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THE SYNTAX OF ASPECT IN THAI*

ABSTRACT. This paper describes the syntax and semantics of the aspect system of Thai. Its interaction between linear order and scope has not been described in detail in the previous literature and its complexity makes it particularly relevant to discussions of the similarity of syntactic and semantic structures. It is argued that Thai presents challenges to some hypotheses about the interface between the syntax and semantics of semantic modifiers, in particular, Cinque's (1999) hypothesis that the semantic structures of modifiers are isomorphic to the syntactic structures that express them, as well as Kayne's (1994) Linear Correspondence Axiom. The syntax of aspect in Thai suggests that syntactic and semantic structures are independent levels of representation that are not mapped uniformly onto each other and that a functional category's lexical entry must record both its part of speech and its combinatorial potential.

Determining the similarity of syntactic and semantic structures within and across languages is an important goal of the study of the interface between syntax and semantics. To that end, *semantic modifiers* have played an increasing role in the last 10 years. By semantic modifiers we mean expressions which, in Categorial Grammar terms, are functors which take as input expressions of type X and return as output expressions of type X (i.e., their semantic type is X/X or $X\backslash X$, depending on whether their input is to the right or left, respectively).[1] The relevance of semantic modifiers stems from their varied surface realizations. For example, in English, verbal semantic modifiers can occur in a variety of positions while the semantic arguments of active verbs are consistently realized as subjects/complements and consistently occur to their left/right.

This paper has two goals. Empirically, we want to describe a complex semantic modifier system from a single semantic domain, that of aspect – that is, expressions whose semantic type is that of

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[1] We reserve the term *functor* to semantic operators or predicates.

event description modifiers. Although many aspects of the Thai aspectual system have been described in the previous literature (see Haas 1964; Kanchanawan 1978; Ekniyom 1979; Boonyapatipark 1983; Thepkanjana 1986; Shelstad 1990; Sookgasem 1990; Singhapreecha 2000, among others), the interaction between linear order and the scope of Thai aspect markers (hereafter, TAMs) has not been described in detail, and its complexity makes it particularly relevant to discussions of the similarity of syntactic and semantic structures. Its complexity provides a touchstone for theories of semantic modification and its syntactic reflexes. Theoretically, we argue that the syntax of aspect in Thai provides evidence for three conclusions: (i) syntactic and semantic structures are independent levels of representation that are not mapped uniformly onto each other; (ii) more than one structural configuration can satisfy the selectional requirements of lexical items; (iii) part-of-speech information does not entirely determine a (functional) category's combinatorial potential and both kinds of information must be recorded in the lexical entries of (functional) heads. These three conclusions conflict with the strong hypothesis presented in Cinque (1999) that the semantic structures of semantic modifiers are isomorphic to the syntactic structures that express them. The first two conclusions also conflict with Kayne's (1994) Linear Correspondence Axiom.

This paper is organized as follows. Section 1 briefly describes the hypotheses laid out in Cinque (1999) and Kayne (1994). Section 2 describes the part of the Thai aspect system that is relevant to this paper. Section 3 shows how several properties of this system make it particularly difficult for the hypotheses which Cinque and Kayne advocate to model. Section 4 presents a detailed analysis of the Thai system within Head-driven Phrase-Structure Grammar (henceforth, HPSG) that eschews those difficulties. Section 5 briefly sketches two other analyses, one within the Principles and Parameter framework, the other within Categorial Grammar, for comparison. Section 6 compares the analyses discussed in sections 3 through 5. Finally, section 7 concludes the paper.

1. Two Hypotheses on the Interface Between Syntax and Semantics

Over the last 15 years, a set of hypotheses has emerged within the Principles and Parameters framework which has important consequences for the interface between the semantics and syntax of (verbal)

semantic modifiers. As far as we can see, many scholars – but not all, see section 5.1 – adopt one of two principles. We call the hypothesis about natural languages that these principles embody the UNIFORMITY HYPOTHESIS (henceforth, UH).

These principles postulate the existence of a cross-linguistically uniform mapping between syntactic structures and the functor-argument structure of semantic modifiers, either by hypothesizing a linear-order to hierarchical structure correspondence or by hypothesizing a universal inventory and hierarchy of functional categories. We informally state these principles below.

Hypothesis 1 (*Linear Order Principle* (*LOP*)). Linear order reflects hierarchical structure (see Kayne (1994) among others).
Hypothesis 2 (*Functional Categories Principle* (*FCP*)). Functional categories are uniform across languages.
a. There is a universal inventory of functional heads (from which languages may choose);
b. There is a universal hierarchy of functional heads.[2]

Both principles lead, for the most part, to the same *structural* analysis of the Thai data and differ only in the trees' category labels (but see section 3.2 for a possible difference). Since the difficulties that the Thai data present concern almost exclusively the structural configuration of clauses containing aspect morphemes, we treat these hypotheses as equivalent for our concerns and discuss them mostly in terms of Cinque's thought-provoking proposal until section 3.2. Suffice it to say that they conspire to predict a single "deep" structure hierarchical configuration for a given set of functional categories, without entering into the details of the role these hypotheses play in the determination of the structure of clauses.[3] Their side effect is to force the introduction of movement operations when a set of lexical items can occur in more than one surface order without any change of meaning. The most relevant prediction of the UH for the syntax of aspect morphemes is stated in (1) below.

[2] Cinque (1999) most emphatically embraces both aspects of Hypothesis 2. Giorgi and Pianesi (1997) seem to espouse only its first part, insofar as they claim that the hierarchical ordering of functional categories is affected by the syncretic bundling of functional features.

[3] We use scare quotes around the word *deep*, since the existence of levels internal to the computational system is called into question in the Minimalist Program. We leave it to the reader to recast the principles in minimalist terms.

(1) The FCP (and to a lesser extent, the LOP) predicts that all languages have the same "deep" aspectual clausal structure.

This paper shows some of the unwelcomed consequences of the UH when dealing with Thai. We contrast hypotheses 1 and 2 with several other approaches to the interface between syntax and semantics, all based on another hypothesis, which we call, for lack of a better term, the REPRESENTATIONAL MODULARITY HYPOTHESIS.[4] We define it below:

Hypothesis 3 (*Representational Modularity Hypothesis* (*RMH*)). Syntactic and semantic structures need not be isomorphic to each other. In particular, semantic scope need not be isomorphic to syntactic constituency or surface linear order at any level of representation.

The RMH is implicitly adopted by most current grammatical frameworks, outside of the Principles and Parameters tradition (and may, to some extent, be incorporated into this framework, see Alexiadou (1997), for example, and section 5.1). It is assumed, as far as we can tell, in Lexical Functional Grammar (Bresnan 1982), Jackendoff's (1997) approach, Autolexical Syntax (Sadock 1990), Categorial Grammar (see Bach 1988 and other articles in the collection), Construction Grammar (Fillmore et al. 1988), HPSG (Pollard and Sag 1994), and Role and Reference Grammar (Van Valin and Lapolla 1997). All these theories assume that syntactic and semantic structures form independent structures (algebras) and that there can be multiple surface expressions of a single semantic structure. We cannot go into details on how this assumption follows from the RMH, since the reasons differ slightly for each framework. The leading idea is that several base syntactic structures can have the same semantic import. Concentrating for now on HPSG, the influence of the RMH is visible in the fact that (i) semantic modifiers can be realized as the syntactic heads, modifiers, or complements of the local trees of which they are part and (ii) function composition allows selectional properties of lexical items to be satisfied by more than one phrase structural configuration. The data we analyze suggest that the RMH leads to a significantly less stipulative analysis of the Thai aspect system than the UH.

[4] We freely borrow the term from Jackendoff (1997) while remaining agnostic on the Fodorian baggage associated with the notion of modularity (Fodor 1983).

2. A Short Description of Thai Verb Complexes

Thai is a strict SVO language with no inflectional morphology. Consequently, Thai sentences can be quite vague both temporally and aspectually.[5] Sentence (2), for example, is four-ways vague, as its translation indicates.

(2) Surii tèɛŋ klɔɔn
Surii compose poem
'Surii is composing/composes (habitually)/will compose/composed a/the poem.'

In fact, a fifth interpretation of sentence (2) is possible, provided a past reference point is introduced, as shown in sentence (3).

(3) Surii tèɛŋ klɔɔn mûa c^{h}ǎn paj hǎa
Surii compose poem when I go visit
'Surii was composing a/the poem when I went to visit her.'

Thai sentences containing bare stems and no aspect marking 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. Because of the absence of aspectual morphology, it is independent words that either precede or follow the main VP that mark aspectual distinctions. Sentences (4)–(6) illustrate[6].

[5] The temporal vagueness of Thai sentences is, of course, often mitigated by the presence of temporal adjuncts or the discourse context.

[6] Thai Aspect Markers (TAMs) are in bold font in examples. Our data was culled from seven speakers, all but one from central Thailand, and all in their twenties or thirties. Perhaps because of the sheer number of possible combinations of aspect morphemes and the subtlety of the aspectual distinctions they encode, speakers' judgments can vary on whether a particular combination of aspect morphemes is allowed. Except where otherwise noted, the data we cite is accepted by all our consultants. More importantly, variation in the acceptability of particular aspect morpheme combinations does not affect the basic facts which the various analyses we discuss attempt to model. For example, some speakers use semi-perfective markers in more limited environments than others, but all speakers we consulted accept sentences (5) and (6).

(4) Surii **kamlaŋ** t^ham ŋaan
Surii PROG do work
'Surii is in the process of working.'

(5) Wilaj **cà?** tɛ̀ɛŋ klɔ̀ɔm bòt nɯ̀ŋ **k^hûun**
Wilaj be.about.to compose poem CL one SEMI-PERFV
'Wilaj will compose a piece of poetry.'

(6) Priida **kamlaŋ cà?** sâaŋ bâan **k^hûun** **maa**
Priida PROG be.about.to build house SEMI-PERFV PERF
'Priida is going to build a/the house.'

Sentence (4) contains a progressive marker which precedes the main VP. Such markers are traditionally called (pre-verbal) auxiliaries (Haas 1964; Boonyapatipark 1983, among others), pre-verbs (Scovel 1970), or pre-serial verbs (Kanchanawan 1978). Sentence (5) contains a semi-perfective marker which follows the main VP.[7] These markers are traditionally called (postverbal) auxiliaries, postverbs, or post-serial verbs by the same authors. Sentence (6) contains aspect markers which precede the main VP and others which follow it. For reasons that will become clear shortly, we use the categorially and positionally neutral labels groups 1 and 2 aspect markers to refer to expressions such as the progressive and semi-perfective, respectively. Thai encodes many aspect distinctions with up to four allowed in a single clause, as sentence (6) shows.[8] Which words are classified as preverbal or as postverbal aspect markers varies across authors and is not easy to determine on either syntactic or semantic grounds. But, if we follow Moens and Steedman (1988) and de Swart (1998) and understand aspectual markers to be event description modifiers, Thai has at least 17

[7] See Koenig and Muansuwan (2000) for a detailed analysis of the semantics of Thai semi-perfective markers. Our English translations are often rough approximations of the subtle aspectual meanings the Thai sentences convey.

[8] Some consultants accept up to five aspect markers. Consultants' variation and uncertainty on the maximal number of TAMs in a single clause suggest that the limit is more pragmatico-semantic than grammatical in nature (i.e., difficulties imagining a context in which a sentence-type could be felicitously uttered or limits on sequences of changes through the aspectual categories space described in Moens and Steedman (1988)).

TABLE I
Thai Aspect Markers

Group 1 TAM	Group 2 TAMs
p^hôŋ: POST-INC	k^htûn: SEMI-PERFV (lit. 'ascend')
rôəm: start, INCH	loŋ: SEMI-PERFV (lit. 'decend')
k^hɔ̀ɔj: experience	ʔɔ̀ɔk: SEMI-PERFV (lit. 'exit')
càʔ: be about to	k^hâw IMPFV (lit. 'enter')
kamlaŋ: PROG	jùu: IMPFV (lit. 'be located')
	paj: IMPFV (lit. 'go')
	paj: PERFV (lit. 'go')
	sǐa: PERFV (lit. 'lose, waste')
	tɔ̀ɔ: continue
	sèd: finish
	còb: end
	maa: PERF (lit. 'come')

aspect markers. We list them in Table I to give readers a feel for the richness of aspectual distinctions which Thai provides.[9]

In Table I, we grouped TAMs by their order of appearance.[10] All TAMs from group 1 *can* occur before the main VP. TAMs from group 2 *must* follow the main VP. Finally, note that more than one member of group 1 TAMs or one member of group 2 TAMs can occur in a string. A crucial property of TAMs for our theoretical concerns is that, as noted in Sookgasem (1990), TAMs that can occur before the main VP can occur after it, *provided* group 2 TAMs follow them. In contrast, TAMs from group 2 can never occur before the main VP. This is illustrated in sentences (7) through (10).[11]

[9] We leave open the possibility that this list does not exhaust the set of TAMs. Some scholars have argued that *léew* 'already' or *jàŋ* 'still' are aspect markers (see Sookgasem 1990, among others), while others have argued they are not (see Muansuwan 2002). The exact extension of TAMs is not crucial to our point. Many scholars, including Scovel (1970) and others, have treated *càʔ* as a future tense marker, rather than as an aspect marker. See Muansuwan (2002) for arguments it is not.

[10] As argued in Thepkanjana (1986), *paj* has both an imperfective and perfective meaning and can modify a different class of main VPs in each of these uses.

[11] Some speakers find sentence (7c) marginal. The ungrammatically of sentence (7d) for most speakers has a semantic source, as we discuss shortly.

(7) a. Wilaj **kamlaŋ càʔ** jéb p^{h}âa **sèd**
Wilaj PROG be.about.to sew cloth finish

b. Wilaj jéb p^{h}âa **kamlaŋ càʔ** **sèd**
Wilaj sew cloth PROG be.about.to finish

c. ? Wilaj **kamlaŋ** jéb p^{h}âa **càʔ** **sèd**
Wilaj PROG sew cloth be.about.to finish

d.* Wilaj **càʔ** jéb p^{h}âa **kamlaŋ sèd**
Wilaj be.about.to sew cloth PROG finish
'Wilaj is going to finish sewing cloth.'

(8) raw k^{h}ɛ̀ɛŋ kamlaŋ càʔ sèd
we compete **PROG** **be.about.to finish**
'we were going to finish competing.'
(Kunlasatree, vol. 769, January 2003)

(9) a. Wilaj jéb p^{h}âa **sèd**
Wilaj sew cloth finish

b.* Wilaj **sèd** jéb p^{h}âa
Wilaj finish sew cloth
'Wilaj finished sewing the cloth.'

(10) a. Wilaj **kamlaŋ càʔ** jéb p^{h}âa
Wilaj PROG be.about.to sew cloth
'Wilaj is going to sew the cloth.'

b.* Wilaj jéb p^{h}âa **kamlaŋ càʔ**

c.* Wilaj **kamlaŋ** jéb p^{h}âa **càʔ**

d.* Wilaj jéb p^{h}âa **kamlaŋ**

Both *kamlaŋ* 'PROG' and *càʔ* 'be.about.to' can occur before the main VP, as sentence (7a) shows; both can occur after the main VP, as sentences (7b) and (8) show; or *kamlaŋ* can precede the main VP and *càʔ* follow it, as sentence (7c) shows. Sentence (9b) illustrates the claim that group 2 TAMs cannot precede the main VP while sentences (10) show that group 2 TAMs must follow *kamlaŋ* and *càʔ* if the latter follow the main VP. Finally, the ungrammatically of sentence (7d) can be explained on semantic grounds. The semantic constraints on the argument of the Thai progressive marker are incompatible with the punctuality of situations described by main

VP + *sèd* "finish VP-ing." The marker *sèd* derives a punctual event description, with which the Thai progressive is incompatible. The presence of *càʔ* in sentences (7b)–(7c) adds the preliminary stages of the event's endpoint denoted by *main VP + sèd*. It thus provides the temporal extension semantically required by the progressive which outscopes it. In other words, sentence (7d) is ungrammatical for the same reason sentences (11) are ruled out.[12]

(11)a.* Wilaj **kamlaŋ** jéb p^{h}âa **sèd**
Wilaj PROG sew cloth finish

b.* Wilaj jéb p^{h}âa **kamlaŋ sèd**
Wilaj sew cloth PROG finish
'Wilaj is finishing sewing the cloth.'

The interaction of the string position and relative scope of TAMs is particularly interesting. We list below in terms as framework-neutral as possible the four basic facts around which our theoretical investigation centers.

Fact 1. The scope of group 1 TAMs is determined by their linear order from left to right, whether they precede or follow the main VP.

Fact 2. The scope of group 2 TAMs is determined by their linear order from right to left.

Sentence (12a) illustrates this last observation. The perfective marker *paj* indicates that the finishing event was completed and thus outscopes *sèd*, as the formula in (12b) indicates.[13] Similarly, the imperfective marker *paj* outscopes *tɔ̀ɔ* 'continue' in sentence (13) and the perfect marker *maa* outscopes *sèd* in sentence (14). The conjunction of these first two facts entails that TAMs from *all* groups

[12] As reviewers point out, the English translation of sentences (7d) or (11a) ('Wilaj is finishing sewing the cloth') is grammatical. We adopt the widely held hypothesis that the combination of the English progressive and punctual event descriptions or achievements triggers a coerced reading by which the non-punctual preliminary stage of the event description is "added" and is modified by the progressive (see Smith 1997, among others). We also assume with Smith and others that coercion potentials differ across languages. Most Thai speakers simply do not allow the kind of preliminary stage coercion which the English progressive admits, One of our consultants seems to marginally accept (7d). Interestingly enough, the same speaker also accepts sentences (11). This suggests that speakers may marginally accept the preliminary stage coercion that most Thai speakers we consulted reject.

[13] We do not represent the semantic contribution of NPs since it is orthogonal to the issues we discuss.

have scope over the main VP, an expected consequence, if aspect markers are event description modifiers.

(12) a. Piti kin k^{h}âaw **sèd paj** lέεw
Piti eat rice finish PERFV already
'Piti has already finished eating rice/the rice.'

b. PERFV(FINISH(eat(e, x, y)))

(13) Piti k^{h}ǐan còdmăaj **tɔ̀ɔ paj**
Piti write letter continue IMPFV
'Piti keeps/kept writing the letters.

(14) Wijada k^{h}ǐan raajŋaan **sèd maa**
Wijada write report finish PERF
'Wijada has finished writing a/the report.'

That the correspondence between left-to-right linear order and scope relations holds irrespective of the position of group 1 TAMs is demonstrated by the fact that the scope relations are identical in all sentences in (7). *Kamlaŋ* has widest scope, *sèd* has narrowest scope, and *càʔ* both outscopes the latter and is outscoped by the former, as shown in the formula in (15).

(15) PROG (BE. ABOUT. TO (FINISH(sew(e, x, y))))

In the sentence in (16a), the group 1 TAM *p^{h}ɔ̂ŋ* 'POST-INC' immediately outscopes the perfective marker which itself outscopes *còb* 'end', as the semantic formula in (16b) shows.[14]

(16) a. k^{h}ǐan rûaŋ jaaw **p^{h}ɔ̂ŋ còb paj**
write story long POST-INC end PERFV
'(I) just finished writing a long story.' (*from Khwanruan,* vol. 740, September 2002)

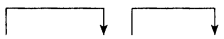
b. POST-INC(PERFV(END(Write (E, X, Y))))

Although acceptability of sentences with strings of group 1 and group 2 TAMs diminishes with their number, sentence (17) is grammatical for most speakers we consulted.

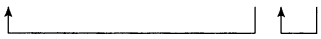
[14] Whether group 1 TAMs always outscope group 2 TAMs is a difficult issue which we discuss in section 4.3.

(17) a. Piti láaŋ caan **kamlaŋ cà? sèd paj** ʔìik baj nʉ̀ŋ
Piti wash dish PROG be.about.to finish PERFV more CL one
'Piti is going to finish washing one more dish.'

b. PROG(BE.ABOUT.TO(PERFV(FINISH(wash(e, x, y)))))



c. Piti láaŋ caan **kamlaŋ cà? sèd paj**



So that readers appreciate the complexity of the relation between scope and linear order in sentence (17a), we graphically represented scope relations in (17c). Arrows above and below expressions indicate the relative scope of aspect markers and the main VP by connecting the outscoping expression to the immediately outscoped expression. The arrows thus clearly depict how dissociated from linear order scope relations are:

- The *immediately outscopes* relation among the first two aspectual functors in the formula in (17b) matches the left-to-right linear order of the words that express them;
- The *immediately outscopes* relation among the last two aspectual functors matches the right-to-left linear order of the words that express them;
- The main VP is immediately outscoped by the third TAM in the sequence of post-main VP TAMs.

The first two facts summarize the inverse correspondence between linear order and scope relations which group 1 and 2 TAMs induce. The next two facts summarize restrictions on the pre-group 1 TAM occurrence of the main VP.

Fact 3. Group 1 TAM can only follow the main VP if they are followed by group 2 TAMs.

The ungrammatically of examples (10b)–(10d) illustrate fact 3.

Fact 4. Group 1 TAMs can only be directly followed by *some* group 2 TAMs.

The contrast between the grammatical sentence (18a) in which *càʔ* immediately precedes the main VP and the ungrammatical sentence (18b) in which it follows the main VP and immediately precedes the semi-perfective or perfect markers illustrates this point. *K^{h}ûun* and

maa minimally contrasts with *sèd*, which can immediately follow *càʔ*, as sentences (7b) and (7c) show.

(18)a. Wilaj **càʔ** tɛ̀ɛŋ klɔɔm bòt nɯ̀ŋ **k^{h}ûn/maa**
Wilaj be.about.to compose poem CL one SEMI-PERFV/PERF
'Wilaj will compose/have composed a piece of poetry.'

b.* Wilaj tɛ̀ɛŋ klɔɔm bòt nɯ̀ŋ **càʔ** **k^{h}ûn/maa**
Wilaj compose poem CL one be.about.to SEMI-PERFV/PERF
'Wilaj will compose/have composed a piece of poetry.'

The Thai aspect system raises at least two kinds of questions that any theoretical model must answer. The first set of questions pertains to the contrast between group 1 TAMs and group 2 TAMs. The two groups display a converse relation between linear order and scope, and members of the second group cannot precede the main VP. We call this set of questions the *mirror problem* and we describe it in (19a). The second set of questions pertains to the fact that the main VP can precede group 1 TAMs only in limited contexts: A particular subset of group 2 TAMs must immediately follow group 1 TAMs. We call this problem, stated in (19b), the *co-occurrence problem*.

(19)a. Why are TAMs scoped *right to left* if and only if they *must follow* the main VP and scoped *left to right* if and only if they *can precede* the main VP?

b. Why must post-main VP group 1 TAMs be immediately followed by group 2 TAMs and why can they be followed by only some group 2 TAMs?

2.1. *Some Other Relevant Facts About Thai*

A few other facts that concern TAMs and Thai syntax are relevant to our discussion. First, for the most part, heads precede their complements (see sentence (2) above among many others), and expressions which seem to be modifiers follow the element they modifiy, as sentences (20a)–(20c) illustrate. Adverbs, adjectives, and degree modifiers all follow the words or phrases they modify.[15]

[15] A handful of adverbs, such as *baŋʔəən* 'accidentally' and *k^{h}ɔ̂ɔjk^{h}ɔ̂ɔj* 'gradually' are exceptions to this generalization and can occur either sentence initially or VP initially.

(20) a. Priida dən rew
Priida walk fast
'Priida walked/walks fast.

b. tùk kàw nán pen $k^hɔ̌ɔŋ$ Priida
building old that COPULA of Priida
'That old building belongs to Priida.'

c. Surii sǔuŋ mâak
Surii tall very
'Surii is very tall.

Second, as fact 4 suggests, group 2 TAMs fall into two classes, those which can be preceded by group 1 TAMs, and those which cannot. This distinction correlates with another syntactic difference, the ability to be negated. Thai has at least three negations, *mâj*, *mâj-dâj*, and *mâj-$c^hâj$*. There is considerable variation among speakers as to which negation can negate which TAM, as already noted in Ekniyom (1979). But, crucially, no negation can precede markers such as the semi-perfective *$k^hûn$*, as sentences (21)–(22) illustrate.[16]

(21) a. Dara mâj-daj **rə̂əm** t^ham ŋaan
Dara NEG start do work
'Dara didn't start working.'

b. Dara t^ham ŋaan mâj **sèd**
Data do work NEG finish
'Dara didn't finish working.'

(22) a.* Dara t^ham ŋaan mâj-daj **k^hûn**
Dara do work NEG SEMI-PERFV
'Dara hasn't worked (to its end).'

b.* Dara t^ham ŋaan mâj **k^hûn**
Dara do work NEG SEMI-PERFV
'Dara hasn't worked (to its end).'

[16] Thepkanjana (1986) already noticed that "aspectual verbs" cannot be negated, but her notion of aspectual verbs only partially corresponds to the classification of TAMs into markers and verbs we propose below. Some of her aspectual verbs are not aspectual at all; some verbs which would be aspectual, it seems, by her definition, can be negated, for example *ʔɔ̀ɔk* 'SEMI-PERFV.'

Negation thus partitions the set of TAMs into two classes. We assign TAMs that can be negated to the part-of-speech *verb*, while TAMs that cannot be negated are assigned to the part-of-speech *marker*. Table II provides the part of speech of all TAMs we mention in this paper.

TABLE II

The part-of-speech categories of TAMs

	Verbs	Markers
Group 1 TAMS	rə̂əm 'start', k^{h}əəj 'experience', kamlaŋ 'PROG', p^{h}ə̂ŋ POST-INC', càʔ 'be about to'	
Group 2 TAMs	còb 'end', sèd 'finish', ʔɔ̀ɔk 'SEMI-PERFV'	maa 'PERF',tɔ̀ɔ 'continue', k^{h}ûːn 'SEMI-PERFV', loŋ 'SEMI-PERFV', jùu 'IMPFV', paj PERFV', k^{h}âw 'IMPFV', paj 'IMPFV', sǐa 'PERFV'

The division into verb and marker TAMs does not seem to match semantic classifications. All three semi-perfective TAMs indicate that the situation denoted by the main verb stopped (or will stop); all three TAMs literally denote spatial motions and the relation between their literal and aspectual meanings is metaphorical. Nonetheless, one semi-perfective TAM is a verb, while the other two are markers. Similarly, the two TAMs *tɔ̀ɔ* 'continue' and *sèd* 'finish' denote aspectual distinctions akin to what Smith (1997) calls superlexical morphemes and ter Meulen (1995) calls aspectual verbs. Despite this similarity in meaning, the first TAM is a marker and the second a verb. It is true that many of the group 2 TAMs that are verbs can also occur as main verbs in meanings which are similar, if not identical to the one they carry as group 2 TAMs. That is, verbal TAMs can be defined as those TAMs which denote functors that take event descriptions when they occur as main verbs. But, contrary to what Thepkanjana (1986) claims, their main verb and group 2 TAM subcategorizations differ. *Sèd* 'finish', for example, subcategories for an NP, not a VP, as a main verb, as sentence (23a) shows (*ŋaan* is indisputably a noun in Thai), and *ʔɔ̀ɔk* syntactically subcategorizes

for a PP as a main verb, as (23b) demonstrates (see Muansuwan 2002: 160 et sq. for details).

(23)a. Malii sèd ŋaan
Malii finish work
'Malii finished her work.'

b. Wira ʔɔ̀ɔk càak ŋaan
Wira exit from work
'Wira quit his job.'

Finally, many group 2 TAMs have spatial literal meanings. Their post-main VP occurrence is thus not surprising, from an historical point of view. They occur where their literal counterparts would have occurred in the Thai serial verb construction, illustrated in (24). In fact, some scholars take the kind of construction illustrated in (24) and the use of the same verbs as group 2 TAMs to form a general Serial Verb Construction (Thepkanjana (1986), but see Muansuwan (2002) for some important differences among what Thepkanjana labels Serial Verb Constructions). When both true serial verbs and group 2 TAMs occur in a single clause, the latter follow the serial verbs, as sentence (25) shows.

(24) Piti dən k^{h}ûn paj
Piti walk ascend go
'Piti walked up, away from the speaker.'

(25) k^{h}âw dən won ʔɔ̀ɔk paj **tɔ̀ɔ**
he walk circle exit go continue
'He continued walking away in circles.'

3. Thai and the Uniformity Hypothesis

We will now discuss how the Uniformity and Representational Modularity Hypotheses would model the data we have just presented, starting with the UH. To account for the fact that the surface structure of sentences which include TAMs differs from that of other languages and that TAMs can occur in different positions, an analysis which relies on the UH must posit the movement of both the main VP and group 2 TAMs. We first present a model of the Thai data that assumes the FCP and then discuss whether a more motivated analysis is possible if one adopts the LOP.

3.1. *Thai and the Uniformity of Functional Categories*

The labeled bracketing in (26) is a representation of a small portion of the verbal functional projections proposed in Cinque (1999). Crucially, it embodies the hypothesis that all semantically modifiying functional categories are heads that select for a particular category as complement (the $\text{Asp}_{\text{prospective}}$ functional head, for instance, selects an $\text{Asp}_{\text{Sgcompletive(I)}}$ (phrasal) category as complement) and that the categories universally occur in the shown order.

(26) [*almost* $\text{Asp}_{\text{prospective}}$ [*completely*$\text{Asp}_{\text{Sgcompletive(I)}}$ [*tutto* $\text{Asp}_{\text{PICcompletive}}$ [*well*Voice[*fast*/*early* $\text{Asp}_{\text{celerative(II)}}$ [*again* $\text{Asp}_{\text{repetitive(II)}}$ [*often* $\text{Asp}_{\text{frequentative(II)}}$[*completely* $\text{Asp}_{\text{Sgcompletive(II)}}$ VP]]]]]]]]

This hypothesis predicts a universal isomorphism between scope and left-to-right linear order. Each verb or functional head should immediately precede the verb or functional head which it immediately outscopes. The previous section amply demonstrates that this hypothesis cannot be true of the surface order of Thai sentences. Consider, for example, (27), in which, in accordance with the strong UH, each aspect operator is a functional head and takes as its complement the phrase headed by the functional or verbal head it immediately outscopes. Despite the fact that (27) represents the necessary (simplified) "deep" structure of sentence (7a) and all its possible variants, the linear surface order of TAMs and the main VP can *never* be isomorphic to the yield of the tree corresponding to (27). (We use Cinque's phrasal labels for convenience.)

(27) [$_{\text{progP}}$ kamlaŋ [$_{\text{prospP}}$ càʔ [$_{\text{compP}}$ sèd VP]]]

Adopting the UH therefore forces us to claim that several movement operations scramble the "deep" linear order of Thai aspectual functional categories and the main VP. First, to account for the fact that the main VP can precede TAMs from groups 1 and 2, although the latter have scope over it, we can hypothesize that the main VP moves over them. Such a movement is illustrated in (28) where the main VP has moved past all three aspect markers to the specifier position of the progressive (or is adjoined to its maximal projection, the two formulations being equivalent for our purposes).

(28) [VP_i [kamlaŋ [càʔ [sèd t_i]]]]

Moreover, since the main VP can also occur between group 1 and group 2 TAMs or between group 1 TAMs, it must be able to also move to several other specifier positions, as shown in (29) and (30).

(29) [kamlaŋ [VP_i [càʔ t_i]]]

(30) [kamlaŋ [càʔ [VP_i [sèd t_i]]]]

Second, to prevent the surface order exemplified in sentences (10b)–(10d), the main VP must not move if group 1 TAMs do not take group 2 TAM complements. In other words, the structure in (31) is ungrammatical.

(31) *[VP_i [càʔ t_i]]

Third, to prevent the surface order exemplified in sentence (18b), the main VP must be prevented from moving past *càʔ* 'be about to' to yield the ungrammatical structure represented in (32). When *càʔ* immediately precedes *sèd*, the main VP *may* move past it; when *càʔ* immediately precedes the semi-perfective marker *k^hûn*, the main VP cannot move past it.

(32) *[VP_i [càʔ [k^hûn t_i]]]

Finally, to account for the fact that scope relations among group 2 TAMs are ordered from right-to-left, *sèd* must move over *paj*, either to the specifier position of the projection *paj* heads or to adjoin to *paj* through head-movement, as shown in (33a) and (33b), respectively.

(33) a. [VP_i [$sèd_j$ [paj [t_j [t_i]]]]]

b. [VP_i [[$sèd_j$ paj] [t_j [t_i]]]]

The logic of a UH analysis of the Thai aspect system should be clear from this sketch of a few partial derivations. The "deep" structure of sentences which contain TAMs obeys the universal isomorphism between left-to-right order and scope relations. Any apparent deviation from this expected pattern is the result of movement operations which target some TAMs and the main VP. Variant analyses of the Thai data would differ only in irrelevant respects from the analysis we have sketched. What matters to us is not the mechanics of such analyses but the fact that some expressions, but not others, *can*, *cannot*, or *must* move. (34) presents a summary of the allowed and required movements.

(34)a. Group 2 TAMs *must* move and adjoin to a higher aspectual head as its maximal projection; group 1 TAMs cannot;
b. Group 2 TAMs cannot move (a) past the main VP or (b) past group 1 TAMs;
c. The main VP *must* move past any group 2 TAM;
d. The main VP *can*, but *need not* move past any group 1 TAM;
e. The main VP *can* move past any group 1 TAM *only if* it complements group 2 TAMs;
f. The main VP *cannot* move past any group 1 TAM when the group 2 TAM that selects it is a *marker* and not a *verb*.

Constraint (34a) is required to insure the right linear order to scope correspondence for group 1 and 2 TAMs. Constraints (34b) and (34c) are needed to reflect the fact that group 1 TAMs and the main VP must both precede group 2 TAMs. Constraint (34d) is needed to account for the variation in surface order of the main VP displayed in (7a)–(7c). Constraint (34e) is needed to exclude sentences (10b) through (10d). Finally, constraint (34f) is required to account for the contrast between sentences (7b) and (18b). Surely, one can devise a set of features for obligatory or optional movements which can describe all these facts (simply because for *any* finite data set one can always find a set of feature-value pairs that *represents* what is grammatical and what is not) The following set of features would account for all but constraints (34e) and (34f).

(35)a. Main VPs are marked $+ F_{\text{Vgroup2TAM}}$ or $+ F_{\text{Mgroup2TAM}}$;
b. Group 2 TAMs are marked $+ F_{\text{Mgroup2TAM}}$;
c. Main VPs are marked $+ F_{\text{group1TAM}}$.

(We assume a Move, rather than Attract, view of movement, since it allows for a simpler description of the needed features. We assume that main VPs move to the specifier position of phrases and that group 2 TAMs are either head-adjoined to the immediately higher head or move to the specifier position of that higher projection. We must also assume that $+ F_{\text{Mgroup2TAM}}$ and $+ F_{\text{vgroup2TAM}}$ *require* the main VP or group 2 TAM to move whenever possible (i.e., when there are group 2 TAMs), but that $+ F_{\text{group1TAM}}$ *allows* movement to the specifier position of group 1 TAMs.)

The kind of approach we have just outlined has two drawbacks. First, the difference in formal features borne by group 1 and group 2 TAMs does not correlate with any other synchronic or diachronic

fact of the language. The distinction between group 1 and group 2 TAMs does not reflect an independently motivated semantic distinction. The class of imperfective markers has members among group 1 TAMs (*kamlaŋ* 'PROG', *càʔ* 'be about to') and group 2 TAMs (k^h*âw* 'IMPFV', *paj* 'IMPFV', *jùu* 'IMPFV') and TAMs akin to what Smith (1997) calls superlexical morphemes are among both group 1 and group 2 TAMs (*rôm* 'start' vs. *tɔ̀ɔ* 'continue' or *sèd* 'finish'). The distinction between group 1 and group 2 TAMs is not related to other syntactic facts either, e.g., the post-head position of modifiers or the serial verb construction historical source of many group 2 TAMs. As a consequence, the proposed account of the mirror problem is entirely stipulative. It does not explain the correlation between the ability to occur before the main VP and the left-to-right scope to linear order correspondence, since there is no independent reason why group 1 TAMs could not move just like group 2 TAMs do. Nor does it explain the correlation between necessarily occurring after the main VP and adjoining to (the projection of) a higher aspectual head.

Second, the co-occurrence problem is not accounted for. The set of feature-value pairs in (35) does not account for the fact that VP movement to the specifier position of group 1 TAMs is possible only if it complements a group 2 TAM (compare (10a) to (10b)–(10d)). Nor does it account for the fact that VP movement to the specifier position of group 1 TAMs is possible only if the main VP complements a *verb* group 2 TAM. Sentence (18a) shows that the main VP can move to the left of *marker* group 2 TAMs. The contrast between sentences (18b) and (36) shows that this movement to the specifier position of a group 2 TAM phrase can be followed by a movement to the specifier position of a group 1 TAM provided that a *marker* does not *immediately* follow the group 1 TAM.

(36) raw k^huj kan **p^hôŋ** **còb paj** nîi-lɛ̀ʔ
we talk to.each.other POST-INCH end PERFV just.now
'We just finished talking to each other.' (*Khwanruan*, July 1995)

As suggested to us, the behavorial contrast between the two classes of group 2 TAMs is reminiscent of a difference in head-government.[17] The contrast between sentences (18b) and sentences such as (7b) or (36) may reflect the fact that *verb* group 2 TAMs head-govern their VP complements, but *marker* group 2 or group 1 TAMs do not. If the trace of the VP complement to a *verb* group 2 TAM is head-governed,

[17] We thank Jeff Runner for clarifying issues discussed in this paragraph.

it can adjoin to any group 2 or group 1 TAM. If the trace of the VP complement to a *marker* group 2 or a group 1 TAM is not head-governed, its movement is severely limited; it cannot cross the barrier of the maximal projection of a *marker* group 2 TAM to move to the SPEC position of a group 1 TAM (Chomsky 1986; Rizzi 1990).[18] Two separate difficulties plague this head-government account of the difference between *verb* and *marker* group 2 TAMs. (i) We know of no independent motivation for grouping together *marker* group 2 and group 1 TAMs. Note, in particular, that group 1 TAMs and *verb* group 2 TAMs can be preceded by negation, but not *marker* group 2 TAMs. (ii) More importantly, this proposal does not account for the fact that main VPs can move to the specifier position of *marker* group 2 TAMs, but cannot move to the specifier position of group 1 TAMs when they do not complement a group 2 TAM. (Compare the ungrammatical movement of the main VP to the specifier position of the group 1 TAM phrase when no group 2 *verb* follows (e.g., sentences (10b)–(10d)) to the grammatical movement of the main VP to the specifier position of the *marker* group 2 TAM phrase in sentence (18a).)[19]

To summarize, the FCP analysis we just outlined answers question (19a) by postulating a certain number of VP and group 2 TAM movement operations. Its answer does not provide an explanation for the correlation between the relative surface positions of group 1 TAMs, group 2 TAMs, and main VPs, and their scopal properties. It also has trouble modeling, let alone providing an explanatory answer, to question (19b).

[18] The grammaticality of sentence (6) suggests that the main VP may move first to the specifier position of the *marker* group 2 TAM with narrowest scope (the leftmost group 2 TAM in the surface string) and that the entire phrase headed by this *marker* may then move to the specifier position of the *marker* group 2 TAM with widest scope.

[19] To properly restrict movement of the main VP past group 1 TAMs, one could stipulate that upon movement to the specifier position of a *verb* group 2 TAM, the feature $+F_{\text{Vgroup2TAM}}$ is erased, and stipulate further that movement to the specifier position of a group 1 TAM is possible only when that feature has been erased on the main VP. Since for historical and semantic reasons, *verb* group 2 TAMs cannot occur to the right of *marker* group 2 TAMs, these stipulations would insure that main VPs move to the specifier position of a group 1 TAM only when the main VP complements a *verb* group 2 TAM in its base position. Aside from technical difficulties (which might merely reflect our lack of imagination), this proposal's total absence of motivation is clear.

3.2. *An Alternative Analysis Under the Linear Order Hypothesis*

As mentioned in the introduction, the UH can be stated either strictly configurationally, as in Kayne (1994) or in terms of a hierarchy of functional categories, as in Cinque (1999). The predictions are for the most part identical and the analysis we just presented can easily be recast in Kayne's antisymmetry approach. But, as a reviewer pointed out, another kind of analysis is available to a Kayne-style approach, namely that group 2 TAMs are predicates involved in small clause structures, along the lines of Sybesma's (1999) analysis of Chinese aspect marker *-le*. Such an analysis would assign to sentence (37a) the analysis in (37b). (We leave aside the subject and other irrelevant details for clarity.)

(37) a. Dara **p^hân** k^hian rûaŋ jaaw **còb** **paj**
Dara POST-INC write story long finish PERFV
'Dara just finished writing the long story.'

b. [p^hân [$_{SC}$ [$_{SC}$ [$_{VP}$ k^hian rɯaŋ jaaw] còb] paj]]

This analysis of the structures in which group 2 TAMs partake eschews appealing to VP movement to account for the order of the main VP and group 2 TAMs or appealing to the movement of group 2 TAMs to account for the right-to-left scope order of group 2 TAMs. But, it violates Cinque's Universal Base Order of functional categories hypothesis. The *recursive* small clause structure exemplified in sentence (37) also violates Kayne's Linear Correspondence Axiom. *Paj* asymmetrically c-commands the main VP, but does not precede it, as Figure 1 shows. Node ζ asymmetrically c-commands γ and precedes the leaves it dominates, but node ϵ asymmetrically c-commands γ, without preceding any of its leaves, thus leading to a violation of the claim that the pairs of terminals dominated by the pairs $<X,Y>$ (where X asymmetrically c-commands Y) is a linear order ($<\zeta, \gamma>$ and $<\epsilon, \gamma>$ being the offending pairs). So, while Kayne's Linear Correspondence Axiom hypothesis is compatible with a small clause analysis of group 2 TAMs, it is not compatible with the

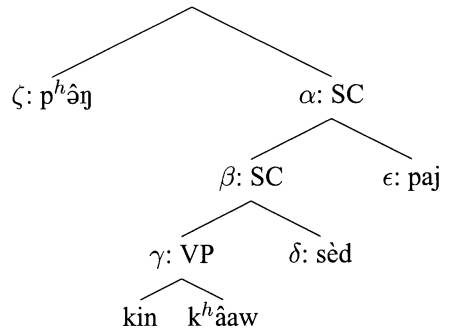


Figure 1. The constituent structure of sentence (37a).

recursive small clause analysis of group 2 TAMs which a complete model of the Thai aspectual data would demand.[20]

4. An HPSG Analysis of TAMs

4.1. *The "dual" Structure of Thai Aspectual Constructions*

Turning now to the RMH, our analysis is based on three hypotheses about the grammars of natural languages that are part and parcel of the HPSG framework: (1) The semantic type of an expression does not predict its morphosyntactic combinatorial requirements; (2) lexical subcategorization requirements need not be satisfied in a single structural configuration; (3) lexical entries record separately combinatorial and part-of-speech information.

We make the following hypotheses with respect to the grammar of Thai. First, TAMs can enter into two syntactic structures. Some TAMs are the heads of Head-Complement structures, others are

[20] Note further that such putative Thai small clauses would differ from typical small clauses in at least one important respect, In all the analyses of small clauses of which we are aware, small clauses are selected by higher predicates, which does not seem the case in sentences such as (9a). Of course, one could posit an empty functional head selecting for the small clause *jéb p^{h}âa* 'sew cloth,' but aside from the absence of any evidence as to the existence and identity of this putative functional head, empty functional heads would then have to be able to vary in their subcategorization properties (between ordinary complements and small clause complements), a proposal which we find methodologically dubious.

the adjuncts of Head-Adjunct structures. Second, some TAMs lexically induce function composition (i.e., subcategorize for what their complements or expressions they modify select). Third, some TAMs impose idiosyncratic selectional restrictions on the part-of-speech category of the phrases that complement them or that they modify. The first two hypotheses will be critical in answering the mirror problem, the third in answering the co-occurrence problem.

4.2. *An Introduction to Minimal Recursion Semantics and HPSG*

The first hypothesis, which is the basis of our HPSG answer to the mirror problem, is stated below.

> *Thai-specific Hypothesis 1 (Non-uniformity of Thai)*. Group 1 TAMs are heads that take VP complements, groups 2 TAMs are VP adjuncts.

To explain how this hypothesis directly accounts for the two different linear order-to-scope correspondences which group 1 and 2 TAMs display, we need to introduce the basics of the particular approach to semantics we use, Minimal Recursion Semantics (henceforth MRS, see Copestake et al. 2001; Copestake et al. 2003, for introductions to MRS). MRS belongs to the growing class of underspecified semantic metalanguages and is one of several semantic metalanguages compatible with HPSG. The flexibility of MRS in modeling scope interactions makes it particularly well-suited to model the Thai data, but our analysis does not crucially depend on the choice of MRS; other semantic metalanguages could certainly be used. MRS represents the meaning of expressions as a flat bag of Elementary Predications (or EPs) encoded as values of a RELATIONS attribute, as the semantics of *Jo loves Pat* represented in Figure 2 illustrates. (To orient the reader, the denotation of the bag of EPs that constitutes the value of the RELATIONS attribute is typically equivalent to the logical conjunction of its members.)

The semantics of this sentence contains three EPs, one for the naming relation between the name *Jo* and its referent, one for the naming relation between the name *Pat* and its referent, and finally one for the love relation between the referents of *Jo* and *Pat*. That the lover is *Jo* and the loved one is Pat is indicated in the figure by the fact that the values of the INSTANCE attributes of the EPs for each NP are identical to the values of the ACTOR and UNDERGOER attributes of the EP corresponding to *loves* (see the co-numbered tags 3 and 4,

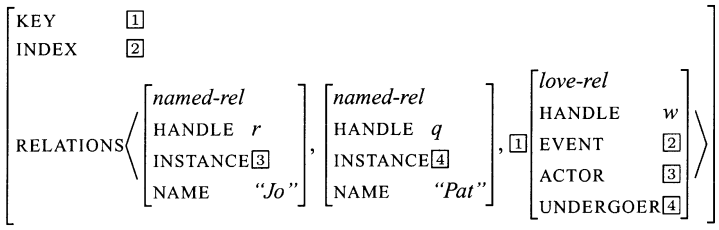


Figure 2. A MRS-style representation of the meaning of the sentence *Jo loves Pat*.

respectively).[21] Since MRS adopts a Davidsonian analysis of situations, the *love-rel* EP contains an event argument. Finally, one of the EPs is selected as the KEY EP and the value of one of the EPs EVENT (or INSTANCE) attribute is chosen as the INDEX of the sentence. The INDEX attribute is introduced to indicate the referent of the word or phrase the structure represents the meaning of. Since our example sentence describes a love situation, the value of the INDEX attribute is identical to the value of the EVENT attribute of the *love-relation*, as the co-numbered tags 2 indicate. The KEY attribute is introduced to keep track of the EP which is the semantic head of a phrase.

MRS was introduced with the explicit purpose of allowing underspecification of scope relations and, to that end, it is crucial to be able to refer to individual EPs. The attribute HANDLE in each EP in Figure 2 serves this role. The HANDLE attribute value *r*, for instance, uniquely identifies the predication associated with the subject NP while the HANDLE attribute value *w* identifies the predication associated with the verb *loves*. Simplifying for purposes of exposition, semantic composition works as follows:[22]

(38)a. The RELATIONS of the mother of a local tree is the concatenation of the RELATIONS of the daugthers;

b. The INDEX and KEY of the mother of a Head-Complement (or Head-Subject) structure is that of the head;

c. The INDEX and KEY of the mother of a Head-Adjunct structure is that of the adjunct.

[21] As a matter of convention we use co-numbered tags to mark identity of attribute values. We use letters for values whose identities are irrelevant.

[22] The formulation of this principle varies slightly from that presented in Copestake et al. (2003), and is more in line with Copestake et al. (2001). It also conforms more to the spirit of the Semantic Principle in Pollard and Sag (1994). Nothing crucial hinges on our formulation.

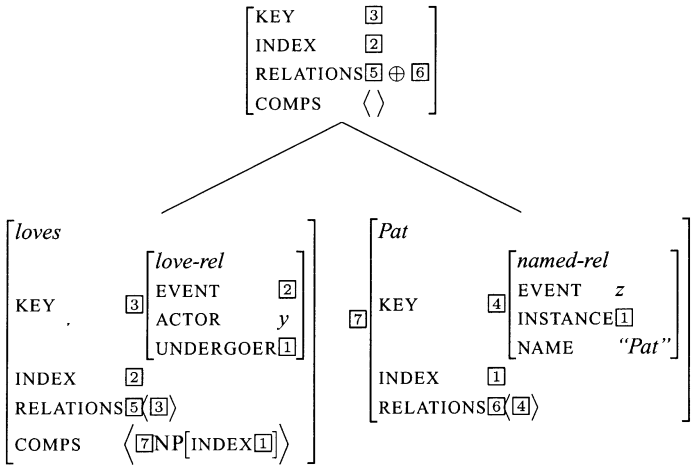


Figure 3. The VP *loves Pat*.

(38a) insures that the semantic contribution of each daughter becomes part of the meaning of the entire phrase by recording the meaning of each daughter on mother nodes. (38b) and (38c) amount to treating the head of a Head-Complement structure and the adjunct of a Head-Adjunct structure as the semantic (but not necessarily syntactic) heads of their respective local trees. Semantic heads provide "visible" information to expressions outside the local tree for purposes of modification or complementation. The upshot of the principles in (38) is illustrated in Figures 3 and 4, which represent the VPs *loves Pat* and *runs fast*, respectively.

As usual in HPSG, the list of complement daughters corresponds to the list of complements the head subcategorizes for (the value of the COMPS attribute, see the co-numbered tags 7).[23] The identification of the mother's INDEX/KEY with the head daughter's INDEX/KEY is marked through the use of the co-numbered tags 2 and 3. Each daughter encodes its contribution to the meaning of the phrase in its RELATIONS and the meaning of the phrase is the concatenation of the meaning of its subconstituents (5 and 6, respectively; ⊕ represents list concatenation). As Figure 4 shows, Head-Adjunct constructs

[23] Technically, only the values of the complement daughters' SYNSEM attributes correspond to members of the head's COMPS attribute. Note also that figures "flatten" the feature geometry of the Attribute-Value-Matrices for purposes of exposition.

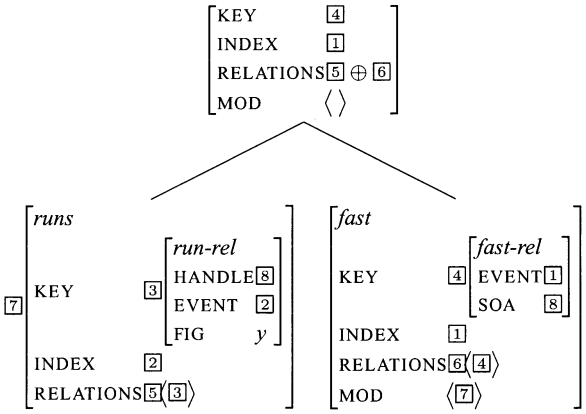


Figure 4. The VP *runs fast*.

parallel Head-Complement constructs but for the fact that the adjunct's INDEX and KEY are now identified with the modifier's INDEX and KEY (see the co-numbered tags 1 and 4). (We assume with Sag, Wasow, and Bender (2003) that modifiers select for the expression they modify through the attribute MOD just as heads select for their complements and that realized complements or modified expressions are removed from the COMPS or MOD lists, through the Generalized Head Feature Principle of Ginzburg and Sag (2001).

The semantic composition principles in (38) must be supplemented by a way for lexical items that denote functors to syntactically select and semantically combine with their arguments (to "hook" their argument positions with the denotation of expressions that they modify or that complement them). If we leave aside the effects of quantifier scope, this can take two forms. First, the content of the functor sign (the head of Head-Complement constructs and adjunct of Head-Adjunct constructs) might include in its KEY EP an argument attribute whose value is identical to the INDEX of the expression which realizes this argument and which the functor syntactically selects (through either its COMPS or its MOD attributes). We call this method of relating the argument positions of functors to their fillers *INDEX-threading*. Figure 3 illustrates INDEX-threading on the English *VP loves Pat*. The argument position for the loved entity (the value of the UNDERGOER attribute) is identified with the INDEX of the complement NP *Pat* (see the co-numbered tags 1). Second, the content of the functor sign (the head of the Head-Complement constructs and the adjunct of Head-Adjunct constructs) might include in its KEY EP an

argument whose value is identical to the HANDLE of the KEY of the element which realizes this argument and which the functor syntactically selects (through either its COMPS or its MOD attributes). We call this method of relating the argument positions of functors to their fillers *HANDLE-threading*. Figure 4 illustrates HANDLE-threading on the English VP *runs fast*. The argument position for the fast event (the value of the SOA or STATE-OF-AFFAIRS attribute) is identified with the HANDLE of the KEY of the modified VP *runs* (see the co-numbered tags [8]).

The semantic import of the two methods of threading argument positions to their fillers can be represented through the two simplified λ-calculus formulas in (39). INDEX-threading results in filling the argument positions of the functor with the value of the INDEX of the expressions it selects whereas HANDLE-threading results in filling the argument position of the functor with the entire EP identified by the HANDLE of the KEY of the expressions it select. In this latter case, the embedded EP can itself semantically select a handle as one of its arguments. Sentences containing multiple aspect markers exemplify such ''recursive'' selection of handles, as we discuss shortly.

(39) a. $\lambda x \lambda e$ (love(e, x, a) $\wedge$ named (a, "Pat"))

b. $\lambda x \lambda e$ (fast(run(e, x)))

If the entire KEY of an expression a functor selects is within its scope, the functor is using HANDLE-threading, otherwise we are dealing with INDEX-threading. For instance, the love relation denoted by *loves* in Figure 3 does not take in its scope the entire EP associated with *Pat* (the EP labeled *named-rel* in Figure 2); hence our use of INDEX-threading in the representation of the meaning of this VP. The fast property denoted by *fast* in Figure 4, on the other hand, *does* take the entire EP associated with *runs* in its scope. (The meaning of *fast* requires the presence of a comparison class which the *run-relation* provides, see Klein (1980).) Since aspect markers, as event description modifiers, take entire event descriptions in their scope, as represented informally in (40), we use HANDLE-threading to model the relation of aspect markers to the phrases that express their arguments.

(40) ASPECT-OPERATOR(EVENT DESCRIPTION)

This introduction to our semantic framework is sufficient, we hope, for readers to understand how our HPSG analysis of the Thai data explains the observations laid out in section 2.

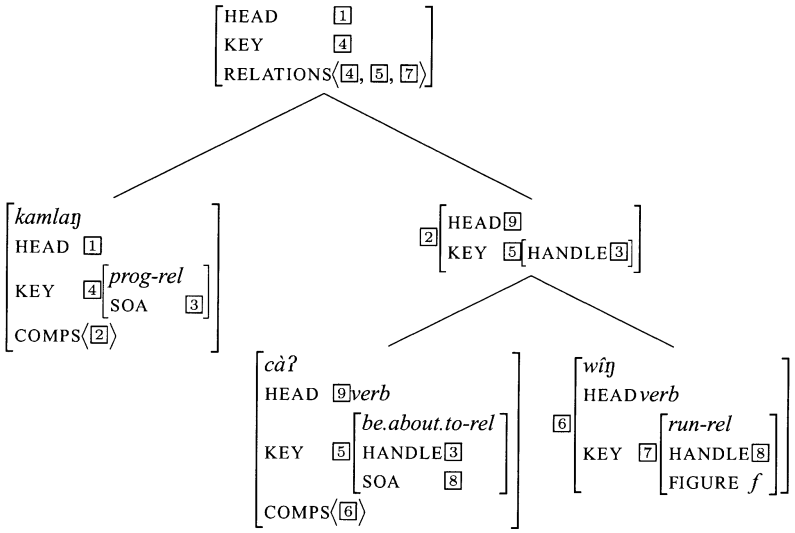


Figure 5. The VP ***kamlaŋ cà? wîŋ*** **'is going to run'.**

4.3. *"Deriving" the facts*

Fact 1 follows from the order of heads and complements and the fact that aspectual heads semantically HANDLE-thread with the meaning of their complements. Since group 1 TAMs are heads that denote functors that semantically select the HANDLE of the KEY of their complements, and complements occur to the right of heads, the relative scope of multiple group 1 TAMs is isomorphic their left-to-right linear order. Figure 5 illustrates this. Note that the Head-Complement schema is used twice in Figure 5 and each time the KEY EP of the head takes as one of its arguments the value of the HANDLE of the KEY of its complement (which is to the right of it). Figure 5 also exemplifies "recursive" HANDLE-threading: *prog-rel* takes a handle as argument, the one labeled 3. This handle identifies an EP, that of *cá?*, which itself takes a handle argument, the one labeled 8. This handle in turn identifies an EP, that of *wîŋ*. The model-theoretic import: of "recursive" HANDLE-threading is easier to understand in the more traditional formula in (41) in which tags identify the EPs that are arguments of functors in Figure 5.

(41) 3 8
PROG (BE. ABOUT. TO (run(e, x)))

Second, and for similar reasons, fact 2 follows from the order of heads and adjuncts and the fact that aspectual adjuncts semantically

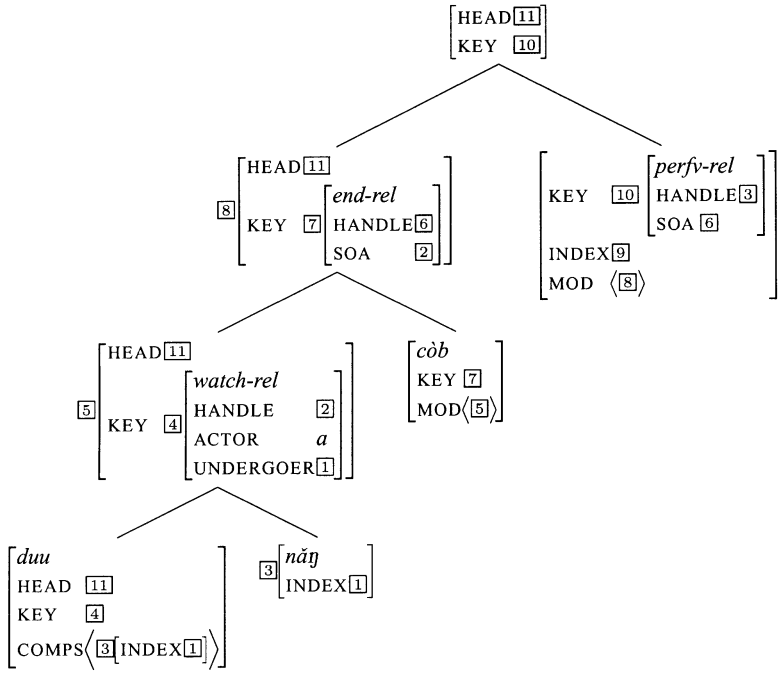


Figure 6. The VP *duu nâj* **cob**.

HANDLE-thread with the meaning of the expressions they modify. Sentence (42a), whose meaning is represented in the formula in (42b), illustrates the isomorphism between the right-to-left order of group 2 TAMs and the outscoping relation. A simplified representation of the relevant part of this sentence is given in Figure 6.

(42) a. Piti duu năŋ **còb paj**
Piti watch movie end PERFV
'Piti ended/finished watching a movie.'

b. PERFV (END (watch(e, x, y)))
6 2

Syntactically, *duu* 'watch' is the head whose *verb* part-of-speech category percolates to the root node of the entire VP (see the tag 11). But, the situation differs semantically. The main VP's KEY is that of its head *duu* 'watch', since it is generated through the use of the Head-Complement schema. But higher VPs' KEYS are that of their modifiers in accordance with principle (38c). Since modifiers occur after the heads they modify and each modifier takes as semantic argument the

HANDLE value of the KEY of the expression it modifies, the outscope relation is now isomorphic with the right-to-left order of TAMs.

As stated, our analysis predicts group 2 TAMs can semantically outscope group 1 TAMs, since the result of combining a group 1 TAM and the main VP is a VP which can itself be modified by a group 2 TAM. In other words, nothing so far prevents the left-association of a group 1 TAM with the main VP (i.e., a structure such as $((TAM_1\ VP)\ TAM_2)$). This prediction is borne out for some speakers. For these speakers, sentence (43) is two-ways ambiguous. In one interpretation *sèd* 'finish' outscopes *rə̂əm* 'start'; in the other, the converse is true.[24]

(43) Wira **rə̂əm** kɛ̀ʔ máj **sèd**
Wira start carve wood finish
'Wira started to finish carving wood.' or
'Wira finished starting to carve wood.'

Many speakers reject the so-called inverse scope reading of sentence (43) in which a group 2 TAM outscopes the group 1 TAM that precedes the main VP. A possible explanation for speakers' variation is that multiple aspect operators sometimes lead to meanings that are difficult to differentiate from a subtlely different meaning expressed more simply and that inverse scope readings are inherently hard to process (see Landman 1996). Alternatively, we can hypothesize that speakers who reject the inverse scope reading have assigned a different part of speech to group 1 TAMs, on the one hand, and VP and *verb* group 2 TAMs, on the other (they have subdivided the part of speech *verb* into two subclasses, say, auxiliary and non-auxiliary verbs) and that group 2 TAMs select for VPs headed by non-auxiliary verbs. We leave corroboration of this rather speculative remark to further research.

Whereas Facts 1 and 2 follow directly from the Non-Uniformity of Thai Hypothesis and general principles of semantic composition, other facts require more idiosyncratic lexical hypotheses regarding the syntactic categories of expressions TAMs select for (either as

[24] An alternative interpretation of this data set, which a reviewer suggested to us, is that the possible ambiguity of sentence (43) steins from the existence of two different lexical entries for *rə̂əm* (corresponding to English 'start' and 'begin') and that the first entry is generated higher than the completive marker *sèd*, while the second is generated lower, along the lines of Cinque (2001) and Cinque (2002). We do not know of any evidence for or against this alternative analysis and leave this matter to further research.

complements or modified expressions). Let's begin with the lexical hypothesis needed to account for the fact that scope to linear order correspondences are preserved when group 1 TAMs follow the main VP, i.e., for the synonymy of sentences (44a) and (44b).

(44) a. Wilaj jéb p^{h}âa **kamlaŋ càʔ sèd**

b. Wilaj **kamlaŋ càʔ** jéb p^{h}âa **sèd**

c. PROG(BE.ABOUT.TO(FINISH(sew(x, y))))

Thai-specific Hypothesis 2, The MOD value of Thai (subject-to-subject) raising verbs and group 2 TAMs includes the MOD value of the *verb* or *marker* expressions they select.

This lexical stipulation parallels more familiar argument composition analyses of auxiliaries and clause-union structures in German or Romance in which a head selects for the complements of its verbal complement (see Hinrichs and Nazakawa 1994; Abeillé et al. 1998 for argument composition analyses of these phenomena within HPSG; see Aissen (1974) for the original Relational Grammar analysis). In a manner similar to the way French auxiliaries or *faire* 'make' select for the complements of their verbal complements, Thai (subject-to-subject) raising verbs (and group 2 TAMs) select for the modified expressions which their verbal complements (expressions they modify) select. We call this kind of composition modified composition.[25]

The verb *kɔ̀ɔd* 'happen' in sentences (45) illustrates our claim that modified composition is not restricted to group 1 TAMs and is a property of all Thai (subject-to-subject) raising verbs. *Kɔ̀ɔd* can either precede or follow the main VP, with no difference in the class of

[25] A reviewer wonders whether proponents of the UH can avail themselves of Principles and Parameters analyses of clause-union. We cannot review here the numerous analyses of clause-union within the Principles and Parameters approach. Most of them assume that the behavior of clause-union verbs derives from the fact that their "sentential" complements are not CPs, but either IPs or VPs (either through a deletion process, as in Rouveret and Vergnaud 1980 or through lexical subcategorization statements, as in Moore 1991). Since the semantic interpretation of group 1 TAMs does not vary with their pre- or post main VP position, this kind of clause-union analysis is incompatible with the UH hypothesis that functional categories are strictly and universally layered. Furthermore, it does not account for the co-occurrence problem. Rosen (1990) hypothesizes that clause-union verbs compose their argument structures. But, since functional heads are not assumed to have argument structures, this analysis of clause-union cannot be adapted to the Thai aspectual system and would not, in any case, account for the right-to-left scopal order of group 2 TAMs.

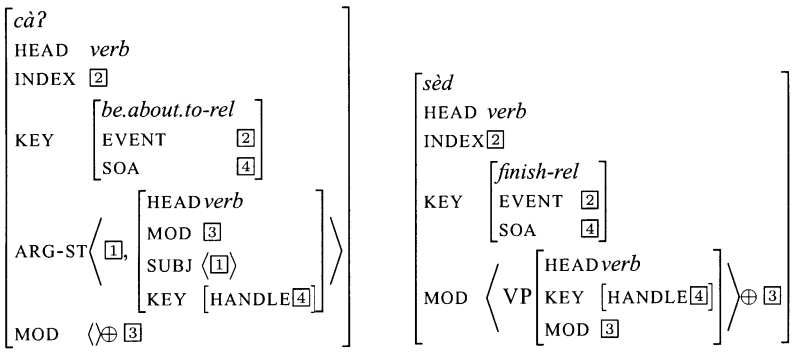
situations the overall sentence felicitously describes. To insure that the semantic argument of *sèd* is the denotation of the main VP in sentence (45b), we need to assume that *kàəd*, like *kamlaŋ* or *càʔ*, is required to modify whatever *sèd* selects as modified expression.

(45) a. Surii **kàəd** t^{h}am ŋaan **sèd** **k^{h}ûun** **maa**
Surii happen do work finish SEMI-PERFV PERF

b. Surii t^{h}am ŋaan **kàəd** **sèd** **k^{h}ûun** **maa**
Surii do work happen finish SEMI-PERFV PERF
'Surii happened to finish working.'

Figure 7 represents simplified lexical entries for *càʔ* and *sèd*. Both TAMs are lexically constrained to modify what their complement/modified expression select as modified expression, as indicated by the fact that their MOD values include the MOD values of their complements or modified expressions (see the MOD value numbered [3]).

These lexical entries insure the semantic synonymy of sentences (44a) and (44b), as the representation of the VP in sentence (44a) diagrammed in Figure 8 illustrates. *Càʔ* modifies whatever *sèd* modifies, and in turn, *kamlaŋ* modifies whatever *càʔ* modifies (see the co-numbered tags [5]). Through such modified composition, the entire phrase *kamlaŋ càʔ sèd* can be taken to syntactically modify the main VP *jéb p^{h}âa*. Furthermore, since the HANDLE of the KEY of the main VP is identified with the SOA argument of the KEY EP of *sèd* (see the co-numbered tags [6]), the main VP is within the immediate semantic scope of *sèd* and, since both *kamlaŋ* and *càʔ* outscope *sèd*, all TAMs



(a) *càʔ* (b) *sèd*

Figure 7. Simplified lexical entries for *càʔ* and *sèd*.

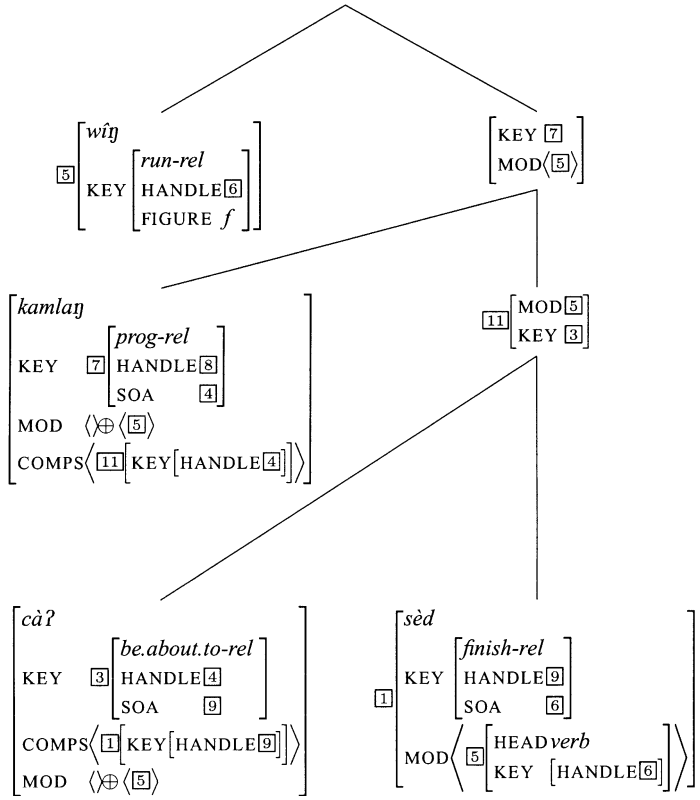


Figure 8. The *wîŋ kamlaŋ cà? sèd* 'be about to finish running'.

have scope over the main VP. The resulting scope is informally diagrammed in formula (46). (4 points to the meaning of cà?, 9 to that of *sèd,* and 6 to that of the main VP.)

(46) 4 9 6
PROG (BE.ABOUT.TO (FINISH (sew(x, y))))

A comparison of the VP represented in Figure 8 and the semantically synonymous VP represented in Figure 9 vividly exemplifies the role modified composition plays in accounting for the event-synonymy of sentences (44a) and (44b). The complement of *cà?* is *wîŋ sèd* in Figure 9. Since *wîŋ* is not a raising verb or a group 2 TAM, it is not required to modify what its complement modifies. Hence its MOD value is the empty list, the value for words and phrases which do not select for a modified expression. It is therefore the empty list value of

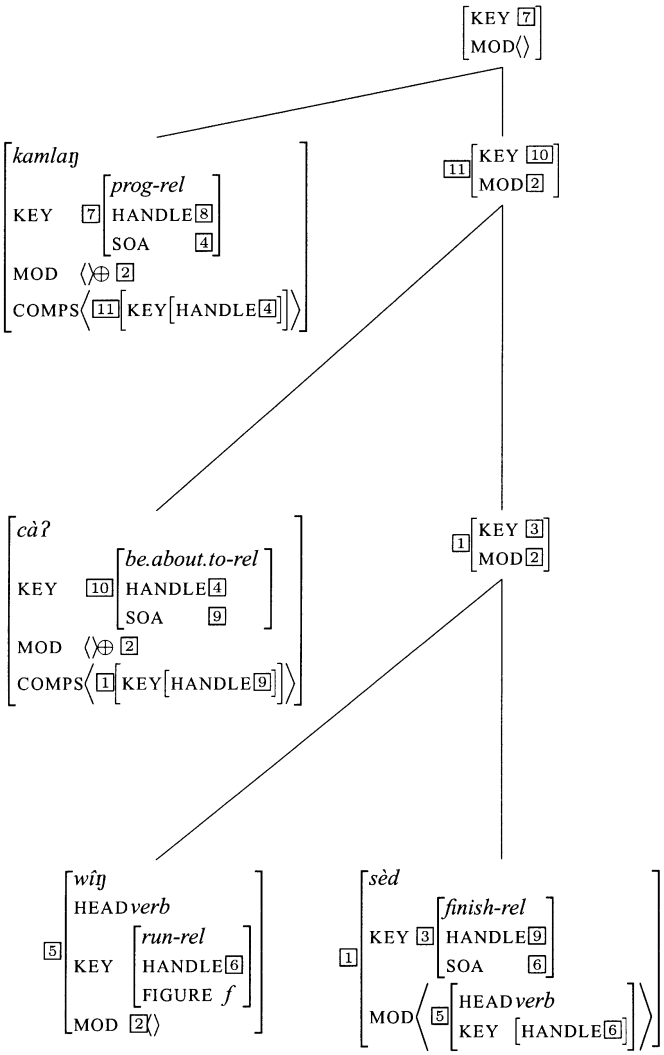


Figure 9. The VP *kamlaŋ cà? wîŋ sèd* be about to finish running'.

its complement that *cà?* concatenates to its own (empty) list of expressions to modify and transmits to *kamlaŋ* (see the co-numbered tags 2). The entire VP therefore does not select for a modified expression. Furthermore, semantically, *kamlaŋ* takes the HANDLE of its complement as its argument and so does *cà?*. Since the KEY of the phrase *wîŋ sèd* is that of its modifier *sèd* (see (38c)), the overall

semantics of the VP is identical to that of the VP represented in Figure 8.

In sum, the principles in (38) and our first lexical hypothesis correctly predict that, despite their differences in linear order, scope relations are identical in sentences (44a) and (44b). This can be achieved without abandoning the robust generalization that what follows an XP in Thai is modifying it. *Sèd* still semantically and syntactically selects the expression it modifies, i.e., the main VP, in Figure 8. But it does not satisfy its selection of a modified expression on its own. It does it indirectly, through complementing *càʔ*, which inherits its selection of a modified expression from *sèd* and then passes it up to *kamlaŋ*.

The analysis we provided of sentences such as (44a) assumes that when group 1 TAMs occur after the main VP, they take group 2 TAMs as complements. This analysis, together with the classification of parts-of-speech we derived from the co-occurrence restrictions between TAMs and negations (see table II), provides an account of Fact 4, provided we make the fo11owing additiona1 assumption.

Thai-specific Hypothesis 3. Group 1 TAMs subcategorize for phrases headed by a *verb*.

This second lexical stipulation correctly predicts that group 1 TAMs can take phrases headed by other group 1 TAMs as complement since group 1 TAMs are always *verb*s. Thus, *kamlaŋ* can take *càʔ*, *sèd* or VPs as complements. It also allows group 2 TAMs that are *verbs* such as *sèd* to complement *càʔ*. Finally, it correctly rules out sentence (18b) since *kʰûun* is a marker. Figure 10 illustrates. *Kamlaŋ* selects for a complement of category *verb*, but *kʰûun* is of category *marker*. The clash in feature values excludes any tree which includes this local tree.

To summarize, the RMH analysis we have outlined answers question (19a) by splitting the semantic class of aspect markers into two syntactic subclasses, those aspect markers that select for complements and those aspect markers that are syntactic adjuncts selecting for expressions to modify. It answers question (19b) by positing that aspect markers lexically induce function composition (modified composition) and that group 1 TAMs subcategorize for VP complements.

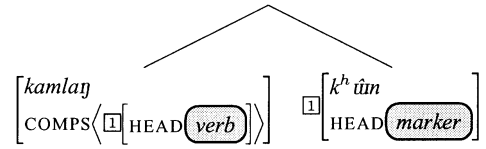


Figure 10. Why group 1 TAMs cannot take a *marker* as complement.

5. Two Other Analyses

5.1. *A Hybrid: The Weak Uniformity Hypothesis*

Much work which assumes the correctness of the split Infl hypothesis (Pollock 1989) subscribes to some version of the LOP and FCP. But, weaker hypotheses are consistent with the overall split Infl hypothesis, as some scholars have explicitly advocated.

> *Hypothesis 4 (Weak Linear order principle (WLOP))*. Linear order mostly reflects hierarchical structure: Heads and specifiers are initial in their local trees (in SVO languages), but not necessarily adverbs.
> *Hypothesis 5 (Weak uniformity of functional categories principle (WFCP)*. For a given language and a fixed lexical array, there is only one "deep" syntactic structure built from this array.[26]

Under these hypotheses – which, to a significant extent, assume some form of representational modularity, since the "deep" syntactic structure is not isomorphic to the (relevant) semantic structure anymore – a possible analysis of TAMs would posit that group 1 TAMs head functional projections while group 2 TAMs are adverbs adjoined to the right of the maximal projection they modify. (47) diagrams the "deep" structure of the sentences in (7).

(47) [kamlaŋ [cà? [VP sèd]]]

The surface linear order in sentence (7a) is now accounted for without VP movement. The mirror mapping between linear order and scope relations of group 2 TAMs exemplified in sentence (12a) is also accounted for without postulating movement of group 2 TAMs, as (48) shows.

[26] We need to restrict hypothesis 5 to clauses of the same type since different clause types might have different functional category projections within a single language, as argued in Thráinsson(1996).

(48) [càʔ [[VP sèd] paj]]

VP movement is still needed, though. Sentence (7b) is accounted for by moving the main VP to the specifier position of the projection headed by *kamlaʔ*, as shown in (49). Sentence (7c) is accounted for by moving the main VP to the specifier position of the projection headed by *càʔ*.

(49) [VP_i [kamlaŋ [càʔ [t_i sèd]]]]

This analysis of the Thai aspect system adequately answers the mirror problem. It explains the difference between group 1 and 2 TAMs in their linear order to scope correspondences by relying on independently motivated syntactic generalizations (cross-categorial order of head and modifiers; historical source of many group 2 TAMs in the Thai serial verb construction). Assuming VPs move only to the left, the fact that the main VP can only precede group 1 TAMs receives a motivated explanation. This analysis also eschews the attribute-value assignments mentioned in (35a) and (35b). More generally, it parallels the HPSG account of the mirror problem and demonstrates that providing a motivated answer to the mirror problem presents no particular difficulty to a movement analysis, *provided* the UH is abandoned.

But, this analysis does not fare as well with the co-occurrence problem. It does not directly provide an answer to why VP movement to the specifier position of group 1 TAMs is possible only if the main VP complements a group 2 verb, i.e., why sentences (10b)–(10d) are ungrammatical. An appeal to *head*-government is not available under the WLOP or WFCP, since group 2 TAMs are modifiers adjoined to the VP they modify. To summarize, like the HPSG analysis, the weaker WLOP or WFCP hypotheses answer question (19a) by postulating a difference in the base structure of group 1 and groups 2 TAMs. Even more so than the UH, these approaches have trouble properly restricting VP movement to the specifier position of group 1 TAMs only when the main VP is modified by a *verb* group 2 TAM.

5.2. *Another Non-transformational Approach to Thai Aspect*

To provide a better understanding of why our HPSG analysis more easily models the Thai aspect system, we now outline an account of the same data within a multi-modal Combinatorial Categorial Grammar (or CCG) approach to language (see Steedman (2000) for

an introduction to CCG and Baldridge (2002) for multi-modal CCG).[27] Leaving aside technicalities, a CCG account of scopal relations between Thai aspectual operators relies on two hypotheses our HPSG analysis also relied on. First, group 2 TAMs are modifiers which select for the expressions they modify. Second, some heads can select the modified expressions their complements select and some modifiers select the modified expressions that the modified expressions they modify select (function composition). Both hypotheses are part of CCG. The forms of function composition needed to handle the Thai aspectual data arc given in (50). As customary, what precedes the double-shafted arrows indicates the syntactic categories of the expressions that are to combine and what follows the arrow represents the syntactic category of the resulting combination. Categories such as VP_Y/VP ($VP_Y\backslash VP$) comprise all expressions that require a VP complement to their right (left) to form a VP_Y.[28]

(50)a. $VP_Y/VP\ VP/VP \Rightarrow_B VP_Y/VP$ (Forward composition, $>$B)
b. $VP_y\backslash VP\ VP\backslash VP\ , \Rightarrow_B VP_Y/VP$ (Backward composition, $<$B)
c. $VP/VP\ \ VP_Y\backslash VP \Rightarrow_B VP\backslash VP_Y$ (Cross-forward composition, $>B_X$)

The kind of composition whose schema is given in (50a) says that combining an expression looking for a VP to its right (to form a VP_Y) and a following expression also looking for a VP to its right (to form a VP) results in an expression which looks for a VP to its right (to form a VP_Y). The second kind of composition, whose schema is given in (50b), is the mirror image of the first schema. It says that combining an expression looking for a VP to its left (to form a VP_Y) and a following expression also looking for a VP to its left (to form a VP) results in an expression which looks for a VP to its left (to form a VP_Y). The third kind of composition, whose schema is given in (50c), says that combining an expression looking for a VP to its left (to form a VP_Y) and a preceding expression looking for a VP to its right (to form a VP) results in an expression which looks for a VP to its left (to form a VP_Y). With the help of these three function composition schemata and ordinary functional application, one can easily model Facts 1-3 and explain the

[27] We thank Pauline Jacobson and Mark Steedman (p.c.) for discussing the content of this section with us.

[28] Because inputs and outputs in our examples are VPs, we have subscripted *Y* to the output VP. For space reasons, we concentrate on the syntactic side of composition in this brief presentation.

$$\dfrac{\text{VP}_{\text{main}} \qquad \dfrac{\text{kamlaŋ :VP/VP} \qquad \dfrac{\text{cà?:VP/VP} \qquad \dfrac{\text{sèd:VP\VP} \quad \text{paj : VP\VP}}{\text{sèd paj:VP\VP}}\,{<}B}{\text{cà? sèd paj:VP\VP}}\,{>}B_X}{\text{kamlaŋ cà? sèd paj:VP\VP}}\,{>}B_X}{\text{VP}_{\text{main}}\ \text{kamlaŋ cà? sèd paj:VP}}\ \text{Func.Appl.}$$

Figure 11. Syntactic (and semantic) composition in Combinatory Categorial Grammar.

mirror problem. Figure 11 presents the proof tree of a sentence whose main VP is Followed by groups 1 and 2 TAMs.

As is, the CCG analysis does not fare well on the co-occurence problem. This is because syntactic categories are exclusively defined by the category of their input and output and the required position of their input. The category of *all* group 2 TAMs is therefore the same, since they all are VP modifiers that follow the expressions they modify. Crucially, the distinction between *marker* and *verb* group 2 TAMs is lost. To solve the co-occurrence problem, lexical items must be able to restrict the kinds of combinatory rules that can apply to them, as suggested in Jacobson (1990) for raising verbs and in Baldridge (2002) more generally. Space prevents us from going into the technical details of multi-modal CCG. The following should suffice for present purposes. In HPSG, the syntactic category of functors distinguishes between their part-of-speech information (recorded in the value of the HEAD attribute) and their combinatorial information (recorded in the values of their various valence attributes (COMPS, SUBJ, MOD, and SPR)). Group 2 TAMs are all similar in selecting a VP on their MOD list and adding the unsatisfied MOD requirements of the expression they modify to this MOD list. But they differ in their part of speech. Some are *marker*; some are *verb*. The distinction between slash categories, such as $VP\backslash VP$ (the pendant to HPSG's valence attributes) and slash types which can adorn slashed categories such as $_{o}$ in $VP\backslash_{o}VP$ (the pendant to HPSG's part-of-spceech information) plays the same role in multi-modal CCG (see Baldridge 2002 for details).

6. Comparing the Analyses

We can now compare UH-based and RMH-based analyses of the Thai data. Evaluating competing analyses across frameworks is an enterprise fraught with pitfalls. What seems like an *ad hoc* stipulation

for some is a natural consequence of first principles for others. Nonetheless, in an attempt to evaluate the UH and RMH hypotheses, we propose that costs of analyses be weighed along three dimensions, as in (51).

(51)a. Empirical coverage;

b. Independent justification of the analytical tools and hypotheses (both cross-linguistic and language internal);

c. Number of stipulations.

With these dimensions in mind, let's review how our main analyses answer the questions the Thai data raise.[29]

1. Why does the relative scope of group 1 TAMs mirror their left-to-right order but that of group 2 TAMs mirror their right-to-left order?

The RMH answer is two-fold. First, heads precede complements and modifiers follow the expressions they modify. Second, group 1 TAMs select complements whereas group 2 TAMs are modifiers. The relative scope of group 1 TAMs follows from the fact that heads precede their complements in the UH analysis too. The relative scope of group 2 TAMs, on the other hand, follows from the assumption that expressions can move only left-ward (see Kayne 1994) and the fact that group 2 TAMs bear the relevant formal feature (see (35b)).

2. Why can certain TAMs only occur after the main VP?

The RMH answer is the same as its answer to the first question. Some TAMs are modifiers. The UH analysis models the same data by stipulating that main VPs bear certain formal features that must be checked by (the projection of) a higher functional head (see (35a) and (35c)).

3. Why can certain TAMs occur both before and after the main VP?

The RMH answer is that Thai raising verbs select the same expressions to modifiy as their *verb* complements, very much like auxiliaries and causatives in Romance languages can undergo argument composition. The UH as well as the WLOP or WTCP answer is that the feature responsible for the movement of main VPs to the

[29] For brevity, we refer to answers provided in sections 3 and 4 as the UH and RMH answers, respectively.

specifier position of group 1 TAMs is weak, in the sense of Pollock (1989).

4. Why can the main VP precede group 1 TAMs only if the group 1 TAM is followed by a group 2 TAM?

The RMH answer is selectional. Group 1 TAMs select for complements and complements occur to the right of their heads. As we pointed out in section 3, the UH analysis as well as analyses which follow the weaker WLOP or WFCP hypotheses do not seem to be able to answer this question.

5. Why can only certain group 2 TAMs immediately follow group 1 TAMs?

The RMH answer is again selectional: Group 1 TAMs select for VPs not markers. The UH answer is that only group 2 *verbs* head-govern their complements. Analyses which follow the weaker WLOP or WFCP hypotheses do not seem to be able to answer this question.

This brief summary shows that both hypotheses can cover most of the Thai aspect data. This is not surprising, since linguistic frameworks have rich enough toolkits to *describe* most possible data sets. But, the two hypotheses differ in the complexity of the resulting analyses. The universality of the aspectual "deep" structure that the UH posits comes at a severe cost. Its account of the mirror problem stipulates formal features that have no independent support in the grammar of Thai. Its account of part of the co-occurrence problem arbitrarily groups together group 1 and *marker* group 2 TAMs (neither group head-governs their complements). Finally, it does not account for the fact, that main VPs that do not complement a group 2 TAM cannot precede group 1 TAMs. In contrast, the RMH analysis only relies on syntactic categories that are independently motivated within Thai. It draws on the cross-categorial order of heads and syntactic adjuncts, the order of heads in the historical source of most group 2 TAMs (serial verb construction), and a universally available function composition lexical class to model the mirror problem. It accounts for the co-occurrence problem through run-of-the-mill subcategorization. Group 1 TAMs select for VPs; their complements' heads must therefore be *verb*s (hence not group 2 *marker*s). More generally, HPSG's RHM hypotheses that semantic modifiers can either participate in a head-complement *or* head-adjunct structure and that words can lexically induce function composition predict the

possibility of an aspectual system like that of Thai. In contrast, the kind of dissociation between linear order and scope which TAMs exhibit is quite unexpected, if the UH is correct. This difference in how the two analyses fare along dimension (51b) highlights our claim that the Thai aspect system challenges the UH.

The difficulties a UH analysis encounters in modeling the mirror and co-occurrence problems might be deemed acceptable if it were so much simpler, i.e., if the *number* of stipulations that the RMH requires was much greater than those required by the UH analysis. But, we do not think this is the case. (52) summarizes the number of stipulations incurred by the RMH analysis.

(52)a. *Classficatory statement* (1): There is a distinct category *of marker* in Thai;

b. *Selectional statements* (15): group 2 TAMs and Thai raising verbs participate in modified composition (2); Thai raising verbs select for a VP (1); each group 2 TAM selects for a modified expression (12);

c. *Membership statements* (9): Some group 2 TAMs are *markers*.

We did not multiply the modified composition and *verb* complement selection stipulations by the number of TAMs since we assume that the lexicon is organized in a hierarchical manner, as proposed in Flickinger (1987) and subsequent *HPSG* work. These two stipulations are declared for the general class of subject-to-subject raising verbs and group 2 TAMs and should only be counted once per word class. Whether the membership statements should be counted as stipulations is not clear since the distinction between verb and marker group 2 TAMs is needed to explain the negation data.

Counting the number of stipulations of the UH is more difficult, since how formal features driving movement operations are introduced into lexical entries is not clear. We propose the following tentative stipulation enumeration.[30]

(53)a. *Existence statements* (3): Three formal features induce the movement of TAMs and the main VP;

[30] The UH might also need to stipulate that marker group 2 TAMs form a distinct part of speech to explain the negation data.

b. *Membership statements* (18): Each group 2 TAM but *maa* (which must occur last) bears the $+F_{\text{Mgroup2TAM}}$ feature (11); each main VP Can bear the $+ F_{\text{Vgroup2TAM}}$, $+ F_{\text{Mgroup2TAM}}$, and $+ F\text{M}_{\text{group1TAM}}$ features; the $F_{\text{group1TAM}}$ features; is weak (assuming that features are universally strong by default) (4); group 2 verbs head-govern their complements (3).

These stipulation counts are, of course, very preliminary and should be considered with caution. They nonetheless suggest that the HPSG RMH is no more *ad hoc* than the UH. The former requires either 16 or 25 stipulations, depending on whether or not assignment of some group 2 TAMs to the *marker* part-of-speech is counted as a stipulation; the latter requires 21 or 30, depending on whether the part-of-speech *marker* is required to model the negation data.

7. Conclusion

This paper has presented the syntax and semantics of the Thai aspect system. We showed that some TAMs can precede *or* follow the main VP, while others must follow the main VP and that the ability of the former to also follow the main VP is severely constrained. We further showed that these two classes of aspect markers display inverse relations between their linear order and relative scope. The scope of the first group is determined by their left-to-right order, irrespective of their position in the string, while that of the second group is determined by their right-to-left order. We provided two main competing analyses of the data. We first outlined an analysis based on the hypothesis that "deep" syntactic structures are isomorphic to the semantic structure of (syntactically active) semantic functional categories. We then discussed an analysis which relies on a weaker hypothesis and allows more than one structural configuration to satisfy the semantic and selectional properties of words. We showed that this weaker hypothesis is more successful in modeling the converse correspondence between linear order and scope of the two groups of TAMs and constraints on the post-main VP occurrence of those aspect markers which can precede the main VP. It can analyze the full complexity of the data with only independently motivated tools. The tools and features are the same as those used in many constructions across languages, and the language-specific feature values it posits (Thai-specific part-of-speech categories, syntactic

selection properties, modified composition) are all independently motivated by data that do not involve aspect markers. Now, one should not draw conclusions that are too broad from the superiority of the RMH in modeling the syntax of aspect in Thai. As was pointed out to us, the UH is more restrictive than the RMH and should not be abandoned too lightly. A final assessment of the two hypotheses will have to await more data from more languages. In the meantime, we hope this paper provides a cautionary tale against the assumption, implicit in many Split Infl analyses, that the relation between scope and ''deep'' phrase structure configurations is simple.

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