slowly $\exists$ e [leaving(e) & Agent(e) = John & slow(e) & e < now]

The untensed clause is (like the verb) a predicate of events. Adverbs, while of a higher type, introduce into the LFs underlying first order predication over events as well. Tense information locates the eventuality with respect to the speech time (also conjunctively), and existential closure applies to give a propositional meaning.

An appealing innovation of the neo-Davidsonian approach, one that is central to our concerns here, is the treatment of Vendler/Dowty-type aspectual classes (Vendler 1967; Dowty 1979). Since all verbs are interpreted simply as predicates of eventualities, the distinctions among the aspectual classes can be characterized in terms of properties of these eventuality predicates. The most straightforward characterization is the following (taken from Bach (1986)):

• State verbs are those verbs that denote predicates of states.
• Activity verbs are those verbs that denote predicates of homogeneous events.
• Accomplishment verbs are those verbs that denote predicates of non-homogeneous events.

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[2] VP-adverbs of the *slowly* type, not S-adverbs of the *probably* type

- Accomplishment verbs are those verbs that denote predicates of momentary events.

The characterization of the classes has become ever more sophisticated (Higginbotham 1996), but the basic intuition has remained the same: it is the character of the eventuality predication that distinguishes the aspectual classes, from one another. It is this latter innovation, at least as it applies to state verbs, that we will take to task in the sequel. Let us now turn to adverb selection.

3.   Verb-Adverb Selection

It is well known that adverbs semantically select the verbs they can appear with (Jackendoff 1972; Rochette 1990). That is to say, certain adverbs appear with some types of verbs but not with other types of verbs. This is illustrated by the pairs in (4)-(6).

(4)   a. Austin tripped accidentally.
        b. ??Austin wrote his book accidentally.

(5)   a. Melanie talked endlessly.
        b. ??Melanie finished her book endlessly.

(6)   a. Steve finished his book quickly.
        b. ??Steve slept quickly.

Before we can give an adquate account of the SAG, we certainly need to understand the mechanisms underlying this kind of verb-adverb selection.

3.1 A Neo-Davidsonian Account of Verb-Adverb Selection

The neo–Davidsonian approach makes available a very appealing perspective on verb-adverb selection of this type. Verb-adverb incompatibility is simply the result of an attempt to apply two incompatible predicates to the same object. In this way it is essentially the same phenomenon as classical "selectional restrictions" (Chomsky 1965; Katz and Fodor 1964) of the type illustrated in (7):

(7)   a. ??My shirt wants to go home.
        b. ??My thoughts were very tall.

In much the way that there is an incompatibility between wanting something and being a shirt, and between being tall and being a thought, there is an incompatibility between being a book-writing and being accidental.

Intuitively this seems right: The infelicity of (4b) does seem somehow seem to be tied to the fact that for an event to be classified as accidental it must be done without intent, whereas any event of book-writing is, necessarily, intentional. The neo-

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Davidsonian approach, of course, gives us a way of making this intuition precise since, formally speaking, the classical subject-predicate case and the verb-adverb case are exactly parallel. In the subject-predicate case (7b) the individual predicate *thought* is incompatible with the individual predicate *tall*, whereas in the verb-adverb case the event predicate *write a book* is incompatible with the event predicate *accidental*.[3]
The infelicity associated with selectional-restriction violations can easily be derived from Grice's (Grice 1975) Maxim of Informativeness. We can say that a predicate Q violates the selectional restrictions of a predicate P iff it is not possible that some entity x satisfy both P and Q. When it is not possible for an entity to satisfy both predicates, a sentence is uninformative, thus infelicitous. It is clear, then, why sentences such as (8) give rise to selectional-restriction violations.

(8)   The bachelor's wife was charming.

The predicate **bachelor**, meaning unmarried man, is not compatible with having a wife Furthermore, such examples point to another feature of selectional restriction violations: When selectional restrictions are violated, speakers attempt to reinterpret one or both of the predicates which are incompatible so as to "save" the utterance. So in (8) a hearer might interpret the word *bachelor* as making reference to a man who, while married, has many other features of bachelorhood. Likewise, we attempt to understand sentences such as (4b) by reinterpreting *accidentally* as being something at least possibly compatible with book-writing, for example we might take it to mean something like *effortlessly and quickly*.

3.2   Back to the SAG

The neo-Davidsonian can, then, easily tell us why there are adverbs that don't appear with state verbs. The account is simply this: Adverbs that select for dynamic or agentive properties of an eventuality, as *slowly* and *intentionaly* clearly do, will not combine with predicates of states, which are static, non-agentive. The sentence (9a) has a perfectly good logical analysis, as indicated by (9b).

(9)   a. ??Peter loved Mary gently.
        b. $\exists e$ [loving(e) & Subj(e) = John & Theme(e) = Mary & gently(e) & e < now]

The reason (9a) is odd is simply that *gently* is a manner of action adverb, meaning roughly the manner in which the event was acted out was gentle. On its stative reading *love* is a predicate of states. States, being static do not have manners of being acted out, and so it is not possible for *gently* to apply to such an eventuality.

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[3] We are being a bit loose about what exactly the event predicate is. In the neo-Davidsonian framework all verbal projections, up to and including the sentence, are interpreted as event predicates, so *write*, *write a book* and *Austin write a book* are all predicates of events, more or less specified as to the participants.

This much is sensible and, in a certain sense, I think it is correct. The problem is that we are stuck thinking there should be some adverbs out there that are formally like *gently* except that they select for non-dynamic, non-agentive eventualities. Classical selectional restrictions are like this. They make up full paradigms. In other words, if P and Q are incompatible, there will be a P' and Q' such that P and Q' are compatible, P' and Q are compatible, and P' and Q' are incompatible. Consider the subject predicate case in (10):

(10)   a. The mountain is tall.
       b. ??My thoughts are tall.
       c. ??The mountain is confused.
       d. My thoughts are confused.

We don't have only have predicate that select for mental objects to the exclusion of others. We also have predicates do that select for other objects to the exclusion of mental objects.

Leaving stative verbs out, verbs and adverbs exhibit this quality as as well. We find such paradigms as (11).

(11)   a. ??John slept quickly.
       b. John ran quickly.
       c. John slept slept deeply
       d. ??John ran deeply.

I would like to suggest that paradigm filling is a characteristic of true selectional restrictions. There is certainly good reason to expect it to be: selectional restrictions reflect the semantic compatibility of predicates of the same semantic type, but of different syntactic category. Since there is no *a priori* association of classes of meanings to syntactic categories (beyond semantic type), we expect that the classes of compatible (and incompatible) predicates should be distributed among the syntactic classes.

This is exactly what is missing in the case of the stative adverb gap, however, and leading me to doubt that it is truly a case of simple semantic selectional at work. To put it another way, from a neo-Davidsonian perspective the lack of stative adverbs is merely an accidental gap. Nothing in the theory rules them out. We can even suggest what kind of logical form they would have:

(12)   *state-adverb* $\lambda P \lambda e [P(e) \ \& \ \text{state-adverb}(e)]$

They would be modifiers of eventuality predicates, with the additional property that happen to select only for eventualities that are non-dynamic and non-agentive. These don't appear, however. Our paradigm has a hole in it, and any linguist should wonder why.

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An often expressed intuition is that the reason for this is that states simply don't have many properties. Events are much more interesting. If events are like paintings, states are like blank canvases. Both have dimensions, but for a canvas that is about all there is to it, whereas for a painting we can talk about the theme of the painting, the shading, the use of light and so on. In the case of states and events, while we can talk about dimensions (spatio-temporal properties) of both, for events we can also talk about the manner, the speed and the intent with which an action is carried out. For states none of these things make sense.

I find this intuition compelling, and take it to show us is that events and states are not two classes of the same type of object, as the neo-Davidsonian would have it, but rather that events are highly articulated things of which states are the most simple form. In the next section attempt to give this intuition formal expression and use it to account for the stative adverb gap. I would like to suggest, that is, that the lack of stative adverbs is not an accidental property of the lexicon, but in fact follows from a certain semantic analysis of state/non-state distinction.

4. Classical Davidsonianism

Davidson (1967) suggested that in contrast to event verbs, "fact" verbs do not have event arguments. This suggestion has been taken up by a number of researchers, who have applied it to the state/non-state contrast in general (see Galton (1984), Löbner (1988), Sandstrøm (1993), and Katz (1995)). On such an account the semantic contrast between (13a) and (13b) is represented at the level of logical form very roughly as in (14).

(13)   a. Sandy kissed Kim.
        b. Sandy liked Kim.

(14)   a. $\exists e$ [kiss(e,Sandy,Kim)]
        b. like(Sandy,Kim)

As we see, transitive state verbs are taken to be of a different logical type than transitive event verbs. For ease of reference, let us call any theory with this feature a "classical" Davidsonian theory, contrasting it with neo-Davidsonian theory, on which all verbs, state verbs included, have underlying eventuality arguments. In other work (Katz 1997; Katz 1999) I have presented a number of arguments for adopting the classical Davidsonian approach in preference to the neo-Davidsonian. Here I will limit myself to the discussion of adverbial modification. In the sections that follow I outline a very specific proposal along classical Davidsonian lines.

4.1 The syntax and semantics of the state/event distinction

Since both state sentences and event sentences have temporal components to their semantics, I will assume that both saturated state verbs and saturated event verbs are predicates of times. Tenses will apply to these to yield propositional meanings. The "upper" part of the system, then, is fairly standard:

- Sentence meanings are propositions
- Fully saturated verbs are properties of times
- Tenses are functions from predicates of times to propositions

We will distinguish fully saturated verbs from "nominally" saturated verbs. Nominally saturated verbs are those that have all their nominal argument roles filled, but may be missing an underlying implicit argument. The basic assumption of the classical Davidsonian approach is that eventive verbs can be nominally saturated without being fully saturated. The basic difference between state verbs and event verbs then is that:

- Nominally saturated state verbs are properties of times
- Nominally saturated event verbs are properties of events

The real difference between state sentences and non-state sentences, then, appears in the "lower" reaches, below the VP and the TP. Following Klein (1994) and others I assume the existence of two aspectual operators that turn predicates of events (nominally saturated event verbs) into predicates of times. These are the operators PERFECTIVE and PROGRESSIVE.

If we make the further natural assumption these operators are syntactic heads, it follows that the state/event contrast is expressed in the syntax, as illustrated in (15):

(15)   a. [$_{TP}$ Sandy$_1$ [$_T$ PAST [$_{AspP}$ PERFECTIVE [$_{VP}$ t$_1$ kiss Kim]]]]
       b. [$_{TP}$ Sandy$_1$ [$_T$ PAST [$_{VP}$ t$_1$ like Kim]]]

Note that there is, then, a mismatch between syntactic category and semantic type in the lexical vocabulary, since stative VPs and non-stative VPs are of different semantic type. Stative VPs and eventive AspPs, however, are both properties of times.

I assume that these syntactic structures are interpreted fairly directly. Here for ease of exposition we translate the syntactic expressions into more familiar logical forms. These logical forms will be interpreted with respect to a structure $\langle D,E,T,<,$time-of$\rangle$, where D is the domain of individuals, among which E is the subset of events, T is the set of time intervals with ordering relation $<$. The function **time-of** takes an event and returns its run-time (this is Krifka's (1989) τ function).

Let me give a concrete derivation. Assuming that semantic combination is simple functional application we can, using the lexicon given below, derive logical analyses of (15a) and (15b). Note that the first order variable t ranges over times, the variable e over events and the others over normal individuals.

kiss $\lambda y \lambda x \lambda e$ [kiss(e,x,y)]
like $\lambda y \lambda x \lambda t$ [like(t,x,y)]

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PAST $\lambda P \exists t [t < now \& P(t)]$

PERFECTIVE $\lambda t \exists e [P(e) \& t \supset time\text{-}of(e)]$

The analyses, then, are as follows:

(16)   a. Sandy kissed Kim.
       b. $[_{TP}$ Sandy$_1$ $[_{T}$ PAST $[_{AspP}$ PERFECTIVE $[_{VP}$ t$_1$ kiss Kim $]]]]$
       c. $\exists t \exists e [kiss(e,Sandy,Kim) \& t \supset time\text{-}of(e) \& t < now]$

(17)   a. Sandy liked Kim.
       b. $[_{TP}$ Sandy$_1$ $[_{T}$ PAST $[_{VP}$ t$_1$ like Kim $]]]$
       c. $\exists t [like(t,Sandy,Kim) \& t < now]$

We have, of course, simplified many of the less relevant issues, such as the treatment of tense. Nevertheless we get what we want: the claim on the one hand that there is a past time at which a kissing of Kim by Sandy occurred, and on the other the claim that there was a past time at which Kim liked Sandy.

There are a number of features of the tense-aspect system of English that fall out of the classical Davidsonian approach. Many of these have been discussed in Katz (1997). Let me note an additional one here. In addition to PERFECTIVE operator, which in English is assumed to be covert, there is also PROGRESSIVE operator, a simple semantics for which is given below:[4]

(18)   PROGRESSIVE $\lambda t \exists e [P(e) \& t \; time\text{-}of(e)]$

Since like PERFECTIVE, PROGRESSIVE is a function from event predicates to time predicates, it should not be able to apply either to state verbs or recursively, which indeed it cannot:

(19)   a. *John is owning a car.
       b. *John is being kissing Mary.

Furthermore, the well-known "stativizing" effect of the progressive (Vlach 1981) also gets a fairly straightforward account, since formally the function PROGRESSIVE is a stativizing operator in that it turns predicates of events into predicates of times.

4.2   A classical Davidsonian account of adverbial modification

The real question we are interested in, of course, is how this whole mechanism accounts for the stative adverb gap. Let's first look at how adverbs are treated. We distinguish, as do the neo-Davidsonians, adverbs that apply to the propositional content–*probably*, *frankly* (S-adverbs, in Thomason and Stalnaker's (1973) terms)–from others.

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[4] This semantics should, of course, be modalized. See Zucchi (1999) for a recent summing up of these issues.

Furthermore, we distinguish temporal adverbials–*yesterday, for an hour, on Sunday*–from those adverbs that we can call event adverbs–*slowly, gently* and the like. As would seem natural, temporal adverbs are predicates of times, event adverbs are predicates of events, and S-adverbs are interpreted as propositional functions. For concreteness, here are some examples:

(20)   a. possibly $\lambda P [\Diamond P]$

         b. slowly $\lambda P \lambda e [P(e) \& \text{slow}(e)]$

         c. yesterday $\lambda P \lambda t [P(t) \& \text{yesterday}(t)]$

The intended interpretation is that *possibly* takes a proposition and modalizes it, *slowly* takes an event predicate and returns a predicate of slow events of the same kind, *yesterday* applies to a temporal predicate to return a predicate of times that were yesterday.

The mechanism of adverbial modification adopted here is fairly simple. In contrast to syntactic theories such as that of Cinque (1999), I follow Wyner (1998) in assuming that the relative order of adverbials follows from semantic principles. In short, adverbials adjoin freely to elements of the extended verbal projection, subject only to semantic compatibility. As we have already outlined, there are two kinds of semantic compatibility to be considered: that of semantic type and selectional-restriction type. The type-driven restrictions restrict the range of possible combinations: For example, S-adverbials must apply to propositional meanings (and therefore adjoin quite high, say to the TP projection), while temporal adverbs must apply to properties of times, and so adjoin either to AspectP or to stative VPs, and event adverbs only apply to eventive VPs. Selectional restrictions then rule out particular predicate/modifier combinations.

When everything functions as it should, as in (21), the event adverb combines with a compatible event predicate, and then an aspectual operator applies, and then a temporal adverb applies to the resulting time predicate.

(21)   a. John left slowly yesterday.

         b. $[_{TP} \text{John}_1 [_T \text{PAST} [_{AspP} \text{PERFECTIVE} [_{VP} t_1 \text{ left slowly}] \text{ yesterday}]]]$

         c. $\exists t [t < \text{now} \& \text{yesterday}(t) \& \exists [t \supset \text{time-of}(e) \& \text{leave}(e, \text{John}) \& \text{slow}(e)]]$

It should be clear that type-theoretical considerations rule out any other order in which these two adverbs could apply.

Like the restriction on stative progressives, the stative adverb gap is a direct consequence of the structure of the theory. As we have already noted there are two things to explain: why eventive adverbs don't apply to stative verbs and why there are no adverbs that don't apply only to stative verbs. The explanation of the first part is essentially identical to that proposed by that implicit in the neo-Davidsonian literature. Here we say that since adverbs such as *slowly* are, underlyingly, properties of events, they cannot apply to stative VPs, which are properties of times.

It is the other part that is interesting. Why are there no stative adverbs? This too follows from the proposal. Consider a potential adverb, *state-adverb*. To apply to stative VP it must be of the type of *yesterday*, that is it must apply to properties of times.[5] But if it is of this type than it must also be able to apply to an eventive AspectPs, since they are taken to be of the same type as stative VPs. So there can be no adverb that can apply to a stative VP without also being able to apply to an eventive AspectP. It is the fact that event sentences are taken to be semantically more complex, in that they have an extra projection that stative sentences lack, from which it follows that there can be no stative adverbs. The crucial distinction here between classical Davidsonianism and neo-Davidsonianism is that, in a sense, all sentences have a stative component on the classical Davidsonian analysis, while on the neo-Davidsonian analysis this would be nonesense, since states and events are in privative oposition.

4.3   *Still* and *no longer*

It has been pointed out to me that there are two adverbs that do select for stative verbs to the exclusion of eventive verbs. These are *still* and *no longer*. These would seem, then, to be direct counterexamples, both the the claim that there is an SAG and to the theory that predicts it.

I do not question the facts. It is quite clear that these two adverbials select for state verbs (or generic interpretations of non-state verbs, which is the same thing):

(22)   a. *John kissed Mary no longer.
        b. *John still wrote a book.

(23)   a. John no longer owned a car.
        b. John was still sick.

It is not at all clear that these adverbs are best treated as stative adverbs, in the sense that the introduce predication over underlying stative eventualities. They would, after all, be most naturally treated as temporal adverbials. If they are temporal adverbials, it not particularly surprising that they appear with state verbs. The question, then, would be why they don't seem to combine with event predicates, or, to be more precise, eventive AspPs. I think there is very good reason for this, however.

To set the stage, we should first note that selectional restrictions of the standard kind are still expected to apply at the level of temporal adverbials. That is we expect there to be certain kinds of predicates of times that are simply incompatible with certain temporal adverbials. In fact, this is a well known phenomenon: The classic cases of *in an hour* and *for an hour* illustrate just this.

(24)   a. Peter ran the race in an hour.
        b. *Peter owned a vacation house in the Alps in an hour.

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[5] It is possible that we need to extend this to a wider class of spatio-temporal indices.

(25)   a. ??Peter ran the race for an hour.
       b. Peter owned a vacation house in the Alps for an hour.

Although both adverbials are predicates of times, because of the lexical semantics of temporal *in* and temporal *for*, the former is compatible with certain types of event verbs and incompatible with state verbs, while the latter is compatible with state verbs. The literature on this topic is extensive and varied (Dowty 1979, Hinrichs 1985, Krifka 1989, Moltmann 1991). There is general agreement, however, that the contrast is due to purely temporal properties of the modifiers. This is, then, normal selectional restriction at work, albeit in the domain of temporal predicates.

As we have already discussed one of the features of selectional restrictions is that there are full paradigms. Since we find temporal modifiers (*in an hour*) that are compatible with the temporal properties of eventive verbs and not stative verbs, it is not surprising that we would find temporal modifiers (*still* and *no longer*) that are compatible with the temporal properties of stative verbs but not with those of eventive verbs.
In fact, when we consider what the semantics of *still* should look like, it is no longer surprising that it should select for state verbs. Intuitively *still P* means that *P* is true at some time, that it was true at some time previous to that, and that it has been true at all the times in between. This is formalized in (26).

(26)   still ; $\lambda P [P(t) \& \exists t' [t' < t \& P(t') \& \forall t'' [t' < t'' < t \rightarrow P(t'')]]]$

This analysis makes it quite clear why *still* elects for state verbs, it requires that the temporal predicates it applies to have the subinterval property. It is well known that this is one of temporal properties that state verbs have but that event verbs lack.
These are, so to speak, counterexamples that indeed prove the rule. The fact that at the level of temporal modification we have normal semantic selection, and that this has properties associated with other cases of semantic selection, make it that much clearer that the absence of "stative adverbs" is not a matter of semantic selection, but rather a reflection of the structure of the interpretive component

5.   Conclusions

In summary, then, I have claimed that there is a missing class of adverbs, adverbs that select only for stative verbs. I have argued that such a lexical gap is not best treated as accidental, but rather should arrise from the structure of our theory of grammar. To that end I have adopted the independently motivated proposal that state verbs are to be distinguished from event verbs in that they do not have an extra "Davidsonian" eventuality argument position. This semantic proposal was then embedded in a syntactic framework in which the distinction between event predication, temporal predication and modal predication were introduced at distinct syntactic projections. Stative sentences, then, do not have either the appropriate syntax or the appropriate type-theoretical semantics to support a class of adverbs that does not also appear with event verbs. The

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fact that there are certain temporal adverbials that appear only in state sentences was then attributed to selectional restrictions of the more familiar kind. There are certain other issues to be addressed, such as the treatment of non-modal, non-temporal modifiers of state verbs.

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