

# How to End Without Ever Finishing: Thai Semi-perfectivity

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## Abstract

Perfectivity is often assumed to entail the completion of the event described by event-denoting stems and their arguments. Although some scholars have noted that perfective markers do not always entail completion, their formal definitions contradict their informal descriptions. We show that these traditional models of perfective aspect cannot account for the aspectual system of Thai. In Thai, perfective markers do not entail that the event was completed: the resulting state of sentences that are in appearance telic in their ‘inner aspect’ need not have been reached. We call these non-completive perfective markers semi-perfectives. We propose a formal model of semi-perfectivity within Discourse Representation Theory that relies on the inclusion of an imperfective operator in the lexical meaning of Thai accomplishment verbs as well as the notion of *maximal event relative to an event description*. We show that this latter notion is strictly weaker than the traditional notion of telicity, thus demonstrating that (a)telicity is not the sole property of event descriptions relevant to the semantics of grammatical aspect.

Perfectivity is often assumed to entail the completion of the event described by event-denoting stems and their arguments (see Herweg 1991, 1991b for an explicit expression of this assumption). In particular, if the stem belongs to the accomplishment Aktionsart class, perfectivity—which we informally define for now as the requirement that the event that the sentence describes is bounded—entails that the accomplishment’s resulting state holds at the reference time interval.<sup>1</sup>

Some scholars, such as Binnick (1991) and Smith (1997), have noted that perfective markers do not always entail completion of the event denoted by

<sup>1</sup> Following Smith (1997), we call the combination of a verb and its arguments, to the exclusion of tense or aspect marking, a verb constellation. We assume that Aktionsart classes are defined, as in Dowty (1979), via statements of the following kind:

- i. If  $P$  is an accomplishment and  $a$  is a specified quantity (in the sense of Verkuyl 1993), then, if  $P(a)$  is true at interval  $I$ , it is not true at all subintervals of  $I$  (adapted from Dowty 1979 p. 166).

Since this paper is only concerned with sentences in which accomplishment predicates combine with arguments that are specified quantities, we use the term accomplishment verb/stem to mean a verb/stem whose meaning includes an accomplishment predicate  $P$  combining with arguments that are specified quantities. We also sometimes refer to verb constellations, clauses, or sentences whose main verb stems belong to the accomplishment class as *accomplishment verb constellations, clauses, or sentences*.

the sentence of which they are part; however, their formal definitions contradict their informal descriptions. In this paper, we show that traditional models of perfective aspect cannot account for the aspectual system of Thai. In Thai, markers traditionally called perfective (see Thepkanjana 1986) do not entail that the event was completed: the resulting state of sentences that are telic in their 'inner aspect' (in the sense of Verkuyl 1993) need not have been reached. We call these non-completive perfective markers semi-perfective. Our fundamental insight is that the non-completive character of sentences that contain the Thai semi-perfective marker results from the fact that, by contrast to English, aspectually unmarked accomplishment clauses in Thai never describe completed eventualities; rather they describe (non-necessarily proper) subparts of inherently bounded eventualities. We argue that a formal model of semi-perfectivity requires the recognition of a weaker property of event descriptions than *telicity*, what we call *maximality*. Whereas aspectual distinctions in English and many other languages revolve around the former notion, Thai aspect involves only the latter. More generally, our formal account of Thai aspect grounds the informal claims of Smith (1997) or Depraetere (1995) regarding the need to recognize notions such as arbitrary boundaries or boundedness aside from telicity proper.

The paper is organized as follows. Section 1 discusses various current accounts of aspect and shows that their formal definitions, implicitly or explicitly, assume that perfectivity is always completive in character. Section 2 presents a subset of the Thai aspect system which reveals that this assumption is incorrect. Section 3 presents a model of the subset of the Thai aspect system described in section 2 within Discourse Representation Theory.

## 1 ASPECTS OF TIME

Because the literature on aspect ascribes different meanings to the same theoretical constructs, we begin with a few terminological pointers. First, we distinguish between the semantic properties that underlie (im)perfective or what we later call semi-perfective sentences and the grammatical markers, which, in some languages, insure the presence of these properties. Thus, we call *(im)perfectivity* or *semi-perfectivity* semantic properties of sentences and reserve the term *(im)perfective* or *semi-perfective markers* to their putative grammatical causes. As Zucchi (1999) emphasizes, the assignment of (im)perfective or semi-perfective semantic effects to particular markers is quite indirect and also depends on the semantic

contributions of other subsentential elements. One should therefore not read too much in our use of the expression *(im)perfective* or *semi-perfective marker*. We only mean to convey by this expression that these markers are a salient determinant of the (im)perfectivity or semi-perfectivity of the sentences in which they occur. Second, the word *telic* is often used to describe inner aspect properties or properties of verb constellations. But it is also used in the tradition of Krifka (1989, 1998) more generally to describe properties of event descriptions. If one takes outer or grammatical aspect operators to be functions from event descriptions to event descriptions (see de Swart 1998), event description properties, such as telicity and atelicity, can be assessed for both verb constellations and verb constellations that are modified by outer aspect operators. It is in this latter sense that we use the words *telic* and *atelic* in this paper.

In Herweg's (1991a, 1991b) analysis of aspect, perfectivity is a property of events (in opposition to states). Thus, sentences that describe events, such as (1), are perfective in Herweg's sense.

(1) Patsy wrote a letter.

More precisely, in Herweg's treatment of perfective aspect, sentences such as (2) denote sets of events once the simple past tense marker is left aside (that is, once the verb constellation is extracted). The past tense marker indicates that the time at which any member of that set of events occurred precedes the time of utterance, as shown in (2). ( $e^*$  denotes the speech event and  $\tau(e)$  the time at which  $e$  occurred).

(2) a. Peter put the book on the table.

b.  $\lambda e$  (PETER-PUT-THE-BOOK-ON-THE-TABLE( $e$ )  $\wedge$  PAST( $e^*$ ,  $\tau(e)$ ))

The (im)perfectivity of sentences in the simple past, in this account, follows from the semantic type of the verb constellation they contain. If the constellation is stative, the overall sentence is imperfective (it characterizes a state, understood by Herweg, following Galton 1984, as a property of time). If the constellation is eventive, the overall sentence is perfective. As de Swart (1998) puts it, the English past tense is aspectually transparent. By contrast to perfectivity which is built in the past tense transparency to the event or state status of the verb constellation, progressive markers are treated as operators that map events onto states. Thus, in Herweg's analysis, the perfectivity of (1) or (2a) does not require a semantic representation or definition. It follows from the definition of the English simple past. The representation of the semantics of (2a) in (2b), which does not include any term, predicate, or operator referring to the perfective aspect, makes this clear. More importantly, if a sentence is perfective, an event of the type that the verb describes must have occurred (or will occur). In particular, if the

verb corresponds to Vendler's (1967) accomplishment class, as is the case for (2a), perfectivity entails the completion of the event: the book ends up on the table.<sup>2</sup>

A similar point can be made for languages that explicitly mark perfectivity or whose past tenses are sensitive to the inner aspect properties of the verb constellations over which they have scope. The Spanish perfective past can, for instance, combine with both telic and atelic verb constellations, as shown in the sentences in (3). But, crucially, when the perfective past combines with a verb constellation that belongs to the accomplishment class, the completion of the action is entailed (the lawn is mowed in (3a)).

- (3) a. Mario cortó el césped  
 Mario mow.PFVE.PST the lawn  
 'Mario mowed the lawn.'  
 b. Mario estuvo enfermo  
 Mario be.PFVE.PST sick  
 'Mario was sick.'

As we show in this paper, the kind of perfective sentences that Herweg analyzes and that is exemplified in (2a) and (3a) is only one kind of perfectivity. Not all perfective sentences entail the completion of events whose corresponding verb falls into Vendler's accomplishment class. We call *completive perfectives* perfective sentences that *do* entail the completion of telic events.<sup>3</sup>

By contrast to Herweg's description of perfective sentences, many treatments of English tense and aspect in the formal semantics literature do not explicitly mention perfectivity at all and merely discuss the temporal aspect of past tenses such as the English preterite. Aspectual considerations arise only when discussing the progressive and the perfect. This is the case in Hornstein (1990), but also in Steedman's (1997) recent summary, and many others. This omission is prompted, we believe, by the correlation between past tense and completive perfective aspect in English and the assumption articulated by Michaelis (1998) that perfectivity is the default grammatical aspect for events. The same omission is true of Dowty's (1979) treatment of the progressive and tense marking. Here again, English simple past tense only contributes tense information. Thus, (4a) is given the

<sup>2</sup> Herweg is not alone in equating perfectivity and occurrence of an instance of the event-type associated with the sentence's verb constellation. For example, when describing the conceptual basis of perfectivity and imperfectivity, Michaelis (1998) (citing Langacker 1991) talks of event boundaries and changes vs constancy and open-endedness and assumes that the boundaries of perfective sentences built around accomplishment verbs match the 'natural' boundaries of telic events.

<sup>3</sup> The notions of non-completive (semi-perfective) and completive perfective sentences parallel the distinction between ending and finishing discussed in ter Meulen (1995).

semantic representation in (4b). The progressive, of course, receives a different treatment, in terms of a PROG operator.

- (4) a. Joan left.  
 b.  $\exists t (\text{PAST}(t) \wedge \text{AT}(t, \text{leave}'(j)))$

This kind of treatment easily extends to languages like Spanish whose past tenses mark aspectual information or are aspectually sensitive. Verb constellations that belong to Vendler's accomplishment or achievement class and that are in the perfective past entail the realization of the state associated with the accomplishment, as sentence (3a) illustrates, while for verb constellations that describe states or activities the perfective past merely entails the cessation of the state or activity. Even though the Spanish perfective past leads to an aspectual shift in the case of atelic verbs, its aspectual import for telic verbs is null, as the English simple past is. Informally speaking, the event boundary that was reached in (3a) was that which is encoded by the verb and its arguments, namely the state of the lawn being mowed. Both the English simple past and Spanish perfective past are aspectually transparent to the 'natural' boundary encoded in telic verbs. The perfectivity of simple and perfective past sentences reduces to the semantic properties of telic verbs, namely to the fact that they describe events with 'natural' boundaries. Transparent treatments of the perfectivity of telic verbs, such as Dowty's, Herweg's, or Hornstein's are unproblematic in all languages (such as English or Spanish) in which perfective sentences are complete. The semantic information that the described event is bounded easily reduces to the semantic properties of telic verbs, since the fact that the 'natural' boundary of a telic event is (or will be) reached is inferable from the fact that a non-progressively marked accomplishment verb constellation is instantiated in the past (or future).

But several scholars have noted that perfectivity is not always complete; in those languages, the perfectivity of sentences containing telic verbs whose arguments are specified quantities cannot be equated with the 'natural' boundary characteristic of telicity. Binnick (1991), Smith (1997), and Singh (1991), in particular,<sup>4</sup> explicitly note this when discussing Slavic, Chinese, and Hindi perfective markers, respectively. For expository purposes, we discuss Chinese *-le* in this section. Smith provides the following sentence as evidence that Chinese *-le* is non complete: even when the event-type described by a verb constellation belongs to Vendler's accomplishment

<sup>4</sup> Talmy (1991, 2000) discuss the same phenomenon in Chinese, although not in the context of perfective markers. See below for details.

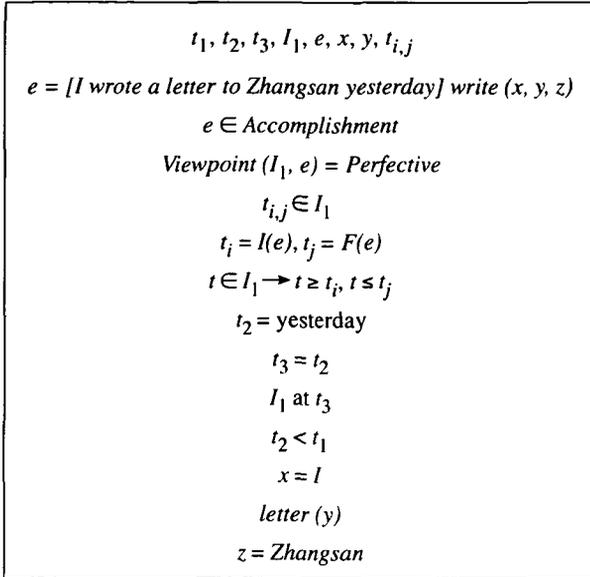


Figure 1 A Smith-style DRS for sentence (6)

class, the inclusion of *-le* does not guarantee that the ‘natural’ end-point associated with the event (in this case, the end of the letter) is reached. We call the kind of perfectivity sentence (5) exhibits *semi-perfectivity*.

- (5) Wo zuotian xie-le gei Zhangsan de xin, keshi mei xie-wan  
 I yesterday write-LE to Zhangsan DE -letter, but not write-finish  
 ‘I wrote a letter to Zhangsan yesterday, but I didn’t finish it.’

Despite the fact that they note that perfectivity does not always entail completion of the events described by telic verbs, the formal descriptions of perfectivity that Binnick and Smith propose do not seem properly to model semi-perfectivity. Smith’s formal account of aspect marking is couched within Discourse Representation Theory (hereafter DRT). To illustrate, consider her formal representation of the English sentence in (6), shown in Figure 1.<sup>5</sup>

- (6) I wrote a letter to Zhangsan yesterday.

The first line of the Discourse Representation Structure (hereafter DRS) in Figure 1 lists a set of discourse markers which are interpreted semantically as denoting individuals in the model’s domain. The second line indicates that the event *e* is the type of event in which the speaker writes a letter to

<sup>5</sup> For ease of exposition, we assume that *write* is a three-place predicate relating a writer, a written object, and a recipient.

Zhangsan. The third and fourth lines state that the event is an accomplishment viewed under the perfective aspect. Lines five through seven indicate that the reference interval of time  $I_1$  includes the initial and final boundaries of  $e$ . Lines eight through eleven indicate that the reference interval is located at an interval of time that is equal to the denotation of the deictic *yesterday* and is located prior to speech time, namely  $t_i$ . Finally, lines twelve through fourteen constrain the interpretations of the discourse markers  $x$ ,  $y$ , and  $z$ . Without entering into the details of this particular representation of the semantic contribution of (6), its major drawback is that it *de facto* forces perfective marking to be always completive. The conventional interpretation of (verifying) embedding functions for DRS such as Figure 1 is that the domain of the model for their interpretation must include individuals for each discourse marker and that, furthermore, these individuals must satisfy the denotata of the predicative conditions listed below the list of discourse markers. Thus, an embedding function that verifies the DRS in Figure 1 must map the discourse marker  $y$  onto an individual in the domain which belongs to the set of individuals which are letters (per the predicative condition on line thirteen). Similarly, a verifying embedding function must also map the discourse marker  $e$  onto an individual of the domain which satisfies each predicative condition which includes  $e$  as one of its arguments. In particular,  $e$  must respect its situation-type condition, as it is encoded on line two. But this amounts to saying that  $e$  is an event of the speaker writing a letter to Zhangsan. Although this representation is adequate for the English sentence in (6), it will not do for the Chinese example in (5), since the latter does not entail that the letter was finished.

Smith's informal description of the semantic difference between the English and Chinese perfectives involves the distinction between 'natural' and 'arbitrary' boundaries for events. The final boundary that is indicated by English-style completive perfective markers is the 'natural' boundary, in case the event has one, whereas Chinese-style non-completive perfective markers only indicate that the event has a final 'arbitrary' boundary. To model this informal description of the difference between English and Chinese, we could explicitly represent the nature of the final boundary in the DRS in Figure 1 and add, for English-style perfective markers, the condition: *culminate*( $e, t_j$ ), where the predicate *culminate* is interpreted to mean that the eventuality  $e$  culminated at  $t_j$  (following Parsons 1990). Including this condition does not affect the interpretation of the DRS for the corresponding Chinese sentence, though. To prevent the erroneous entailment that an event  $e$  in which the speaker has written a letter to Zhangsan occurred, we must include a condition for Chinese-style perfective markers that would explicitly preclude  $t_j$  from being the time at which  $e$  culminates.

But this would not do either. Chinese is simply vague on the issue of whether  $t_i$  is or is not the 'natural' boundary of the event. In fact, the nature of embedding functions on DRS makes any additional condition similarly incapable of preventing the Chinese DRS corresponding to Figure 1 from having a model-theoretic interpretation that entails the completion of  $e$ . Any verifying embedding function must map discourse markers such as  $e$  to individuals in the domain and the second line of the DRS in Figure 1, which the corresponding Chinese DRS must also include, forces this denoted event to be one in which the speaker has written a letter to Zhangsan.<sup>6</sup>

Binnick (1991) formal definition of perfective marking does not seem to fare better.<sup>7</sup> Adopting Johnson's (1981) analysis of the Kikuyu completive marker, he proposes the following definition of the perfective marker COMP (the formulation is simplified in irrelevant respects,  $\phi$  stands for any verb constellation).

- (7) COMP  $\phi$  is true relative to a time interval  $i$  and a world  $w$  iff  $\phi$  is true relative to  $i$  and  $w$ .

Clearly, such a definition makes the perfective always be completive, an assumption which the Chinese example in (5) and the Thai data presented in the next section contradict. More generally, no formal account of aspect of which we are aware properly models instances in which perfectivity does not entail the completion of telic events. Our own analysis of the Thai aspectual system solves this problem, as we show in section 3. But, before presenting our model, we must describe in detail the relevant parts of the Thai aspect system.

## 2 THE THAI ASPECT SYSTEM

Thai's aspect system is particularly rich, too rich for us to be able to discuss it in its entirety in this paper. We merely outline its overall features and

<sup>6</sup> The only other alternative of which we can think is to assume that line two does not denote the set of events in which the speaker wrote a letter to Zhangsan. This set of events would only be described by taking together several predicative conditions, including those of lines two through four. Unfortunately, the meaning of the predicative condition on line two is now unclear: what constraint on the value of  $e$  does it encode?

<sup>7</sup> We say seem, because Binnick's description of the formal semantics of tense and aspect is more a literature review than a new proposal. It is therefore difficult to know what Binnick's own formal definition of the perfective would be. But he seems to favor the formal approach of Johnson (1981) on p. 300, where he says the following (PERF stands for perfect operators, IMPFVE for imperfective operators, and PFVE for perfective operators): 'A successful universal set of truth conditions for the operators PERF, IMPF, and COMP (alias PERF, IMPVE, and PFVE) along the lines of Johnson's (1981) proposals . . . seems feasible.' We therefore discuss only Johnson's formal treatment.

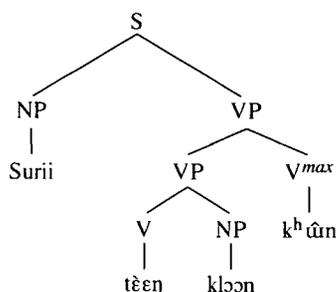


Figure 2 The syntactic structure of Thai aspectual serial verb construction

discuss in detail the aspectual markers on which this paper focuses. Thai aspect can be marked with auxiliaries in pre-main verb position (see sentence (8)) or by serial verbs in post VP position, as illustrated in sentence (9). We do not discuss pre-verbal aspectual auxiliaries in this paper. We are only concerned with the more pervasive way of marking aspect in Thai, namely through the use of a serial verb construction, which sentence (9) illustrates. (The English translation of (9) is inadequate, as we discuss shortly. We provide it as an approximation of the semantics of the perfective marker *k<sup>h</sup> uin*. A similar caveat applies to most of the translations of Thai aspect markers.)

- (8) Surii kamlanŋ t<sup>h</sup>am ŋaan  
 Surii PROG do work  
 'Surii is in the process of working.'
- (9) Surii tɛɛŋ klɔɔn k<sup>h</sup> uin  
 Surii compose poem ascend  
 'Surii composed a/the poem (*perfective*)'

The syntactic structure of sentence (9) is shown in simplified tree form in Figure 2. The notation  $V^{max}$  is meant to indicate that the constituent can either be a single word or a phrase. Muansuwan (1999) argues on the basis of adverb placement and the so-called *do so* test that serial verb constructions are recursively adjoined to a  $V^{max}$  constituent. Since the syntactic details of Thai serial verb constructions are orthogonal to our concerns, we will simply assume this analysis without arguing for it (see Thepkanjana 1986 for a different syntactic analysis of Thai serial verb constructions).

The set of Thai verbs that can occur as serial verbs and encode aspectual information is comparatively large. It includes the verbs listed in Table 1.<sup>8</sup>

<sup>8</sup> The expression telic events in the second column is only used mnemonically. Tests of telicity of the kind mentioned in fn. 1 do not apply to the corresponding Thai verbs, as our description of the aspect system of Thai will make clear. Since providing an exact characterization of the set of verbs

Table 1 Thai serial aspectual verbs

Encoded aspect	Aktionsart of the initial verb	First serial verb	Second serial verb
Perfective	Telic events	$k^h\hat{u}m$ 'ascend', $l\eta$ 'descend', $\text{ʔ}\text{ɔ}k$ 'exit'	$paj$ 'go'
Imperfective	Activity	$kh\hat{a}w$ 'enter'	$paj$ 'go'
Perfect	Any		$maa$ 'come'

This paper concentrates on the perfective markers  $k^h\hat{u}n$  'ascend' is restricted in its occurrence; it mainly combines with verbs of creation, as the contrast between sentences (9) and (10) illustrates. But  $k^h\hat{u}n$  can also combine with achievement verbs, as sentence (11) shows.

(10) \* $Surii\ k^h\hat{a}a\ n\acute{o}k\ s\acute{a}am\ tua\ k^h\hat{u}n$   
 Surii kill bird three CLASS ascend  
 'Surii killed three birds' (intended reading)

(11) a.  $k\hat{a}ed\ r\acute{a}\text{ʔ}\text{-}b\hat{a}ed$   
 happen explosion  
 'There was an explosion/There used to be explosions.'  
 b.  $k\hat{a}ed\ r\acute{a}\text{ʔ}\text{-}b\hat{a}ed\ k^h\hat{u}n$   
 happen explosion ascend  
 'There was an explosion.'

By contrast, the serial verb  $l\eta$  'descend' mostly combines with verbs of destruction and is therefore felicitously used in combination with  $kh\hat{a}a$  'kill', as sentence (12) illustrates.

(12)  $Surii\ k^h\hat{a}a\ n\acute{o}k\ s\acute{a}am\ tua\ l\eta$   
 Surii kill bird three CLASS descend  
 'Surii killed three birds'

The perfective marker  $\text{ʔ}\text{ɔ}k$  'exit' encodes the same aspectual information as  $k^h\hat{u}n$ , but seems to add a presupposition that the act was difficult to accomplish. Thus, sentence (13) has the same aspectual characteristics as (9), but adds the presupposition that writing the poem was hard for Surii.

(13)  $Surii\ t\acute{e}e\eta\ k\acute{l}\text{ɔ}n\ \text{ʔ}\text{ɔ}k$   
 Surii compose poem exit  
 'Surii composed a poem.'

Table 1 describes the aspect encoded by  $k^h\hat{u}n$ ,  $l\eta$ , or  $\text{ʔ}\text{ɔ}k$  as perfective.

with which each aspect marker combines is not our focus, we do not discuss the issue further in this paper.

But the notion of perfectivity involved parallels the one that Chinese *-le* encodes, namely what we call semi-perfectivity, as sentences (14) and (15) illustrate. The inclusion of *k<sup>h</sup>ûn* or *loŋ* marks that the activity of writing (in (14)) or eating (in (15)) must have stopped. But the poem need not be completed in (14), nor the rice (in the amount of three bowls) be finished in (15), even though it is a frequent implicature of sentences such as (14) or (15).<sup>9</sup>

Like Chinese *-le*, Thai *k<sup>h</sup>ûn* appears to be a semi-perfective marker.

- (14) Surii tɛɛŋ klɔɔn k<sup>h</sup>ûn tɛɛ jaŋ mâj sɛd  
 Surii compose poem ascend but still not finish  
 ‘Surii composed a/the poem, but has not finished it yet.’
- (15) Surii kin k<sup>h</sup>âaw sâam c<sup>h</sup>aam loŋ tɛɛ kin mâj mòd  
 Surii eat rice three bowl descend but eat not finish.up  
 ‘Surii managed to eat three bowls of rice, but did not finish them.’

The fact that sentence (14) does not entail that the poem was completed, but merely that the writing stopped, is unlikely to be due to a property of the direct object. The same absence of completion is observed when the NP is a specified quantity, as in (16a), when it is modified by a deictic determiner (16b), or even when it is a pronoun (16c).

- (16) a. Surii tɛɛŋ klɔɔn sɔɔŋ bòt k<sup>h</sup>ûn tɛɛ jaŋ mâj sɛd  
 Surii compose poem two CL ascend but still not finish  
 ‘Surii composed two poems, but has not finished it yet.’
- b. Surii tɛɛŋ klɔɔn bòt nîi k<sup>h</sup>ûn tɛɛ jaŋ mâj sɛd  
 Surii compose poem CL this ascend but still not finish  
 ‘Surii composed this poem, but has not finished it yet.’
- c. Surii tɛɛŋ man k<sup>h</sup>ûn tɛɛ jaŋ mâj sɛd  
 Surii compose it ascend but still not finish  
 ‘Surii composed it, but has not finished it yet.’

Since all forms of direct object NPs in Thai lead to a non-necessarily completive interpretation of the event description, assigning the locus of this semantic effect to the direct object would be tantamount to claiming that NPs like *klɔɔn sɔɔŋ bòt* ‘two poems’, *klɔɔn bòt nîi* ‘this poem’, or *man* ‘it’ mean something like some part of two poems, some part of this poem, or some part of it, respectively. But, NPs cannot always be ascribed such a

<sup>9</sup> By contrast to Hindi non-completive perfective markers discussed in Singh (1991), whether the measures of food are described by natural or rational number names does not affect the non-completive nature of the overall sentence, as a comparison of sentences (i) and (15) demonstrates.

- (i) dɛk p<sup>h</sup>û-chaaj kin kɛek nùŋ c<sup>h</sup>in krûŋ loŋ tɛɛ kin mâj mòd  
 the boy eat cake one piece half descend but eat not finish.up  
 ‘The boy ate one and half pieces of cake, but did not finish it.’

partitive interpretation. In particular, when the verb describes a punctual event, this interpretation is not available, as illustrated in (17).

- (17) ɾɔŋrian p<sup>h</sup>aŋ loŋ  
 school collapse descend  
 'The school collapsed.'

(17) can only mean that the whole school collapsed. If only part of the school collapsed, it must be explicitly mentioned. We conclude that the absence of necessary completion in (14) or (15) cannot be ascribed to the vagueness of the interpretation of Thai NPs. Rather, it arises from the combination of accomplishment stems and the semi-perfective markers *k<sup>h</sup>ûn* or *loŋ*.

Despite the absence of any indication that the telic act was completed in either (14) or (15), there is clear evidence that the inclusion of *k<sup>h</sup>ûn*, *loŋ*, or *ʔɔk* means that the described eventuality must include a boundary, i.e. that it ended. Compare the sentence in (18a) to the sentence in (18b).

- (18) a. ?Suri tɛŋ klɔn sǎam bɔt leʔ kamlaŋ tɛŋ jùu  
 Surii compose poem three CLASS and PROG compose CONT  
 'Surii is composing/composed three poems and is still composing them'  
 b. # Surii tɛŋ klɔn sǎam bɔt k<sup>h</sup>ûn leʔ kamlaŋ tɛŋ jùu  
 Surii write poem three CLASS ascend and PROG compose CONT  
 'Surii composed three poems and is still composing them'

Sentence (18a) is slightly odd pragmatically, but is grammatical. By contrast, (18b) is ungrammatical: the activity of composing must have been terminated prior to speech time. *K<sup>h</sup>ûn* thus indicates that the described event of composing ended. This conclusion is confirmed by the behavior of duration and interval adverbials. As sentence (19) shows, duration *for*-phrases are not compatible with *k<sup>h</sup>ûn*. Conversely, sentences containing *k<sup>h</sup>ûn* are compatible with an interval *in*-phrase, as (20) shows. (Similar contrasts exist for the other two perfective markers, *loŋ* 'descend' and *ʔɔk* 'exit'.)

- (19) \*Suri tɛŋ klɔn sǎam bɔt k<sup>h</sup>ûn pen wee-laa nùŋ c<sup>h</sup>ûa-mɔŋ  
 Surii compose poem three CLASS ascend be time one hour  
 'Surii composed three poems for an hour'  
 (20) Surii tɛŋ klɔn sǎam bɔt k<sup>h</sup>ûn naj nùŋ c<sup>h</sup>ûa-mɔŋ  
 Surii write poem three CLASS ascend in one hour  
 'Surii wrote three poems in an hour'

The ungrammaticality of (19) is easily accounted for if a sentence containing *k<sup>h</sup>ûn* describes an event rather than a state or activity, and we assume, as argued in for example de Swart (1998), that *for*-phrases are functions from states or activities onto (bounded) events. Sentences

containing *k<sup>h</sup>ûn* describe individuals of the wrong sort for the domain of the function denoted by the *for*-phrase. Sentence (20) is more interesting from a theoretical perspective since, despite what the English translation suggests, it does not entail that all three poems were finished (although it seems to imply that all three were begun). We discuss this issue at length in section 3.

Sentence (18a) demonstrates that Thai sentences do not need to include any aspect or tense marking and that one possible translation of bare verbal stems is an English present progressive form. But this is not the only possible aspectual or temporal interpretation of such sentences. Thus, sentence (21) is four-ways ambiguous or vague, as its translation indicates.

- (21) Surii tɛ̀ɛŋ klɔ̀ɔn  
 Surii compose poem  
 'Surii is composing/composes (habitually)/will compose/composed a/  
 the poem.'

In fact, a fifth interpretation of (21) is possible, provided a past reference point is provided, as shown in sentence (22).

- (22) Surii tɛ̀ɛŋ klɔ̀ɔn mûa c<sup>h</sup>ǎn paj hǎa  
 Surii compose poem when I go visit  
 'Surii was composing a/the poem when I went to visit her.'

The same temporal ambiguity or vagueness applies to sentences describing states, as shown in (23).

- (23) Surii mii k<sup>h</sup>wam sùk  
 Surii have NOM happy  
 'Surii is/was/will be happy.'

Thai sentences containing bare stems and no aspect or tense marking (hereafter bare sentences) are therefore ambiguous or vague both aspectually and temporally. They can describe bounded or unbounded eventualities, and they can describe eventualities that hold at time intervals that overlap, precede, or follow the time of utterance, as sentences (21) and (24) establish.

- (24) prûŋ-níi Surii k<sup>h</sup>ǎn còdmǎaj  
 tomorrow Surii write letter  
 'Surii will write a letter tomorrow.'

Sentence (25) shows that the addition of the perfect marker *maa* to a bare sentence preserves its aspectual, but not temporal, vagueness: the described eventuality that led to a state that currently holds is either imperfective or perfective, but must have occurred in the past. In other words, it marks

either that a past event resulted in a state that presently holds or that a state or activity that started in the past still presently holds.

- (25) Surii tèeŋ klɔɔn maa  
 Surii compose poem come  
 ‘Surii has composed/has been composing a/the poem.’

Because of the aspectual vagueness of the Thai perfect marker *maa*, its occurrence with accomplishment verbs does not entail the completion of the eventuality, as sentence (26) illustrates. (The aforementioned disclaimers regarding the appropriateness of English translations apply to (26).)

- (26) Surii tèeŋ klɔɔn maa tèe jaŋ māj sèd  
 Surii compose poem come but still not finish  
 ‘Surii has composed a/the poem, but did not finish it yet.’

Interestingly enough, the combination of *k<sup>h</sup>ûn* ‘ascend’ and *maa* ‘come’ seems to entail the completion of the act of writing, as (27) illustrates. This emergent semantics appears to defy compositionality, since neither the sentence’s component parts nor the syntactic construction via which they combine carries the additional information that the event was completed. The perfective marker *k<sup>h</sup>ûn* says that the event stopped, it does not require it to be finished. The perfect marker *maa*, on the other hand, does not even require the event to be bounded in the past. The activity might still be going on. The next section discusses this apparent emergent semantics in more detail.

- (27) # Surii tèeŋ klɔɔn k<sup>h</sup>ûn maa tèe jaŋ māj sèd  
 Surii compose poem ascend come but still not finish  
 ‘Surii composed a/the poem but did not finish it yet.’

We have now presented the most important data for our model of non-completive perfective or semi-perfective marking in Thai and turn to a formal model of semi-perfective aspect in Thai.

### 3 AN ANALYSIS OF THAI ASPECT WITHIN DISCOURSE REPRESENTATION THEORY

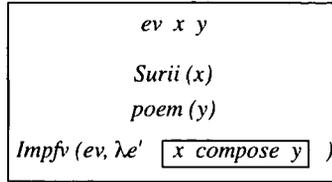
#### 3.1 *Are Thai accomplishment verb stems ambiguous?*

Sentences (21), (22), and (24) demonstrate that Thai bare sentences can receive either a past, present, or future temporal interpretation, and an imperfective or perfective aspectual interpretation. At least two ways of

modeling this interpretive vagueness of Thai bare sentences suggest themselves. One assumes that the semantics of bare sentences is appropriately vague. The other assumes that some of the interpretations are derived through covert aspectual (or temporal) operators, which have been independently argued for in the description of aspectual shifts. Consider sentence (28a) from de Swart (1998) (her (22)), and its proposed informal semantic representation in (28b). The operator  $c_{he}$  is an unexpressed coercion operator that semantically converts homogeneous eventualities (i.e. states or activities) into eventualities that are bounded (events), thus creating an eventuality description of the right semantic type for the aspectual constraint on the use of *in-phrases*.

- (28) a. The program ran in four minutes.  
 b. [PAST [IN four minutes [ $c_{he}$  [the program run]]]]

Similarly, we could describe the interpretations of Thai bare sentences as aspectually ambiguous because of the presence, for some of their interpretations, of a covert coercion operation that maps homogeneous eventualities (states or activities) onto events or, conversely, events onto homogeneous eventualities. Since Thai bare sentences can involve verbs that describe events or homogeneous eventualities (compare (22) to (23)), we can, for example, posit that the primary aspectual interpretation of bare sentences is the one that is consistent with the type of eventuality being described: the bounded event interpretation, if the verb constellation describes a class of events, and a homogeneous eventuality if the verb constellation describes a class of homogeneous eventualities. A covert coercion operator would, then, be needed to derive other possible aspectual interpretations from this primary interpretation. Because the proposed primary and coerced aspectual interpretations cover the two possible aspectual interpretations of bare sentences, it is hard to find empirical evidence against this analysis. Our reasons for rejecting this approach are therefore only metatheoretical. By contrast to English or other languages for which covert coercion operators have been invoked, the covert coercion operator needed to derive the non-primary aspectual interpretation of Thai bare sentences must be used irrespective of any aspectual constraints imposed by adverbial phrases or other overt morphosyntactic material. Whereas the use of a covert coercion operator for (28a) is motivated by the semantic requirements of the interval phrase *in four minutes*, the use of a covert coercion operator for (21) is not required by independently motivated semantic constraints associated with a word or phrase. Such 'uninvited' uses of a coercion operator contrast with other cases in which coercion is typically invoked, which all involve a sortal mismatch between the semantic types of two morphosyntactically expressed elements (see Moens & Steedman 1988; Pustejovsky 1991; Sag & Pollard



**Figure 3** An example of a DRS for a sentence containing a bare verb stem

1991; de Swart 1998). The appeal to covert coercion in the absence of sortal mismatches between expressed constituents weakens theories of the interface between syntax and semantics: the ability to postulate covert operators that are not independently motivated increases the space of possible analyses. We therefore do not pursue the covert coercion approach, but assume instead that Thai bare sentences are vague in their interpretations. It should be noted, though, that our analysis of the Thai aspect system can be recast with minimal changes within an analysis that assumes the presence of covert coercion operators.

### 3.2 *The semantics of Thai accomplishment stems*

We use Discourse Representation Theory to formalize our description of the aspect system of Thai. Since we follow traditional representations of Discourse Representation Structures, we do not introduce DRT in the text. (See Kamp & Reyle (1993) or de Swart (1998) for details on the representations of tense and aspect in DRT.) The appendix presents a compositional, linear DRT fragment of Thai that covers the data we discuss in this paper. Accounting for Thai semi-perfective markers requires the introduction of two new event description operators. Other changes in our DRT representation of aspect are purely technical.

1. An *Impfv* operator that all accomplishment verbal stems carry;
2. A *Max* operator that encodes the notion of semi-perfectivity.

Our account of the Thai aspect system relies on the hypothesis that Thai accomplishment stems are fundamentally ‘imperfective’ in that they do not refer to complete eventualities, but to (non-necessarily proper) subparts of inherently bounded eventualities. This fundamental imperfectivity of Thai accomplishment stems is indicated informally in the paraphrase of our hypothesized semantics for (21) (repeated in (29a) below) in (29b). By ‘inertia’ worlds, we mean Portner’s (1998) definition of this notion, first introduced in Dowty (1979). Simplifying somewhat, ‘inertia worlds’ in this Kratzer’s (1981)-style rewording of Dowty’s account of the progressive are

worlds that are compatible with what is relevant to Surii's completion of the poem and in which Surii is not subsequently interrupted. In all those worlds, she finishes the poem.

(29) a. Surii t̄eη kl̄o:n  
 Surii compose poem  
 'Surii is composing/was composing/composes (habitually)/will compose/composed a/the poem.'

b. There is an eventuality  $ev$  which is a subpart of an eventuality  $e'$  such that in 'inertia' worlds,  $e'$  is an event of Surii composing a poem.

The Discourse Representation Structure which this paraphrase explicates is given in Figure 3. Figure 3 reads as follows. There is an eventuality  $ev$  which is a part of an eventuality of Surii composing a poem. We call  $ev$  the described situation and Surii's composition of a poem the characterizing situation. The use of the predicate *Impfv* encodes our hypothesis that Thai accomplishment stems are fundamentally biased toward imperfectivity. The meaning of the condition that includes this predicate (hereafter, condition  $\alpha$ , see (30a)) is given in (30b).<sup>10</sup>

(30) a.  $\alpha = \text{Impfv}(ev, \phi)$

b. An eventuality  $ev$  and an event description  $\phi$  satisfy condition  $\alpha$  if and only if there is an  $e'$  which (non-necessarily properly) includes  $ev$  and satisfies  $\phi$  in all 'inertia' worlds—i.e. in all worlds compatible with what it would mean to complete  $ev$  without being interrupted.

The embedding of the event description that characterizes  $ev$  within the *Impfv* operator is needed since, by hypothesis, Thai accomplishment bare stems do not encode completion: only in 'inertia' worlds did an event of Surii writing a poem occur. The inclusion of condition  $\alpha$  renders Thai accomplishment bare sentences similar to sentences marked with imperfective markers or the English progressive. Intuitively, Thai accomplishment bare stems are like imperfectively marked accomplishment verbs in French illustrated in (31).<sup>11</sup> Like the corresponding French verbs in the *imparfait*, Thai accomplishment bare stems either carry a non-completive semantics (compare (29a) to (31a)) or an habitual interpretation (compare (29a) to (31b)).

<sup>10</sup> The inclusion in the main DRS of the predicative condition *poem*( $y$ ) on the discourse marker  $y$  erroneously suggests that a poem was created. The same issue arises for progressive forms of English verbs of creation, as Kamp & Reyle (1993: 577) note. Since this issue is orthogonal to the main point of our paper, we do not discuss it further.

<sup>11</sup> We assume here the traditional analysis of French 'imparfait' as an imperfective past tense rather than as an aspectually sensitive past tense as de Swart (1998) does. Nothing substantial hinges on this choice.

- (31) a. Martha composait un rondo (quand on sonna  
 Martha compose.IMPF.PST a rondo (when INDEF ring.PFVE.PST  
 à la porte)  
 at the door)  
 'Martha was composing a rondo (when someone rang the bell).'
- b. Martha composait un rondo tous les jours  
 Martha compose.IMPF.PST a rondo every the days  
 (quand elle était jeune)  
 (when she be.IMPF.PST young)  
 'Martha used to compose a rondo a day (when she was young).'

Our characterization of the semantics of *Impfv* focuses on the non-habitual, progressive translation of Thai bare stems illustrated in (21) and (22). It embodies the hypothesis that the simple past translation we give for sentence (21) corresponds to pragmatically induced interpretations that bare stems *can* receive in context, not to additional meanings they might have; only the progressive and habitual translations correspond to meanings. Furthermore, we do not explicitly discuss how the habitual reading of *Impfv* arises. We assume the same mechanism which leads to the availability of habitual readings of imperfective operators in other languages is also at play in Thai (see Smith 1997 for some details). Our analysis of the semantics of *Impfv* closely parallels modal theories of the progressive. In both cases, sentences describe subparts of eventualities. But, despite this parallel, the predicate *Impfv* differs from ordinary progressive operators in one important respect.<sup>12</sup> *Ev* is not required to be a proper subpart of *e'*.<sup>13</sup> This relaxation of the constraint on the relation in which *ev* and *e'* must stand is critical to the analysis of Thai semi-perfective markers, as we will shortly see. This difference between the predicate *Impfv* and traditional analyses of the progressive operator *PROG* is motivated by the different functions of the two operators. The English progressive marker modifies a stem whose tense form would otherwise transparently describe eventualities of the type denoted by the verb constellation, as we discussed in section 1. It is thus fitting to treat the progressive as an aspectual shift operator. The function of the predicate *Impfv*, on the other hand, is merely to characterize the

<sup>12</sup> Many analyses of the progressive assume that the progressive shifts the aspectual class of the verb constellation from a non-stative eventuality to a state (see Herweg 1991a; Kamp & Reyle 1993: 576 and de Swart 1998, among others). Since condition  $\alpha$  is included in the semantic translation of stems (see the appendix), it is impossible to determine whether or not the operator *Impfv* shifts the aspectual class of the verb constellation to which it is added.

<sup>13</sup> Portner's (1998) definition of the progressive operator is in term of time intervals *i* and *i'* rather than eventualities *ev* and *e'*. His proper inclusion requirement therefore applies to time intervals: *i* must be a non-final subinterval of *i'*. Nothing substantial hinges on this difference.

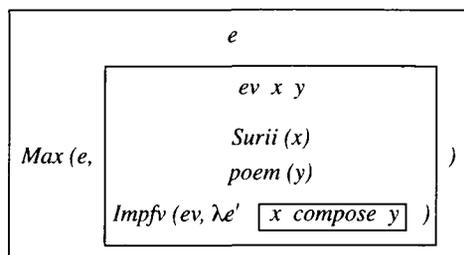
described eventuality *ev*, with the help of a description of the type of eventuality *e'* which would ensue, if *ev* were completed.

The inclusion of an additional *Impfv* operator might seem unsatisfactory to some readers since it adds some complexity to the lexical meanings of Thai accomplishment stems. They always include two pieces of meaning, a basic relation among participants in the described eventualities and an aspectual operator mapping this class of situations onto their subparts. Furthermore, the inclusion of two meaning components in the semantics of Thai accomplishment stems blurs Verkuyl (1993) distinction between inner and outer aspect. The basic relation between participants in the described eventualities belongs to the accomplishment Aktionsart and is a component of the sentence's inner aspect. The *Impfv* operator pertains to what Verkuyl calls outer aspect in that its semantic import, once the relation is saturated, is to map an event description onto another event description. Thus, Thai accomplishment stems comprise both a component that is traditionally viewed as part of inner aspect and a component that is traditionally viewed as part of outer or grammatical aspect. Can such a complexity be avoided?

We do not think so, as suggested by the fact that others who have discussed similar phenomena include, explicitly or implicitly, the same kind of complexity in the lexical meaning of stems. Talmy (1991) and Talmy (2000), for instance, discuss a similar phenomenon in Chinese in terms of the concept of implicated fulfilment verbs. Such a notion clearly requires Chinese accomplishment stems to include information relative to the sought-after telic result (the fulfilment) and an indication that it need not be reached (that it is only implicated). Zucchi's (1999) use of Parsons' notion of incomplete events to model the seemingly similar behavior of certain Russian verb stems might suggest we could avoid our two meaning components analysis. A Zucchi-style analysis would, for instance, say that the Thai accomplishment stem *tɛɛŋ* 'to compose' simply denotes incomplete (or non-necessarily complete) events of composition. But, in fact, such an analysis would not lead to a reduction in the complexity of the semantics of Thai bare stems since the concept of incomplete event is itself complex. It must include both information relative to what the completed event would be and an indication of the relation between the incomplete event and its completion. Zucchi's use of the predicate *Cul* to model the effect of adding the perfective prefix *na-* to Russian incomplete event denoting stems demonstrates this.<sup>14</sup>

The predicate *Cul* is meant to account for the following observation. Whereas occurrences of inflected forms of the root *pisat'* 'to write' denote

<sup>14</sup> The addition of *na-* results in a complete event description, according to Zucchi. The Russian suffix *na-* thus contrasts with Thai *k<sup>h</sup>uɯn*. It is a (completive) perfective marker, not a semi-perfective marker.



**Figure 4** An example of a DRS for a sentence containing a bare verb stem and  $k^h'im$

incomplete events, inflected forms of the stem *napisat'* 'write out' describe complete events. Thus, if *napisat'* is used in a sentence which describes John's activity of writing a letter, the sentence entails that the letter was completed. The Parsons-style formulas in (32) illustrate this observed shift in meaning which the prefix *na-* carries. (32a) is Zucchi's semantic translation for *pisat'*, (32b) is the formula which results from combining *pisat'* with the relevant arguments, and (32c) is the formula which results from prefixing *na-* to *pisat'* before combining it with its arguments.

- (32) a.  $\lambda Q \lambda z \lambda e$  [writing( $e$ )  $\wedge$  Agent( $e$ ,  $x$ )  $\wedge$  Theme( $e$ ,  $Q$ )]  
 b.  $\exists e$  [writing( $e$ )  $\wedge$  Agent( $e$ , John)  $\wedge$  Theme'( $e$ , a letter)]  
 c.  $\exists e \exists t$  [writing( $e$ )  $\wedge$  Agent( $e$ , John)  $\wedge$  Theme'( $e$ , a letter)  $\wedge$  Cul( $e$ ,  $t$ )]

By including the operator *Cul*, (32c) insures that the event corresponding to  $e$  culminated. But what event? The same event  $e$  of writing a letter, which is described by the formula in (32b) as incomplete. The stem *pisat'* must therefore include enough information relative to what kind of eventuality *writing*( $e$ ) can describe that we know whether or not *Cul*( $e$ ,  $t$ ) is satisfied. This is tantamount to saying that the stem must include information about what a culminated instance of *writing*( $e$ ) is as well as information to the effect that the event  $e$  did not necessarily culminate. As was the case for Talmy's concept of implicated fulfilment, the notion of incomplete event informally includes the two components of meaning our representation of the meaning of Thai bare accomplishment stems explicitly includes.

### 3.3 The semantics of semi-perfectivity

Equipped with our characterization of the aspectual interpretation of bare sentences, we can easily represent the semantic contribution of non-

completive perfective or semi-perfective markers, like Thai  $k^h\hat{u}n$ . Sentence (9) which contains this semi-perfective marker (repeated below as (33a)), can be paraphrased informally as in (33b).

- (33) a. Surii t̄ɛɛŋ klɔɔn  $k^h\hat{u}n$   
 Surii compose poem ascend  
 ‘Surii composed/will compose a/the poem.’
- b. There is an eventuality  $ev$  which is a subpart of an eventuality  $e'$  such that in ‘inertia’ worlds,  $e'$  is an eventuality of Surii composing a poem; AND, in the ‘real’ world, there is no  $e''$  of which  $ev$  is a proper subpart and which is a subpart of  $e'$ .

The relevant DRS for this sentence is diagrammed in Figure 4. The additional condition which semi-perfective markers such as  $k^h\hat{u}n$  introduce follows AND in the informal paraphrase in (33b), namely that  $ev$  is a maximal subpart of the continuations  $e'$  that would fit the eventuality description of Surii writing a poem. This condition corresponds to the notion of the terminal point of an event relative to an event-description  $\phi$  in Krifka (1989). The definition of the condition is shown in (34) below ( $\sqsubset$  stands for a (strict) part-whole relation on eventualities).

- (34) The referent of a discourse marker  $e$  satisfies the predicative condition  $Max(e, \phi)$  if and only if  $e$  is the largest eventuality which satisfies  $\phi$ , that is, if there is no eventuality  $e''$  such that  $e \sqsubset e''$  which satisfies the eventuality description  $\phi$ .

The condition  $Max(e, \phi)$  encodes the fact that  $k^h\hat{u}n$  indicates that  $e$  is bounded with respect to the eventuality description encoded by the VP over which it has scope. Formally, it is interpreted as an operator that maps an eventuality description onto another eventuality description. The fact that the eventuality description  $\phi$  that  $Max$  takes as argument includes a predicate whose semantics includes a modal component (the predicate *Impfv*) ensures that the boundedness of  $e$  does not entail completion of the eventuality description by which  $e$  is characterized. Note that if the composition of the poem *was* completed,  $Max(e, \phi)$  requires  $e$ —not a larger event of which  $e$  is a part—to be that event of Surii composing a poem, a consequence which accords with our empirical data. Sentence (33a) *can* describe a situation in which Surii completed the poem. In Smith’s (1997) terms, the ‘natural’ boundary of the situation in which Surii wrote a poem and the ‘arbitrary’ boundary of the situation which the sentence describes coincide in this use of (33a) and the inclusion of the described situation in the characterizing situation is not proper. Hence our relaxation of the inclusion requirement in the semantics of *Impfv* in (30b).

Now that we have formally defined the semantic contribution of  $k^h\hat{u}n$ , let

us return to the interaction of the semi-perfective with duration and interval adverbial phrases. Our observation was that sentences that include  $k^h\hat{u}n$  can felicitously combine with interval adverbial phrases, but not duration ones. This suggests that Thai semi-perfective sentences are telic, an expected property for an aspectual marker traditionally classified as perfective.<sup>15</sup> But matters are more complex. Another diagnostic of telicity—one that is often part of the definition of telicity—is the anti-subinterval property stated below in (35) (to be compared to the subinterval property given in (36)).

- (35) ANTI-SUBINTERVAL PROPERTY: If an eventuality description  $\phi$  applies to a situation  $s$  whose temporal trace is  $t$ , it does not apply to any situation  $s'$  properly included in  $s$  whose temporal trace  $t'$  is properly included in  $t$ .
- (36) SUBINTERVAL PROPERTY: If an eventuality description  $\phi$  applies to a situation  $s$  whose temporal trace is  $t$ , it applies to (all) situations  $s'$  included in  $s$  whose temporal traces are included in  $t$ .

Whereas atelic sentences obey the subinterval property stated in (36), telic sentences obey the anti-subinterval property. Informants report that the truth of sentences such as (33a) at time interval  $t$  is compatible with its truth at interval  $t'$  properly included in  $t$ , suggesting that sentences that include  $k^h\hat{u}n$  are not telic after all. Thus, sentences that include the perfective marker  $k^h\hat{u}n$  pass one test of telicity (the ability to co-occur with interval *in*-phrases), but fail another (the anti-subinterval property). The cause of this split behavior is easy to explain when the ‘intensionality’ of the notion of telicity is taken into account. As convincingly argued in Krifka (1989, 1998), telicity is a property of eventuality descriptions rather than of eventualities themselves. One and the same eventuality can be telic or atelic depending on how it is described. Krifka (1998) defines telicity as follows (p. 206): ‘we can characterize telicity as the property of an event predicate  $X$  that applies to events  $e$  such that all parts of  $e$  that fall under  $X$  are initial and final parts of  $e$ .’

The fact that telicity applies to eventuality descriptions explains why sentences containing  $k^h\hat{u}n$  do not conform to Krifka’s definition of telicity.  $k^h\hat{u}n$  is added to sentences containing bare stems which are atelic. It adds the information that the eventuality stopped. Speakers do not interpret this assertion of the presence of a boundary as adding to the eventuality description associated with bare sentences. In other words, speakers take the whole DRS in Figure 4 to be a description of the eventuality denoted by

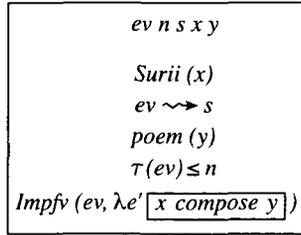
<sup>15</sup> As we mentioned earlier, (a)telic, in this paper, is taken to be a property of event descriptions and as such can apply either to verb constellations that are not modified by outer or grammatical aspect operators or to the output of the application of such operators (assuming they are modeled as functions from event descriptions to event descriptions).

the discourse marker *ev* included in the second argument of the operator *Max* and still conceive of the description of *ev* as that of an eventuality that is a part of a larger, maybe non-completed, eventuality  $e'$  in which Surii wrote a poem. The description of *ev* is therefore still not telic: a proper subpart of *ev* is also a subpart of  $e'$  and therefore satisfies the characterization of *ev* encoded by the verb constellation. The failure of sentences that contain  $k^h\hat{u}n$  to obey the anti-subinterval property still raises the question of how we shall semantically characterize the boundedness of events described by sentences containing  $k^h\hat{u}n$ . It turns out that characterizing this non-telic notion of boundedness is a simple generalization of Krifka's notion of telicity, which we call maximality and is encoded in our *Max* operator. We define the notion of an event's maximality with respect to a description  $\phi$  in (37) ( $U_E$  stands for the set of eventualities).

$$(37) \text{Max}(e, \phi) \leftrightarrow (\phi(e) \wedge (\neg \exists e'' \in U_E [e \sqsubset e'' \wedge \phi(e'')]))$$

(37) says that an event  $e$  is maximal with respect to a description  $\phi$  if and only if there is no larger event  $e''$  which satisfies  $\phi$ . It is clear that if a description  $\phi$  is telic in Krifka's sense, then every event which satisfies it is maximal with respect to  $\phi$ . Otherwise, two events  $e$  and  $e''$  such that  $e$  is properly included in  $e''$  would satisfy  $\phi$ ;  $e$  would then be an event which both satisfies  $\phi$  and is not a final part of  $e''$ , contra Krifka's definition of telicity. Of course, maximality is weaker than telicity since it does not preclude the existence of an event  $e''$  smaller than  $e$  which satisfies  $\phi$ .

The contrast between maximality and telicity provides a formal definition of the informal distinctions between natural and arbitrary boundaries or between boundedness and telicity found in Smith (1997) and Depraetere (1995), respectively. The operator *Max* also resembles de Swart (1998) function *BOUND* which maps a state onto a quantized portion of the state. It differs from it in two points. First, its input is not a state, but an eventuality. That the input to the operator denoted by  $k^h\hat{u}n$  can be a dynamic eventuality is best demonstrated by its effect on achievement verbs. If the input to *Max* was required to be a state, its application to an achievement verb constellation would require the eventuality description encoded in (11a), repeated below in (38a) to be first coerced into a stative eventuality description. The ensuing effect of this coercion would parallel the often discussed effect induced by the application of the English progressive to achievement verbs illustrated in sentence (39) and we would expect (38b) to carry a similar interpretive trace of this coercion.



**Figure 5** An example of a DRS for a sentence containing a bare verb stem and *maa*

- (38) a.  $k\grave{a}ed \ r\acute{a}ʔ-b\grave{a}ed$   
 happen explosion  
 ‘There was an explosion/There used to be explosions.’  
 b.  $k\grave{a}ed \ r\acute{a}ʔ-b\grave{a}ed \ k^h\acute{u}n$   
 happen explosion ascend  
 ‘There was an explosion.’
- (39) The bomb was exploding.

But neither sentence in (38) conveys the reading that the (coerced) stativization of an achievement predicate typically conveys. The absence of any such interpretive aftermath suggests that the semantic contribution of  $k^h\acute{u}n$  (namely the operator *Max*) does not require states as input. Second, it is not clear that the semantics of de Swart’s BOUND operator is appropriately sensitive to the eventuality *description* it takes as input. By contrast, the semantics of the operator *Max* as we stated it in (37) crucially depends on the nature of the description  $\phi$ . To understand the need for this relativization of *Max* to eventuality descriptions, consider the following, felicitous context of use of sentence (33a). *Surii* *did* finish composing a poem. In fact, she composed two other poems afterwards. Thus, the eventuality described by (33a) is included in a larger eventuality of *Surii* writing three poems. A strictly ‘extensional’ definition of *Max* such as the one in (40) is therefore inadequate: a larger eventuality of which the eventuality of *Surii* writing *one* poem is part *does* exist.

$$(40) \text{Max}(e) \leftrightarrow \neg \exists e'' \in U_E [e \sqsubset e'']$$

By including the additional constraint  $\phi(e'')$  in (37) we capture the fact that what  $k^h\acute{u}n$  indicates in sentence (33a) is that there is no strictly larger eventuality that can be characterized as a subpart of *Surii* *writing a poem*.

Our analysis of semi-perfectivity resembles Talmy’s (1991, 2000) analysis of Chinese sentences containing *-le*; like his, our analysis of Thai aspect hypothesizes a lexical basis of semi-perfectivity. We claim that the *Impfv* operator is lexically associated with accomplishment stems (either

directly or through redundancy rules or templates). Similarly, while Smith (1997) attributes the absence of an entailment of completion in (5) to the perfective marker *-le*, Talmy attributes it to the lexical semantics of Chinese accomplishment verbs, which, as we mentioned earlier, he dubs *implicated fulfilment verbs*. But Talmy does not precisely describe what makes Chinese accomplishment verbs *implicated fulfilment verbs*. Nor does his analysis explicitly relate the semantics of Chinese implicated fulfilment verbs to corresponding English *attained-fulfilment verbs*. By contrast, our analysis of Thai semi-perfectivity explicitly models the relation between English-style and Thai-style accomplishment verbs. Thai verbs embed English-style accomplishment semantics inside of an aspectual *Impfv* operator.

Because both *Impfv* and *Max* are aspectual operators, our account is also similar to Smith 1997 analysis of Chinese *-le* discussed in section 1. But whereas Smith entirely attributes the semi-perfectivity of sentence (5) to *-le*, we claim semi-perfectivity arises from the combination of two factors:

1. an *Impfv* operator associated with accomplishment stems;
2. a *Max* operator associated with the semi-perfective marker *k<sup>h</sup>ûn* or *-le*.

Furthermore, by contrast to Smith, we provide a formal account of the interaction of *Impfv*, *Max*, and the non-aspectual predicates contributed by verbal stems.<sup>16</sup>

### 3.4 *The semantics of the Thai perfect marker*

Finally, we propose the following analysis of the perfect marker *maa*. The meaning of sentence (25) (repeated below as (41a)) is paraphrased in (41b). As was the case for *k<sup>h</sup>ûn*, the contribution of *maa* follows AND.

- (41) a. Surii tɛɛŋ      klɔɔn maa  
 Surii compose poem come  
 ‘Surii has composed/is composing a/the poem.’
- b. There is an eventuality *ev* which is a subpart of an eventuality *e'* such that in ‘inertia’ worlds, *e'* is an event of Surii composing a poem; AND *ev* occurred in the past; AND *ev* can be associated with a final boundary which entails the presence at the time of utterance of a state *s*.

The DRS that corresponds to this paraphrase is represented in Figure 5.

<sup>16</sup> Our analysis resembles somewhat more Park’s (1993) suggestion that a modal operator be used to represent seemingly corresponding data in Korean. We would like to thank Robert Van Valin for pointing out this parallel to us.

The DRS in Figure 5 follows the representation of the perfect presented in Kamp & Reyle (1993) but for the substitution of the notion of resulting state to that of abutting state in conformity with van Eijck & Kamp (1997). It says not only that the temporal trace of *ev* (or  $\tau(ev)$ ) precedes or overlaps with speech time (represented by *n*) and that *ev* is characterized by condition  $\alpha$ , but also that *ev* resulted in a state *s* that holds at speech time. This representation covers both usages of *maa* in which *ev* has ended before speech time, but *ev*'s resulting state still presently holds and usages of *maa* in which *ev* is still currently holding. Thus, we use the word *resulting* (represented in the figure by  $\rightsquigarrow$ ) as a cover term for a loosely defined notion of consequence which subsumes both so-called existential and resultative readings of perfect markers. We cannot attempt to solve the complex issue of the semantics of the notion of result in this paper (see Michaelis 1998 for a comprehensive survey). But we need to describe in more detail the possible contextual interpretations of sentences that contain *maa* in order to account for the unfelicity of sentence (27), repeated below for convenience.

- (42) # Surii tɛ̀ɛŋ klɔ̀ɔn kʰu:n maa tɛ̀ɛ jaŋ mɔ̀j sɛ̀d  
 Surii compose poem ascend come but still not finish  
 'Surii composed a/the poem but did not finish it yet.'

We first note that *maa* can receive both existential and resultative readings (McCawley 1971). Sentence (43) illustrates the existential reading (using the *before* test discussed in Michaelis 1998). Sentence (41a) (under the non-progressive reading) illustrates the resultative reading.

- (43) cʰɔ̀n kin hɔ̀j-tàak maa kɔ̀ɔn  
 I eat snail come before  
 'I have eaten snails before.'

Second, even when *maa* combines with verbs that belong to the class of accomplishments and receives a resultative reading, it does not require the event to be completed, as (44) shows and is marked in Figure 5 by the predicative condition  $\tau(ev) \leq n$ . Determining what resulting state of current relevance is involved in such cases requires the contextualization of sentences like (44). Sentence (45) illustrates this.

- (44) tʰə̀ tɛ̀ɛŋ nàŋsũu maa tɛ̀ɛ kə̀əd pùaj cʰuŋ mɔ̀j tɛ̀ɛŋ  
 she write book come but happen sick therefore NOT write  
 tɔ̀ɔ  
 continue  
 'She has written a book, but she got sick, so she did not continue.'

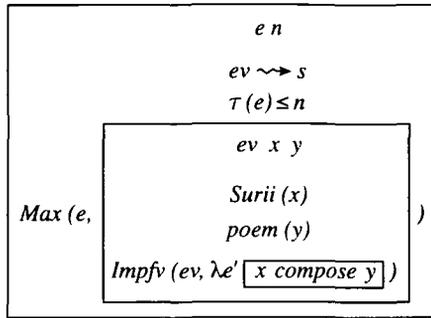


Figure 6 An example of a DRS for a sentence containing both *k<sup>h</sup>in* and *maa*

- (45) *k<sup>h</sup>un tɛɛŋ nãŋsũu p<sup>h</sup>aašaa ʔaŋ-krid maa, bɔ̀t-kwam p<sup>h</sup>aašaa*  
 you write book language English come article language  
*farànsèed kôʔ nãaj*  
 French then easy  
 'You have written a book in English, so (writing) an article in French is easy.'

The following situation is one possible context of interpretation for (45). The addressee is a native speaker of Thai and knows French much better than English. She is afraid of writing an article in French. She has written part of a book in English (say, 150 pages), but never finished it (she realized its content was not stellar, although the English was quite good). Under those circumstances, the utterance of (45) is felicitous and the second clause expresses the state of current relevance that *maa* requires. Crucially, this resulting state does not depend on the completion of the book.

Third, we follow Depraetere (1998) and assume that the notion of current relevance often used to characterize the resultative interpretation of the present perfect covers two classes of relations between the past event and the state that holds at speech time (between the referents of *ev* and *s* in Figure 5). Both are illustrated in (46) (adapted from Depraetere's example (10)).

- (46) a. Susan has watered the plants.  
 b. The plants have been watered.  
 c. Susan must be recovering as she has managed to water the plants.

(46b) describes one possible currently relevant state for the interpretation of (46a). This state is entailed by sentence (46a). (46c) describes another possible currently relevant state for the interpretation of (46a). But the relation between (46a) and (46c) is this time one of conversational implicature (more precisely, particularized conversational implicature) in

the sense of Grice (1975). More generally, currently relevant states can be related to the past event described by sentences containing a perfect marker either via implicatures or lexical entailments.<sup>17</sup> The discussed contextual interpretation of sentence (45) shows that even in the case of verb constellations that belong to the class of accomplishments, the resulting state which *maa* requires to presently hold need not be related to the described event through lexical entailment. Thus, sentence (45) does not require the book to be finished; that is, the lexically entailed state need not hold at speech time. The state of current relevance whose presence *maa* demands is in this case the one described by the second clause: writing an article in French is now easy for the addressee.

### 3.5 *The pragmatics of combining the semi-perfective and the perfect markers*

Having formally described the aspectual interpretations of bare sentences and sentences that contain a single aspect marker (the semi-perfective *k<sup>h</sup>ûn* or the perfect *maa*), we can discuss the aspectual interpretation of their combination. As mentioned previously, when both markers co-occur, the completion of the event which the sentence describes (the event whose corresponding discourse marker in the previous figure was *ev*) seems entailed. The relevant sentence is (42), the first clause of which is repeated below in (47a). Adding *k<sup>h</sup>ûn* excludes interpretations of the sentence in which the characteristic eventuality *ev* is still going on at speech time. *Ev* must have ended prior to speech time, although, the presence of *maa* requires a resulting state of *ev* to currently hold. A paraphrase of the contextual semantic value of sentence (47a) is given in (47b). The DRS derived by merging the DRS in Figures 4 and 5 is diagrammed in Figure 6.

- (47) a. Surii tènɛŋ klɔ̀ɔn k<sup>h</sup>ûn maa  
 Surii compose poem ascend come  
 ‘Surii has composed a/the poem.
- b. There is an eventuality *ev* which is a subpart of an eventuality *e'* such that in ‘inertia’ worlds, *e'* is an event of Surii composing a poem; AND, in the ‘real’ world, there is no *e''* of which *ev* is a proper subpart and which is a subpart of *e'*; AND *ev* occurred in the past; AND *ev* can be associated with a final boundary which entails the presence at the time of utterance of a state *s*.

Since neither of the DRS from the merger of which the DRS in Figure 6

<sup>17</sup> As mentioned in fn. 1, we must here relativize the notion of lexical entailment to fillers of argument positions which are specified quantities.

derives requires the poem to have been completed, the resulting DRS does not either. How can we, then, account for the infelicity of (42)? We claim that sentence (47a) does not in fact entail that Surii finished the poem, although it strongly implicates it. It merely requires that the composition event be finished, which the sentence without *k<sup>h</sup>ûn* does not, as Figure 5 shows. To understand why sentence (47a) strongly implicates the completion of the poem, we must first consider an interesting additional restriction on the use of the perfective marker *k<sup>h</sup>ûn*, which we have not heretofore discussed and which sentences (48a) and (49a) illustrate.

- (48) a. Surii t<sup>h</sup>am k<sup>h</sup>waam sà-ʔaad bâan k<sup>h</sup>ûn  
 Surii do NOM clean house ascend  
 'Surii cleaned the house.'
- b. Surii t<sup>h</sup>am k<sup>h</sup>waam sà-ʔaad bâan maa  
 Surii do NOM clean house come  
 'Surii has cleaned the house.'
- c. Surii t<sup>h</sup>am k<sup>h</sup>waam sà-ʔaad bâan k<sup>h</sup>ûn maa  
 Surii do NOM clean house ascend come  
 'Surii has cleaned the house.'
- (49) a. c<sup>h</sup>ân k<sup>h</sup>ian klœn p<sup>h</sup>aašaa farànsèed bon kràdaan k<sup>h</sup>ûn  
 I write poem language French on blackboard ascend  
 'I wrote a poem in French on the blackboard.'
- b. c<sup>h</sup>ân k<sup>h</sup>ian klœn p<sup>h</sup>aašaa farànsèed bon kràdaan maa  
 I write poem language French on blackboard come  
 'I have written a poem in French on the blackboard.'

Consistent with our analysis of semi-perfective *k<sup>h</sup>ûn*, (48a) does not entail that the house was entirely cleaned. But its interpretation requires that the subportion of the house that was cleaned remains clean at speech time. Similarly, (49a) does not entail that the poem was entirely written on the board, but its interpretation requires that the portion of the poem that was written remains on the blackboard at speech time. This additional interpretive constraint does not hold when *maa* replaces *k<sup>h</sup>ûn*. Thus, (48b) can felicitously be uttered if the portion of the house which was cleaned got dirty before speech time and (49b) is felicitous if the portion of the poem that was written on the board has been erased before speech time. The additional condition on the interpretation of *k<sup>h</sup>ûn* that we illustrated with sentences (48a) and (49a) provides the key, we believe, to the strength of the implicature of completion, which sentences that combine *k<sup>h</sup>ûn* and *maa* typically induce.

The constraint that the partial result of the subpart of the accomplishment that was carried out lasts until speech time renders *k<sup>h</sup>ûn* similar to a present perfect. But, by contrast to true present perfect markers, the

reference time of *k<sup>h</sup>ûn* sentences is not the time of utterance, but the past interval at which the event occurred. The fact that sentences containing *k<sup>h</sup>ûn* can combine with temporal adverbials such as *mûa-waan-nîi* ‘yesterday’, but not *tɔɔn nîi* ‘now’ supports our claim that *k<sup>h</sup>ûn* is not a perfect marker. The fact that the reverse is true of *maa* confirms that it is indeed a perfect marker. Sentences (50) and (51) illustrate.

- (50) a. Surii t<sup>h</sup>am k<sup>h</sup>waam sà-ʔaad bâan k<sup>h</sup>ûn mûa-waan-nîi  
 Surii do NOM clean house ascend yesterday  
 ‘Surii cleaned the house yesterday.’  
 b. \*tɔɔn nîi Surii t<sup>h</sup>am k<sup>h</sup>waam sà-ʔaad bâan k<sup>h</sup>ûn  
 moment this Surii do NOM clean house ascend  
 ‘Surii cleaned the house now.’
- (51) a. \*Surii t<sup>h</sup>am k<sup>h</sup>waam sà-ʔaad bâan maa mûa-waan-nîi  
 Surii do NOM clean house maa yesterday  
 ‘Surii has cleaned the house yesterday.’  
 b. tɔɔn nîi Surii t<sup>h</sup>am k<sup>h</sup>waam sà-ʔaad bâan maa  
 moment this Surii do NOM clean house maa  
 ‘Surii cleaned the house now.’

Furthermore, the fact that *k<sup>h</sup>ûn*—but not *maa*—can be used in story telling—a genre that favors perfective markers and tends to exclude perfect markers—confirms the results of the frame adverbials test. The discourse in (52) illustrates this. (The same discourse with *maa* substituted for *k<sup>h</sup>ûn* is ungrammatical.)

- (52) Surii k<sup>h</sup>id k<sup>h</sup>am tɔɔb ʔòk cuŋ k<sup>h</sup>ian raaj-ŋaan k<sup>h</sup>ûn  
 Surii think word answer exit then write report ascend  
 càak nân t<sup>h</sup>ə t<sup>h</sup>am ʔaa-ħaan k<sup>h</sup>ûn  
 leave that she do food ascend  
 ‘Surii found the solution, then she wrote the report. After that, she cooked.’

Sentence (45) shows that, in general, the state of current relevance whose existence is guaranteed by *maa* may be derived via particularized conversational implicatures. Why, then, does the derivation of the resulting state via lexical entailment appear to be the only available option when *maa* combines with *k<sup>h</sup>ûn*, as in sentence (42)? We say *appear*, because despite what sentence (42) suggests, lexical entailment is not the only possible source of the resulting state for sentences which contain both *k<sup>h</sup>ûn* and *maa*. Consider the sentences in (53). (53a) can receive a resultative reading either via lexical entailment or implicature. (53b) requires that a partial, lexically entailed, result hold at speech time (the portion of the book which was written must still exist). Finally, the resultative reading of (53c), like that of

(53a), can stem from a lexical entailment or a conversational implicature, but it additionally requires that the portion of the book that was written still be available at speech time.

- (53) a. Surii t̄eɲ n̄əŋs̄uɯ k<sup>h</sup>ɔ̄ɲ t<sup>h</sup>əə maa  
 Surii compose book of she come  
 'Surii has composed her book.'
- b. Surii t̄eɲ n̄əŋs̄uɯ k<sup>h</sup>ɔ̄ɲ t<sup>h</sup>əə k<sup>h</sup>ûn  
 Surii compose book of she ascend  
 'Surii composed her book.'
- c. Surii t̄eɲ n̄əŋs̄uɯ k<sup>h</sup>ɔ̄ɲ t<sup>h</sup>əə k<sup>h</sup>ûn maa  
 Surii compose book of she ascend come  
 'Surii has composed her book.'

The implicature-driven resultative reading of (53c) is certainly not its favored reading, but it is possible. One possible such contextual interpretation of (53c) is paraphrased in (54). The sentence in bold represents the additional constraint on the interpretation of *k<sup>h</sup>ûn* we discussed in the context of sentences (48a) and (49a). The sentence in italics represents the particularized implicature-based resultative reading induced by *maa*.

- (54) Surii partially wrote a book in the past (but did not complete it). **The part that was written is still available.** (Since it's difficult to write) *she's exhausted.*

Situations that fit the interpretation paraphrased in (54) are rare and this explains why, outside of particular contexts, (42) is *unfelicitous*. But the cause of this *unfelicity* is pragmatic and not semantic, as shown by the fact that (53c) *can* receive an implicature-driven resultative reading. Furthermore, we can easily account for the decreased salience of the implicature-based resultative reading when *k<sup>h</sup>ûn* precedes *maa*. Michaelis (1998) notes that the lexical entailment reading of resultative perfects is the favored reading for verb constellations that belong to the accomplishment class. The presence of *k<sup>h</sup>ûn*, which requires that a *lexically entailed* partial result of carrying out the accomplishment still holds at speech time, only reinforces this interpretive bias toward a lexically based resultative reading. Hence the strength of the implicature of completion reflected in the judgment in (42).

#### 4 CONCLUSION

Although perfectivity is often assumed to entail completion of events that belong to the accomplishment class, several languages possess perfective

markers that contravene this assumption (those we call semi-perfectives). Scholars who have discussed semi-perfective markers either remain informal in the description of their semantics or provide an inadequate model of it. This paper tries to remedy this gap and presents a formal account of the semantics of semi-perfective markers based on a description of a portion of the Thai aspect system. Our model of Thai semi-perfectivity relies on the inclusion of an imperfective operator in the lexical meaning of Thai accomplishment verbs and the notion of *maximal event relative to an event description*. This latter notion, inspired by Krifka's 1998 definition of telicity, is strictly weaker than telicity: any event which satisfies a telic event description  $\phi$  is maximal relative to  $\phi$ , but the converse is not true. Our paper thus demonstrates that (a)telicity is not the sole property of event descriptions relevant to the semantics of grammatical aspect; mere maximality sometimes matters too. Furthermore, by providing a model of semi-perfectivity which extends existing theories of telicity, the notion of event maximality grounds the informal notions of arbitrary boundary and atelic boundedness discussed in Smith (1997) and Depraetere (1995). We also argue in this paper that Thai accomplishment sentences never *mark* completive perfectivity; they always describe subparts of telic eventualities and leave it to processes of pragmatic enrichment to determine whether an event description that belongs to the class of accomplishments was completed. We demonstrate that even in circumstances where completion seems to be marked—that is, when the perfective and perfect markers combine—completion is merely a strong implicature. Although our analysis of semi-perfectivity was based exclusively on Thai, we believe it extends to other South Asian and East Asian languages for which a similar phenomenon has been reported. These include Chinese (see e.g. Talmy 1991; Smith 1997), Hindi (see e.g. Singh 1991), Korean (see e.g. Park 1993), and Tamil (see e.g. Paramasivam 1977).<sup>18</sup> Whether an analysis along the lines of the one we proposed for Thai fits all these languages is left for future work.

## APPENDIX: COMPOSITIONAL CONSTRUCTION RULES FOR SIMPLE THAI SENTENCES

This appendix contains sample lexical semantic translations necessary to the constructions of the DRS for the simple sentence types we discuss in this paper. We adopt the compositional and linear version of DRT advocated in Zeevat 1989 and van Eijck &

<sup>18</sup> Ikegami (1985) discusses a seemingly similar phenomenon in Japanese, but our consultants did not confirm his analysis. Whether Slavic non-completive perfective markers also belong in this group is unclear to us, because of the high degree of lexicalization displayed by Slavic imperfectives and perfectives.

**Table 2** Some words of Thai

Word	Translation	Type
klɔɔn 'poem'	$\lambda P(a \ \& \ \text{poem}(a) \ \& \ P(a))$	$((e, T), T)$
Surii 'Surii'	$\lambda P(b \ \& \ \text{Surii}(b) \ \& \ P(b))$	$((e, T), T)$
tɛ:ŋ 'compose'	$\lambda P \lambda c \lambda e_2 (P \lambda d (\text{Impfv}(e_2, \lambda e_1, \text{compose}(e_1, c, d))))$	$((e, T), T), (e, (e, T))$
k <sup>h</sup> u:n 'ascend'	$\lambda P \lambda c \lambda e_3 (\text{Max}(e_3, P(c)))$	$((e, (e, T))(e, (e, T)))$
maa, 'come'	$\lambda P \lambda c \lambda e_4 (s \ \& \ P(e_4)(c) \ \& \ e_4 \rightsquigarrow s)$	$((e, (e, T)), (e, (e, T)))$
	$\lambda P(e_5 \ \& \ P(e_5))$	$((e, T), T)$

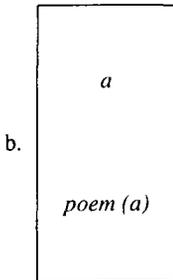
Kamp (1997). Table 2 lists the semantic translations and types of a few Thai words which illustrate the semantic issues on which this paper concentrates.

The relative complexity of the translations is the result of two factors:

1. The need to make available to the perfective and perfect markers the eventuality parameters introduced by the VPs over which they have scope.
2. Our assumption that semantic composition proceeds as dictated by surface constituency.

Clauses in the translations that consist of single letters from the upper half of the alphabet, such as *a*, introduce discourse markers and correspond to variables at the top of boxes in the box representation we have used until now. All other clauses correspond to predicative conditions. & is a merge operator which can be thought of as a dynamic form of conjunction. (See van Eijck & Kamp (1997) for details on various possible interpretations of merge operators.) (55a) thus corresponds to (55b) in box representation.

(55) a. *a & poem (a)*



The lexical meanings summarized in Table 2 give rise, after  $\beta$ -reduction, to the semantic translations of the numbered nodes of Figures 7, 8, and 9 shown in (56), (57), and (58), respectively.

- (56) 1  $\lambda c \lambda e_2 (a \ \& \ \text{poem}(a) \ \& \ \text{Impfv}(e_2, \lambda e_1, \text{compose}(e_1, c, a)))$   
 2  $\lambda c \lambda e_3 (\text{Max}(e_3, \lambda e_2 (a \ \& \ \text{poem}(a) \ \& \ \text{Impfv}(e_2, \lambda e_1, \text{compose}(e_1, c, a))))))$   
 3  $\lambda e_3 (b \ \& \ \text{Surii}(b) \ \& \ \text{Max}(e_3, \lambda e_2 (a \ \& \ \text{poem}(a) \ \& \ \text{Impfv}(e_2, \lambda e_1, \text{compose}(e_1, b, a))))))$   
 4  $(e_5 \ \& \ b \ \& \ \text{Surii}(b) \ \& \ \text{Max}(e_5, \lambda e_2 (a \ \& \ \text{poem}(a) \ \& \ \text{Impfv}(e_2, \lambda e_1, \text{compose}(e_1, b, a))))))$
- (57) 1  $\lambda c \lambda e_4 (s \ \& \ a \ \& \ \text{poem}(a) \ \& \ \text{Impfv}(e_4, \lambda e_1, \text{compose}(e_1, c, a))) \ \& \ e_4 \rightsquigarrow s$   
 2  $(e_5 \ \& \ b \ \& \ \text{Surii}(b) \ \& \ s \ \& \ a \ \& \ \text{poem}(a) \ \& \ \text{Impfv}(e_5, \lambda e_1, \text{compose}(e_1, a, b))) \ \& \ e_5 \rightsquigarrow s$
- (58) 1  $\lambda c \lambda e_4 (s \ \& \ \text{Max}(e_4, \lambda e_2 (a \ \& \ \text{poem}(a) \ \& \ \text{Impfv}(e_2, \lambda e_1, \text{compose}(e_1, c, a)))) \ \& \ e_4 \rightsquigarrow s)$   
 2  $(e_5 \ \& \ b \ \& \ \text{Surii}(b) \ \& \ s \ \& \ \text{Max}(e_5, \lambda e_2 (a \ \& \ \text{poem}(a) \ \& \ \text{Impfv}(e_2, \lambda e_1, \text{compose}(e_1, c, a)))) \ \& \ e_5 \rightsquigarrow s)$

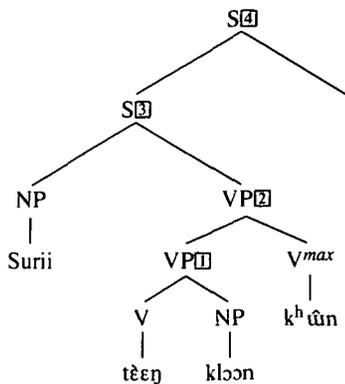


Figure 7 A Thai sentence which contains *k<sup>h</sup>u<sup>n</sup>*

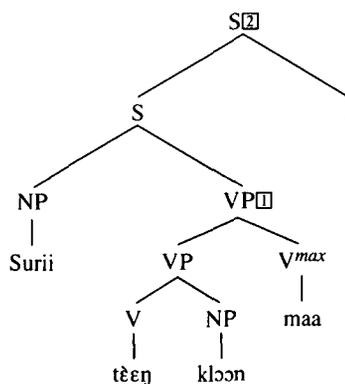


Figure 8 A Thai sentence which contains *maa*

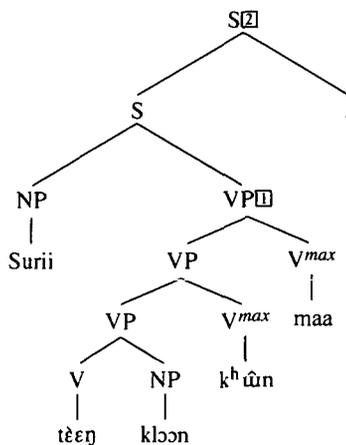


Figure 9 A Thai sentence which contains *k<sup>h</sup>u<sup>n</sup>* and *maa*

A few more comments on our semantic translations are in order. First, we included the *Impfv* operator directly in the semantic translation of the word *tɛɛŋ* 'compose'. A linguistically more appropriate representation would let a lexical redundancy rule or template introduce this operator, which the semantic translation of all Thai accomplishment verbs must contain. We leave the formulation of such a rule or template to another occasion. Second, since *maa* can adjoin to a VP which may or may not contain  $k^h\hat{u}m$  and neither  $k^h\hat{u}m$  nor *maa* need occur, the final reduction of the  $\lambda$ -abstracted eventuality variable that the semantic translations of VPs include must be left to a constituent that has scope over the largest VP. We decided to ascribe this final  $\beta$ -reduction to the end of sentence marker '.' which already carries a semantic function in linear compositional DRT. (For ease of exposition, we left out of the translations the other semantic contribution of end of sentence markers.) The semantic translation of any verb or operator that takes a propositional argument would also need to effect the  $\beta$ -reduction of this eventuality variable.

Third, the desire to provide a compositional treatment of aspect sometimes leads to a nesting of DRSs. van Eijck & Kamp's (1997) analysis of the English perfect already requires one level of embedding. So does de Swart's (1998) analysis of the progressive as a sentential operator or our analysis of the *Max* operator. These embeddings are mere technical artefacts of the fact that, within a compositional approach to DRT, operators cannot just grab eventuality descriptions such as  $Impfv(e, \lambda e' \text{ compose}(e', c, a))$  to serve as an argument of an aspectual operator such as *Max*. The entire semantic representation of the constituent over which *Max* has syntactic scope must serve as one of its arguments. To get around this purely technical need for DRS embeddings, we could adopt a metalanguage that provides us with the ability to 'grab' arbitrary sub-representations, such as a Feature Logic of some kind (see Carpenter 1992). But such a move would require a complete restatement of DRS construction rules. We opt for a more conservative approach and simply accept an additional level of DRS embedding in our representation of sentences which contain  $k^h\hat{u}n$ .

The DRS embeddings that result from the semantic representations of aspectual operators have an unintended adverse consequence that we cannot fully address in this paper. Discourse markers corresponding to a subset of NPs—all postverbal NPs in our paper and van Eijck & Kamp's (1997), all NPs in de Swart (1998)—may be introduced in embedded DRSs when aspectual operators which have VP or sentential syntactic scope modify main verbs. These discourse markers are nonetheless accessible to cross-sentential anaphoric pronouns, as the English discourses in (59) demonstrate:

- (59) a. John was talking to a woman<sub>i</sub>. She<sub>i</sub> looked unhappy.  
 b. John has written a book<sub>j</sub> on this issue. It<sub>j</sub> is quite good.

Established definitions of accessibility within DRT render the discourse markers introduced by the NPs *a woman* and *a book* impossible antecedents of the pronouns *she* and *he* in de Swart's (1998) analysis of the English progressive or in van Eijck & Kamp's (1997) analysis of the English perfect.<sup>19</sup> This prediction is clearly not borne out. Amending the definition of accessibility to accommodate such discourses is not difficult, but it comes at a cost: a purely structural definition of accessibility is no longer feasible.

We conclude this appendix by providing the model-theoretic interpretation of the two aspectual operators on which our analysis of semi-perfectivity relies, *Impfv* and *Max*. For

<sup>19</sup> Determining whether sentences which include *Max* are similarly problematic is difficult in view of the prevalence of null anaphors in Thai.

convenience, we state the interpretive rules in terms of the notion of an embedding function from discourse markers to individuals of the domain as presented in Kamp & Reyle (1993).

- (60) a. An embedding function  $f$  verifies the condition  $Impfv(e, \phi)$  at world  $w$  iff  $f$  maps  $e$  onto an eventuality  $E$  such that in all 'inertia' worlds  $w'$  there is an eventuality  $E'$  of which  $E$  is a part such that  $f$  verifies  $\phi(e')$  ( $f(e') = E'$ ).<sup>20</sup>  
 b. An embedding function  $f$  verifies the condition  $Max(e, \phi)$  iff  $f$  maps  $e$  onto an eventuality  $E$  such that there is no  $E'$  of which  $E$  is a proper subpart which verifies  $\phi(e')$  ( $f(e') = E'$ ).

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<sup>20</sup> As mentioned earlier, the definition of 'inertia' worlds we adopt is that proposed in Portner (1998).

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