

Stage structure and stage salience for event semantics

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Draft version

1 Introduction

It is generally considered at least since Moens & Steedman (1988) that eventualities should be decomposed into sub-eventualities or *stages* (cf. also Parsons 1990, Smith 1991, Kamp & Reyle 1993). Formal models of situation structure seldom pay attention to the actual ontological status of stages – either assuming that situations (a cover term I will be using to refer to any type of eventuality, whether stative or not, cf. Smith 1991) should be reified (following Davidson 1967) or should be represented as propositions associated with some interval semantics (cf. e.g. Partee 1973, Verkuyl 1993). De Swart (1998) is a notable exception to this ; but I will show here that the type of treatment she advocates (namely one based on the idea that the aspectual contribution of tenses only involve *aspectual type shifts*, and no such a thing as an *aspectual viewpoint*, as proposed in e.g. Guillaume 1929 and Smith 1991) cannot account for certain facts, and notably for phenomena resorting to what I will call *stage salience* – intuitively, the varying ability of stages to be made ‘visible’ in particular syntactic and semantic contexts.

Before moving to the study of stage salience, I will propose a formal treatment of situation structure and tense aspectual semantics that incorporates the notions of *aspectual focus* and *aspectual viewpoint*.

2 Defining stage structure

2.1 Types of stages

I argue that (at least) three canonical types of stages should be distinguished when trying to describe lexical aspectual information (which I will call *stage structure*) associated with *predicative structures* (namely a verb and its full complementation) :

- i) *inner stages* are ascribed to all situation types; they are their ‘core’ stages, i.e., what Smith (1991) calls *developments* ; if a situation is telic, the inner stage includes its terminus (culmination¹) ; they are selected by unmarked uses of the *past progressive* or *simple past*, and if non atomic (non punctual), by *begin* and *start*;
- ii) *preparatory stages* are causal stages instantiated for some types of atomic (so-called ‘punctual’) telic situations ; they are selected under *prospective readings* of the past progressive (cf. *John was winning the race*); moreover, they are *peripheral* to the stage structure (they are ‘detachable’ from it, as argued in Smith 1991), having a presuppositional status (they remain valid under negation and modality ; thus *John did not win (the race)* entails the validity of a preparatory stage) ;
- iii) *result stages* are resultative subsituations ascribed to all situation types, with major differences between telic and atelic ones ; they can be described by sentences in the *perfect*.

These three types of stages can be used to make up a variety of situation types. In this paper, and following Caudal (2000a), I distinguish between three basic situation types: *terminations* (telic, dynamic), *processes* (atelic, dynamic) and *states* (atelic, non-dynamic). *Dynamcity* indicates that an event has some causal content. In addition, I define *atomicity* as a property of terminations that cannot be interrupted then

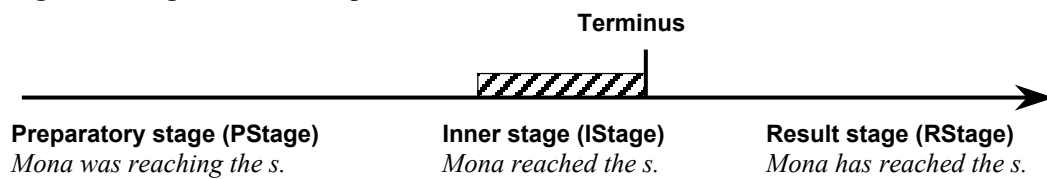
¹ I will not regard terminuses (final points of inner stage) as stages because tenses cannot focus on them isolatedly, going against a current trend in the literature ; cf. e.g., Kamp & Reyle (1993).

resumed ; the inner stages of atomic terminations are devoid of proper subparts². Contrariwise, non-atomic predicative structures describe situations that can be interrupted then resumed. They allow for the *perfect progressive*³, and are compatible with *completely* and *finish*, cf. (1), whereas atomic termination sentences reject all those markers, cf. (2):

- (1) a. *John finished drawing the circle.* (non-atomic termination)
 b. *John has been drawing the circle.*
 c. *John drew the circle completely.*
- (2) a. **John finished leaving* (atomic termination)
 b. #*John has been leaving.* (OK only if iterative)
 c. #*John left completely.* (OK if frequentative)

I am giving in Figure 1 an illustration for the application of stage decomposition to an atomic telic situation described by the predicative structure *Mona – reach the summit*. Note that each stage can be described isolatedly using specific tenses, as shown in italics at the bottom of the figure.

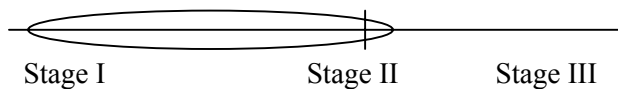
Figure 1 : Stage structure for predicative structure *Mona – reach the summit* :



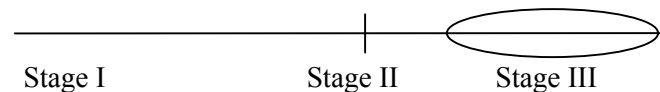
2.2 Comparison with existing theories of stage structure

Let us now briefly review the main differences between the present theory of *stage structure* and related existing theories. I will particularly focus on the theory of stage structure proposed in Kamp & Reyle (1993), bearing in mind that many of the points made here extend in fact to similar models (e.g. Moens & Steedman 1988, Parsons 1990, de Swart 1998). I am giving in (3)-(5) the stage decomposition attributed by Kamp & Reyle to the situations described by the corresponding sentences. They show that these authors assume a viewpoint based approach to aspectual semantics.

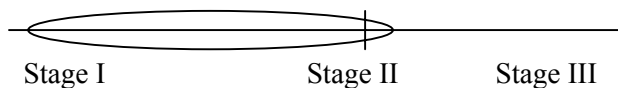
- (3) *Mary wrote a letter.*



- (4) *Mary has written a letter.*



- (5) *Mary reached the summit.*



² Note that although punctual telic events (i.e. Vendler's achievements) are always atomic, atomic telic events may not be punctual (**the ship has been sinking*, cf. Caudal 2000a). Punctuality thus seems to be a complex category combining atomicity and non-durativity. I will therefore not make use of the achievement/accomplishment distinction.

³ I take sentences in the *perfect progressive* to describe 'intermediary' result states.

Two striking differences appear my model and Kamp & Reyle's : first, Kamp & Reyle (1993) consider that *terminuses* (*Stage II* on the above diagrams), are a kind of stages of their own (whereas I consider *Stage I* and *II* to be one and a single stage, *Stage II* being merely the endpoint of *Stage I*). Second, they assign a similar stage structure to so-called 'achievements' (cf. (5)) and so-called 'accomplishments' (cf. (3)) (whereas my model would attribute them different stage structures ; *reaching*-situations should receive a preparatory stage, an inner stage and a result stage, whereas *writing*-situations would only receive an inner stage and a result stage).

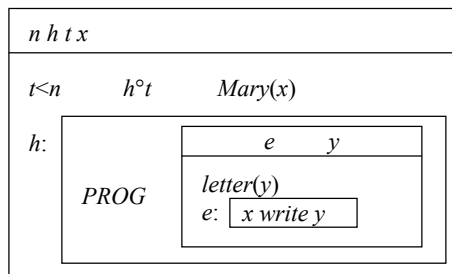
I believe the following points stand in the way of Kamp & Reyle's approach to stage decomposition. First, it fails to capture the very peculiar nature of the 'Stage II' part of *reaching*-situations – for indeed it is *presuppositional*. Smith (1991) theory of stage structure introduces a distinction between *detachable* and *non-detachable* 'Stages I' ; I call the former *preparatory stages*⁴ to express this distinction. Second, Kamp & Reyle (1993:558) argue that aspectual viewpoints select one or several stages. Although I agree that aspectual viewpoints *can* select several stages at the same time, I claim in addition that stages that are never singled out by any tense are not full-fledged stages. Consequently, since 'Stages II' cannot be singled out by any tense (at least in the case of non-atomic telic sentences), they should not count as stages of their own right. Moreover, I believe that the type of stage decomposition I propose for atomic telic verbs like *reach* (namely a preparatory stage followed by an atomic inner stage, and of course a result stage) are intuitively more satisfying than Kamp & Reyle's. Indeed, by considering that inner stages are 'core' stages, my theory can account for the intuition that the (atomic) interval at which someone *reaches* some location plays somehow the same aspectual role as the interval at which someone *writes a letter* – in both cases they are the 'central' part of the described situations. Contrariwise, Kamp & Reyle (1993) will treat these two stages as distinct types of stages. Finally, Kamp & Reyle's theory of stage structure can be regarded as redundant inasmuch 'Stages II' exist only if 'Stages III' exist, and vice versa – one could dispense with either of the two in order to represent telic situations. I take this to be an indication of the fact that 'Stages II' are not stages but merely final endpoints for the inner stages of telic situations.

2.3 Correlations between a model of lexical aspect and a model of grammatical aspect

Most formal accounts of stage structure consider that within a (neo-)Davidsonian framework, all result stages and most preparatory stages are introduced *via* aspect-shift operators.

Thus, assuming that *Discourse Representation Structures* or DRSs⁵ (noted *K*) can be used to model situation descriptors and that $e:K$ notes a situation *e* described by DRS *K*, de Swart (1998) argues for instance that the *perfect* creates result states through an aspect-shift function *PERF* mapping DRSs describing any eventuality type onto stative DRSs, and that the *progressive* maps event DRSs (dynamic situations) onto stative DRSs situations via a *PROG* operator (cf. Figure 2 for an illustration of the formal treatment she proposed within the DRT framework).

Figure 2 : DRS for *Mary was writing a letter* (de Swart 1998)



⁴ Detachability expresses the fact that a stage is not *conceptually* part of an event, but rather some kind of 'satellite' stage.

⁵ I assume some degree of familiarity of the reader with the DRT (*Discourse Representation Theory*, cf. Kamp & Reyle) framework in what follows.

Whether operators introducing stages are syntactically licensed by tenses or appear through coercion mechanisms is not a matter of concern to me here⁶. The point is that under such a view, preparatory and result stages are *derived* rather than *primitive* stages ; lexical entries⁷ of verbs are merely inner stage descriptors from which other stages are constructed. Contrariwise, it is argued here (following Caudal & Roussarie 2000 and Caudal 2000a) that several eventuality descriptors should be lexically associated with verbs⁸, thus constituting a richer lexical basis for aspect calculus. Related views are defended in Higginbotham (2000), which treats verbs as descriptors of lists of eventualities. Note that one could in principle salvage an aspect-shift operator based approach by encoding in the lexicon at least some information about stage salience. It would essentially boil down to obliterating the difference between viewpoint-based and aspect-shift operators-based approaches to aspect calculus, since it would amount to recognize that stage structure information can be *primitive* and is not purely *derived*.

Indeed, there seems to exist strong correlations between the nature of a given model of lexical aspect and that of the associated model of grammatical aspect. It is perfectly nonsensical for a theory of grammatical aspect relying solely on aspect-shift operators to assume that stage information should be lexicalised, since peripheral stages (and all types of aspectual interpretations, in fact) are *derived* from inner stages in a dynamic fashion. But if it can be shown that stage information *must* be lexicalised, then such an approach would be in danger of over-generating aspectual interpretations (by deriving unwanted stages and therefore aspectual interpretations). I will try and show in some further section of this paper that it is indeed the case. The point is that our model of grammatical aspect must fit our model of lexical aspect.

However, this does not mean that the very idea of a model of grammatical aspect involving aspectual type-shifts should be abandoned. It would merely mean that such a model must *also* incorporate some notion of viewpoint along with a richer model for lexical aspectual information. Part of the question I intend to answer here is in fact that the now well-established opposition between aspect shift vs. viewpoint approaches to grammatical aspect may not be as absolute as many authors seem to assume (see e.g. de Swart 1998⁹). As noted by J. Jayez (p.c. ; see also Jayez 2002), the *formal* differences between viewpoint and aspect-shift-based theories is almost impossible to assess because only the latter have been formally ‘materialized’, the latter remaining (at least from an ‘hardcore’ model-theoretic stance) largely vague as to the formal means they should make us of. I will try and show here that even a viewpoint based approach to grammatical aspect must incorporate some notion of aspectual shift (and this is indeed the case in Smith 1991, at least in a covert manner), whereas conversely, an aspect-shift based theory of aspect cannot dispense with a viewpoint and aspectual focus-like mechanism. This results in largely neutralizing the difference between these two types of approach.

3 Stage salience

Having disserted at some length on the problems that await us, I intend to move to the actual core of my argumentation, by showing (i) why stage salience is an empirically identifiable part of lexical aspectual information (section 3.1), and (ii) to give a tentative classification of telic ‘verb constellations’ (to use Smith’s terminology) in terms of stage salience (section 3.2).

⁶ However, see Bonami (2002) for a plea against de Swart’s aspectual coercion operators.

⁷ Whenever I refer to the aspectual content of lexical entries, I intend to refer to *disambiguated* lexical entries, involving specific uses of verbs – and therefore, lexical items *in context* rather (i.e., involving a specific argument structure as well as semantic relations with its argument NPs, e.g. selection restrictions) than ‘crude’, out-of-context lexical items.

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⁹ For instance, H. de Swart (p.c.) does not reject the idea that viewpoint operators may exist in a model of tense & aspect semantics, provided (i) aspect shift / coercion operators are nevertheless allowed and (ii) viewpoint operators apply at a higher level than the latter (in fact at the same level as time operators in her model). I believe that most proponents of the viewpoint approach do or could agree with such a view. For instance, Smith (1991) implicitly adopts such a dual treatment based on both aspect shift and aspectual viewpoint operators.

3.1 Why stage salience ?

I believe that stage structure is but an empty shell if one does not introduce along with it the concept of *stage salience* put forth in Caudal (2000a). The existence of stage salience phenomena is the best empirical justification for the introduction of stage structures and viewpoint operators. It militates for a viewpoint-based conception of aspectual semantics, see e.g. Smith (1991). Under this latter type of view, tenses possess an aspectual meaning inasmuch they can act as ‘camera lenses’ focusing on a particular stage, highlighted by the speaker (i.e., being the object of some speech act, e.g. an assertion). *Stage salience* predicts that not all stages will be equally easily ‘focused on’.

Empirical evidence for stage salience can be found in tense semantics, VP modifier semantics and in aspectual lexical semantics. Thus, so-called *aspectually neutral* or *underspecified tenses* such as the English *simple past* normally focus on the same stage in the absence of VP modifiers or discursive constraints, namely the inner stage, which is the most lexically salient stage. But given appropriate contexts, they may focus on other stages, rendered ‘more salient’ by contextual mechanisms. Thus (6) normally describes an inner stage, but in an appropriate context (for instance within an *explanatory* discourse structure, e.g. *The house is empty now. Yannig left*), it can describe a result stage.

(6) *Yannig left.*

It can be shown that VP modifiers act as aspectual focus constraints : although the inner stage should appear as the default reading of (7), in (8), the *for*-phrase forces viewpoint to focus *also* on the result stage. Caudal (2000a) called this type of aspectual alternation the *Resultative Durative Alternation*, and the aspectual interpretation of (8) a *Resultative Durative* reading. It seems in fact that (8) describes not only the result stage, but in fact a sequence comprising both the inner and result stages : (8) asserts that Yannig left (inner stage) AND that his absence lasted for two days (result stage). If this analysis is correct, then *slowly* and the *for*-phrase offer conflicting focal information in (9). It seems that *slowly* selects only the inner stage, whereas the *for*-phrase requires the result stage to be focused in addition.

(7) *Yannig left.* (default reading : focus on inner stage)

(8) *Yannig left for two days.* (focus on result stage possible)

(9) **Yannig left slowly for two days.* (conflicting focal information)

These ‘aspectual focus’ effects of VP modifiers can help identify lexical semantic variation for stage salience. Thus, the contrast between (8) and (10) can be explained as follows : while verbs pertaining to the *leave*-class receive result stages accessible to focal information contributed by VP modifiers¹⁰, those pertaining to the *arrive*-class do not allow VP modifiers to force underspecified tenses to focus on result stages. I will assume that this contrast arises from a difference in *stage salience* : result stage descriptors are more salient in the *leave*-class than in the *arrive*-class. Contrariwise, the contrast between (11) and (12) shows that while *arrive* is endowed with a preparatory stage salient enough to be accessible to a degree modifier such as *almost*, *leave* is not. This double distinction suggests that *leave*-verbs are “result stage oriented” (*leave* basically indicates the coming into being of a state of absence) whereas *arrive*-verbs are “preparatory stage oriented” (*arrive* basically indicates the end of a previously begun process – namely that described by the preparatory stage).

(10) **Yannig arrived for two days.* (focus on result stage blocked)

(11) *Yannig almost arrived.* (preparatory stage almost finished)

(12) *Yannig almost left.* (no part of a (proper) leaving-event occurred)

I assume that three salience degrees should be distinguished in the lexicon : 2 stands for highest lexical salience (it makes stages accessible to aspectually underspecified tenses), 1 for medium lexical salience (it

¹⁰ In this sense, the semantics of VP modifiers incorporates some kind of ‘aspectual focus’ operator. These operators interact with the viewpoint information contributed by tense morphemes, and with the salience information encoded in the lexicon.

makes stages accessible to VP modifier focal information), and 0 for low lexical salience (it makes stages accessible only for specific viewpoint information, as conveyed by tenses like the *perfect*).

Consequently, *leave* and *arrive*-verbs will receive different sets of salience properties in the lexicon (result stage descriptors will receive a salience of 1 in the *leave*-class and 0 in the *arrive*-class. In contrast, preparatory stage descriptors will have a salience of 1 in the *arrive*-class, while they will be missing in the *leave*-class. Note that inner stages remain the most (lexically) salient stages in both classes, since they receive a salience of 2).

Of course, other types of stage structures can be shown to exist. Thus, in contrast to *leave* and *arrive*, verbs such as *throw* are neither “result stage” nor “preparatory stage” oriented (they even seem to lack the latter kind of stage), since they neither allow a durative resultative reading with *for*-phrases (but accept an iterative one, in which case the inner stage is selected) nor a gradual reading with *almost* (compare (14) and (11)). Verbs or verb constellations (to use a term proposed in Smith 1991) such as *emerge* or *come out* also differ from *leave*-verbs inasmuch they seem to possess a very salient result stage (i.e., it receives a salience of 2, making it as salient as their inner stage) because they easily receive a resultative reading in the *progressive* (whereas *leave*-verbs hardly can, as an extended corpus study revealed in Caudal 2000a). Thus, sentences in the *progressive* in (15)-(16) are roughly equivalent to sentences in the *pluperfect*. This almost inherent resultative meaning is a unique property that distinguishes the *emerge*-class from other types of telic verbs.

- (13) #Yannig **threw** a stone for two days. (focus on result stage impossible ; iterative reading OK)
(14) Yannig almost **threw** a stone. (no part of a (proper) throwing-event occurred)
(15) It was great, especially because we **were (just) coming out** of our country's centennial year.
(Hansard Corpus)
≈ ... we **had (just) came out** of our country's centennial year.
(16) When European colonists first came here they found [...] civilizations that were more highly developed than the civilizations they came from in Europe that **were just emerging** from the Dark Ages. (Hansard Corpus)
≈ ... the civilizations they came from...**had (just) emerged** from the Dark Ages.

Coming back to the comparison with other existing theories, note that the de Swart / Moens & Steedman approach to aspectual semantics cannot account for the contrasts in (7)-(10). For instance de Swart (1998) would predict a type-clash between the semantics of *for* and the situation described in (10), resulting in some aspectual type-shift ascribing to this sentence an inaccurately felicitous reading comparable to that of (8). It also seems that aspect-shift based theories of aspectual semantics are not (at the present time, at least) capable of predicting very peculiar ‘resultative’ readings such as those of (15) and (16). One could trace back those shortcomings into the lexical component of those theories, which is not sufficiently rich ; but then again, I believe that an appropriate aspectual lexical theory should make viewpoint operators a necessity at the grammatical level¹¹.

To conclude this section, it appears that a viewpoint-based treatment of aspect along with an appropriate theory of aspectual lexical information is ideal to capture the kind of lexical constraints that are expressed by the notions of *stage structure* and *stage salience*.

3.2 A few aspectual classes based on stage structure and stage salience

The following (non-exhaustive) list of aspectual classes can be distinguished on the basis of stage structure and stage salience information (stages salience is noted *Stage:degree* in abbreviated form ; *PS* means *Predicative Structure*) :

¹¹ Again, the only possibility for aspect-shift theories to account for the above facts would be to introduce lexical constraints ‘blocking’ certain aspect-shift operators. This would amount to ‘mimicking’ viewpoint mechanisms, so that the distinction between them and viewpoint theories would vanish, in a sense.

- (i) Inceptive telic PSs¹² (*leave-class* ; *IStage:2/RStage:1* ; no PStage) : these PSs are compatible with resultative durative reading (i.e., they accept both the ‘endpoint’ reading of *in*, and the resultative durative reading of *for*) ;
- (17) a. Yannig **left** *in +for three hours*.
 b. *They took a gamble on me because I left for two freaking years.* (web corpus : <http://www.switchmagazine.com/skateboardinginterviews/>)
 c. *Silliman left for two winters to study at the Medical College of the University of Pennsylvania.* (web corpus : <http://www.peabody.yale.edu/people/whoswho/SillimanB.html>)
- (18) a. Yannig **borrowed** *Mona’s car in + for thirty minutes*.
 b. *He [Jesus] borrowed a grave for three days.* (webcorpus : <http://sermonideas.com/catalog/easter.htm>)
 c. *They borrowed the flash light for a while.* (webcorpus : <http://www.joyofwine.net/thrips/year2000/may00.htm>)
- (19) Yannig **deserted** *his post in +for three days*.
 (20) Yannig **abandoned** *his post in +for three days*.
- (ii) Median telic PSs (*throw-class* ; *IStage:2/RStage:0* ; no PStage) : these PSs are only compatible with *in*-phrases ; they reject resultative durative readings with *for*, and are deprived of preparatory stages ;
- (21) Yannig **threw** *a stone in + *for three seconds*.
 (22) Yannig **ate** *his porridge in + *for three minutes*.
 (23) Yannig **walked to** *the post office in + *for three minutes*.
 (24) Yannig **entered** *the room in + *for three minutes*.
- (iii) Culminating telic PSs (*reach-class* ; *PStage:1/IStage:2/RStage:0*) : these PSs reject resultative durative readings, but possess a preparatory stage, cf. the interpretation of (25b/c) ;
- (25) a. Yannig **reached** *the summit in + #for three hours*. (OK if iterative)
 b. Yannig **nearly reached** *the summit*.
 c. Yannig **did not reach** *the summit*.
 (26) Yannig **arrived in** *Gwened in + #for three hours* (idem).
 (27) Yannig **won** *a bridge game in + #for three hours*. (idem)
- (iv) Resultative telic PSs (*emerge-class* ; *IStage:2/RStage:2*) ; these telic PSs behave almost like culminative PSs, except that their RStage is so salient it can get focused using non-aspectually specialized tenses (in particular progressive tenses), cf. the near equivalence (≈) given with sentences in the *perfect* in (28) and (29) ;
- (28) a. *The submarine emerged in + for three minutes*.
 b. *The submarine was (just) emerging. ≈ The submarine had (just) emerged.*
 c. *We, first and foremost, We first who have experienced the formidable fate of succeeding Pope Pius XII to the Throne, from which there emerged for two decades the great figure of him who was great as a man and great as a Pontiff.* (web corpus : <http://www.users.qwest.net/~slrorer/HeightsOfHeroism.htm> ; papal address given by Paul VI, 12. March 1964)

¹² As shown in Dowty (1979) and Piñón (1999), pragmatic factors must be taken into account when combining *for*-phrases with telic PSs. It appears that some result stages simply reject such a possibility because they are irreversible. Thus, *John died for thirty minutes* is ruled out in a normal world, but OK in a play or movie. See Caudal (2000a) for more on this issue.

- (29) a. *Yannig came out in + for three days.*
 b. *She **was** (just) **coming out** of the little village of Mickley when she saw the old lady, standing by the road, with a crude hand-written sign saying "Brockbourne" in her hand.* (web corpus : <http://web2.uvcs.uvic.ca/elc/studyzone/410/reading/hikert.htm>)
 ≈ *She **had** (just) **came out** of the little village of Mickley when...*
 b. *It was great, especially because we **were** (just) **coming out** of our country's centennial year and we showed great optimism, great hope and great confidence in our country.* (Hansard Corpus)
 ≈ *...we **had** (just) **came out** of our country's centennial year...*
 c. *When South Africa were admitted to the International Cricket Council in 1991, Hunte immediately offered his services. He **came out** for two months, liked what he saw, and returned later in the year with his family to become the national development coach, sponsored by the MCC. (The Times; 05/12/99)*

Additional data (based on the distribution and interpretation of various combinations of adverbial modifiers and tenses) can be put forth to define other classes of predicative structures and underlying stage structures, but I will not discuss them here because they imply other types of stage relations and possibly stages. Thus, verbs like *seek*, *look for*, *hunt* are associated with a special kind of stage beyond their RStage, which is so to speak ‘targeted’ although it is not reached. I will not say more here about these other classes.

4 Formal treatment within the DRT framework

Since I mentioned in my introduction the necessity of proposing a formal treatment of a viewpoint based treatment of grammatical aspect, I will now expose a tentative formal treatment of both stage structure and ‘aspectual focus’. *Aspectual focus* (i.e., the set of eventually visible stages, usually but not always reduced to a singleton) is calculated using viewpoint information and constraints conveyed by VP modifiers (in fact specific aspectual focus operator), as argued in Caudal (2000a).

4.1 Towards a formal model for stage structure

This formal treatment will be couched in a DRT-style semantics, treating the aspectual content of lexical entries as triplets $\langle S, R, D \rangle$ consisting in a set of stages S (reified as sub-DRSs), a set of relations R between stages (with a causo-temporal content ; see the *Conseq_Telic* relation in (30)), and a set of salience property ascriptions D . I will represent the latter using a predicate ζ assigning to each stage in S a salience degree in $\{0;1;2\}$, as shown in (30)). (30) reflects the fact that *leave* should be considered as possessing an *inceptive* stage structure – its result stage receives a salience 1, whereas it does not include *per se* a preparatory stage. Following a well-established DRT convention, stative situational referents are noted s , while dynamic situational referents are noted e . Stage typing information is given as indices (thus e_I notes a dynamic inner stage referent, while s_R notes a stative result stage referent, etc.).

(30) Lexical stage structure and salience information for *leave*

$$\left\langle \left\{ \begin{array}{l} K_I : \lambda e_I \lambda y \lambda x \quad \boxed{IStage_leave(e_I, x, y)} \\ K_R : \lambda s_R \lambda y \lambda x \quad \boxed{RStage_leave(s_R, x, y)} \end{array} \right\} ; \right. \\ \left. \left\{ Conseq_Telic(K_I, K_R) \right\} \right. \\ \left. \left\{ \zeta(K_I, 2) ; \zeta(K_R, 1) \right\} \right\rangle / leave$$

I will discuss here two types of ‘abstract aspectual relations’ pertaining to R (a concept already introduced in Caudal & Roussarie 2000 and Caudal 2000a). Note first that although the treatment of lexical aspectual

information is related to a formal proposal made in Asher & Pustejovsky (1998), it departs from it in that I do not treat stage relations as discourse relations, but rather as lexical entailment relations of an aspectual kind. I take this move to be motivated by more recent developments within the SDRT framework according to which discourse relations (cf. e.g. Asher & Lascarides 2001) are (*relational*) *speech act types*. Abstract aspectual relations as those given in (30) should be kept carefully apart from speech act types, because they never convey any illocutionary (nor, of course, perlocutionary) content – they simply are not speech act types, but are rather relations pertaining to the field of lexical knowledge, capable of having pragmatic as well as semantic side effects. See Caudal & Roussarie (this conference).

Let us define now two of these stage three relations, namely *Transition* (which corresponds to any ‘change-of-state’ relation between stages), *Consec_Telic* (which relates inner stages to result stages within telic lexical entries) and *Consec_Atelic* (which relates inner stages to result stages within atelic lexical entries). A flavour of their semantics is given by the following temporal axioms (recall that a DRS K can be defined as a pair conjoining a universe of referents U_K , and a set of conditions on those referents $Cond_K$, i.e. $K = \langle U_K, Cond_K \rangle$):

- (31) $Transition(K_1, K_2) \wedge P(e_1) \in Cond_{K_1} \wedge Q(e_2) \in Cond_{K_2} \rightarrow e_1 < e_2$
‘if *Transition*(K_1, K_2) holds, $P(e_1)$ is part of the conditions of DRS K_1 , and $Q(e_2)$ is part of the conditions of DRS K_2 , then e_1 precedes e_2 (these stages form a *transition*, i.e. a change-of-state)’
- (32) $Conseq_Telic(K_1, K_2) \wedge P(e_1) \in Cond_{K_1} \wedge Q(e_2) \in Cond_{K_2} \rightarrow Transition(K_1, K_2) \wedge Cause(e_1, e_2)$
‘if *Conseq_Telic*(K_1, K_2) holds, then *Transition*(K_1, K_2) holds ; if $P(e_1)$ is part of the conditions of DRS K_1 , and $Q(e_2)$ is part of the conditions of DRS K_2 , then e_1 precedes and causes e_2 ’
- (33) $Conseq_Atelic(K_1, K_2) \wedge P(e_1) \in Cond_{K_1} \wedge Q(e_2) \in Cond_{K_2} \rightarrow e_1 <^\circ e_2$
‘if *Conseq_Atelic*(K_1, K_2) holds, $P(e_1)$ is part of the conditions of DRS K_1 , and $Q(e_2)$ is part of the conditions of DRS K_2 , then e_1 left-overlaps with e_2 ; there is no transition between e_1 and e_2 ’

Operator $<^\circ$ indicates ‘left overlap’ (that is, if a_1 and a_2 are the initial and final boundaries of the temporal trace of e_1 , and b_1 and b_2 correspond to the initial and final boundaries of e_2 , then $e_1 <^\circ e_2$ roughly¹³ entails $a_1 < b_1 < a_2 < b_2$, assuming that $<$ expresses temporal ordering between instants).

The empirical motivation for introducing stage relations are multiple, but they are primarily connected with the *interpretative effects* of aspectuo-temporal information. Thus, although speaker does not assert the result stage of Yannig’s absence in (34), it is possible to establish a coreference relation (for a discussion of *event coreference*, see Danlos 1999) between it and the situation denoted by the NP *his absence*. The RStage is therefore *pragmatically inferred* (although it is not part of the semantic content of the utterance). Stage relations make explicit the inference patterns needed to account for such interpretative phenomena.

- (34) *Yannig left. His absence worried his staff.*

For additional facts illustrating the interest of stage relations, see Caudal & Roussarie (this conference), as well as Caudal & Veters (2002a,b)¹⁴,

¹³ I will not discuss any further the semantics of $<^\circ$, but it should be clear that in fact *Conseq_Atelic* must guaranty that any subpart of an inner stage must *always* entail the validity of the corresponding result stage. Thus *Yannig was cold* always entails *Yannig has been cold*, even if we ‘view’ only a tiny subpart of Yannig’s ‘state of coldness’.

¹⁴ In these latter papers, it is argued that the so-called *narrative* use of the French *imparfait* (known to be akin to the meaning of the *passé simple*) is an interpretative by-product of discourse relations established on pragmatic grounds. Transitions between stages are inferred, and result stages are introduced into the pragmatics *via* stage relations, while they remain absent from the semantics.

4.2 Why a mereological approach should not be favored

One could wonder at this point whether a simpler formal treatment could make it possible to simply this apparently cumbersome theoretical apparatus – and in particular whether it is absolutely necessary to treat stages as *separate* situational entity descriptors. Giving up this theoretical choice would mean that stages should be regarded as ontologically included within a unique, overall situational referent *via* part-of relations. This is precisely the route taken by J. Pustejovsky in his *Generative Lexicon Theory (GL)* (see Pustejovsky 1995). For the sake of simplicity, I will focus on the 1995 version of GL, but the point I am making here remains valid for more recent versions of the aspectual component of GL, see e.g. Tenny & Pustejovsky (2000). The idea that within a Davidsonian approach, situations are endowed with a mereological structure dates back at least to Bach (1986), and has become a common assumption in many subsequent works – see for instance Link (1987, 1998), Krifka (1992, 1998), among others. I do not intend to question the interest of attributing a mereological structure to situational entities at all (on the contrary, I *do* attribute a mereological structure to such entities in my model), but rather to question the interest of treating ‘stage relations’ (or whatever equivalent concept) as part-of relations. To the best of my knowledge, only Pustejovsky (1995) made such a move¹⁵.

Let us briefly present GL’s aspectual component. Aspectual information is represented within GL entries *via* typed feature structures. The *EVENTSTR* field of GL entries is dedicated to expressing such aspectual information. It contains a list of sub-atomic referents encoded in features $E_1 \dots E_n$, corresponding more or less to the notion of stage advocated here¹⁶. *EVENTSTR* also includes a field called *RESTR* that contains a list of (ordered) part-of and temporal relations between stages $E_1 \dots E_n$ (more precisely between the underlying referents $e_1 \dots e_n$); they involve notably the following operators : $<$ (strict partial order), $<_{\infty}$ (exhaustive ordered overlap), \circ (overlap), $<_{\infty\alpha}$ (exhaustive ordered overlap), *b* (part), *a* (proper part) (see Pustejovsky 1995:69 for the semantics of those operators).

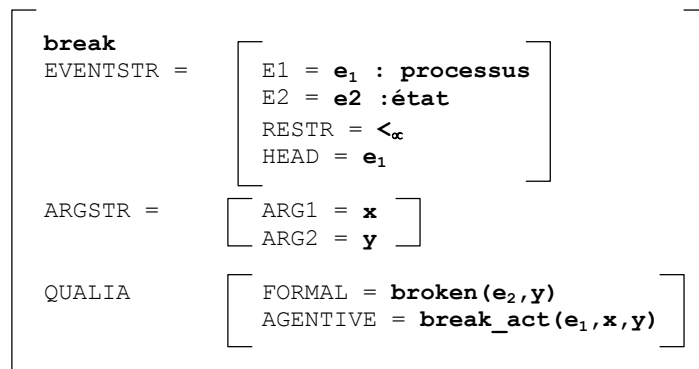
Finally, *EVENTSTR* incorporates a *HEAD* field that expresses ‘headedness’ for a single stage, using a unary operator $*$. *Event headedness* can be regarded as the GL equivalent for my notion of *stage saliency*, except it is a simpler concept in two respects : (i) it can only bear on one stage (it is little more than a ‘tag’ attached to it) whereas stage structure has several distinct saliency degrees, and associates one of them to each stage, and (ii) it actually conflates two types of aspectual information that are kept separate in the present theory, namely *stage typing* (in terms of centrality / peripherality) and *stage saliency*.

The lexical entry for *break* is given in (35) ; its *EVENTSTR* feature structure is reformulated as an aspect tree in (36) (a mode of representation often used in Pustejovsky 1995) *EVENTSTR* indicates that situations described by *break* involve two distinct stages : a causal stage encoded in *E1* (corresponding to its inner stage) and a result stage encoded in *E2*. *RESTR* stipulates that a breaking situation includes the two corresponding subevents (they are its subparts), and that $e_1 < e_2$. I will not expose here the role played by the *ARGSTR* and *QUALIA* features, because it is not relevant to the present argumentation. Note though that the lexical semantic typing of these subevents is represented in so-called *QUALIA ROLE* features (pertaining to the *QUALIA* feature structure of GL lexical entries).

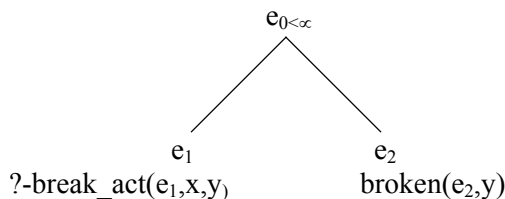
¹⁵ Interestingly enough, neither Kamp & Reyle (1993) nor Parsons (1990) did, while adhering to a Davidsonian AND viewpoint-based conception of aspect construal ; although they hinted at this possibility, they did not pursue it. Kamp & Reyle even explicitly rejected such a theoretical move, see Kamp & Reyle (1993:559, note 27).

¹⁶ It seems to me that the notion of sub-atomic situation (or just *subevent* in Pustejovsky’s terminology) sometimes pertains more either to the real of extralinguistic ontology, or to some semantic field distinct from aspect. Thus Pustejovsky (1995:71) considers that a verb like *accompany* involves two simultaneous subevents. I do not see why this should have an impact on the lexical aspectual information associated with this verb, since the allegedly distinct subevents can never be isolated by any aspectual marker. Although it clearly pertains to the presuppositional content of *accompany* (and probably has an impact on its use in discourse), it does not seem to determine the aspectual interpretations one can attribute to this verb.

(35) GL-style lexical entry for *break*



(36) Aspectual tree for *break*



Although this mereological approach to stage structure (and in fact all theories of stage structure relying on a similar mereological strategy) might seem appealing at first sight, I believe it suffers from some serious shortcomings that should lead us to reject it. Its main defect is its inability to distinguish stage typing from stage saliency and to correctly capture the semantic phenomena that underly them.

The very notion of ‘peripherality’ seems to be rather paradoxical when talking about sub-atomic parts of a single situational entity ; it is hard to come by a notion of mereology that would leave room for the notion of *detachability* proposed in Smith (1991), and which underlies the notion of ‘preparatory stage’ I proposed. Preparatory stages are *detachable* inasmuch they are not really part of a situation, but rather some kind of presupposed aspectual ‘satellite’ to the inner stage. They are accessible to adverbial modifiers that normally exclude the ‘core’ aspectual meaning of a verb (such as *nearly*) ; thus *John nearly won (the+a) race* nevertheless entails that John did partake in a race. I will therefore consider that a mereological approach to situation structure is bound to fail to capture *stage typing*, and in particular the distinction between peripheral vs. central stages (i.e. preparatory and result stages as opposed to inner stages). The point I will make below is that this inability to correctly represent ‘stage peripherality’ makes it impossible for mereological approaches to stage structure to express stage saliency in a proper way.

As indicated above, James Pustejovsky’s theory of situation structure does incorporate a notion which seems *prima facie* to resemble stage saliency, namely *event headedness*. But I will show that event headedness rather seems to mix up stage typing and stage saliency, whereas I take these notions to be autonomous (although not altogether orthogonal, since inner stages are always maximally salient). To make this clear, let us review a few examples and arguments discussed in Pustejovsky (1995) to nurture the notion of event headedness.

Pustejovsky takes ‘headed subevents’ (headed stages) to be aspectually proeminent because they are accessible to adverbial modification. According to this author, (37) describes a situation whose result stage is headed because it can be ‘focused on’ using *for*-phrases, producing what I called above *resultative durative readings*. Pustejovsky therefore brands such situations as *right-headed events*. He argues that conversely, verbs describing situations whose preparatory stages can be ‘focused on’ using adverbial modification (cf. *quietly* in (38)) should be called *left-headed events*. Consequently, according to the

tests given in (38) and (39) verbs such as *reach* and *arrive* should be classified as describing left-headed rather than right-headed situations.

- (37) *Mary left town for two weeks.* (Pustejovsky 1995:74)
(38) *Mary quietly drew a picture.* (Pustejovsky 1995:75)
(39) a. *Mary quietly reached the summit+arrived.*
b. **Mary (reached the summit+arrived) for two weeks.*

It seems that Pustejovsky (1995a:73) misclassifies the *arrive*-class of situations when he identifies them as right-headed rather than left-headed, thus contradicting his very own tests (cf. (39))¹⁷. How come did such a misclassification occur? I believe it to be a consequence of Pustejovsky's treating stage salience and stage peripherality (stage typing) as conjoined or even identical notions. Indeed, *arrive* and *reach* seem to be endowed with what I called *culminative stage structures*, possessing an unusually salient preparatory stage. At the same time, this stage is merely *peripheral* inasmuch it describes some kind of causal event that precedes the 'core stage', namely the inner stage (i.e., the very instant at which one arrives at or reaches some location). One can conclude from this that Pustejovsky somehow paid more attention to the peripheral nature of the preparatory stage rather than to its obvious unusual salience when he misclassified *arrive*, or rather that he used stage salience to express stage peripherality, for want of a theory capable of treating separately these two notions. According to me, not all 'peripheral' stages are necessarily non-salient (non-headed in Pustejovsky's terminology), and conversely.

But this is a mere guess, mind you. The crucial point with GL's 'event headedness' is in fact the following : even if we correct Pustejovsky's mistake and classify situations described by *arrive* and *reach* as left-headed, then we are forced to assign these verbs the same aspectual content as *draw* in *draw a picture* (cf. (38), and the fact that *draw a picture* cannot receive a durative resultative reading). In doing so, we would fail to capture some important aspectual differences between these two types of verbs (we would fail for instance to explain why the use of *nearly* with these two classes of verbs yields very different interpretations). So whatever 'headedness' route we take, we are bound to arrive at unwanted conclusions. The problem with Pustejovsky's aspectual theory is that it cannot represent properly the *peripheral* nature of the causal subsituation inherent to *arrive/reach* as opposed to the *non-peripheral* nature of the causal subsituation inherent to *draw a picture*, because it makes use of a part-of relationship in both cases. I think that the only solution to this problem is in fact to give up such a mereological approach¹⁸.

To summarize, a proper theory of situation structure should not be mereological because such a move precludes the possibility of distinguishing stage salience from stage typing (stage peripherality, in fact), because mereology simply makes it difficult (if not impossible) to represent the latter notion.

4.3 Stage structure and a formal theory of aspectual focus

Let us turn again to aspectual focus calculus. Recall that it involves not only stage structures (i.e., lexical aspectual information) and viewpoints (i.e., the aspectual content of tenses) but also aspectual focus effects of VP modifiers.

¹⁷ Pustejovsky does not apply the tests to any example involving the *arrive* verb, but he gives it as lexically describing left-headed events in his synthetic classification of situation types, cf. Pustejovsky (1995:73).

¹⁸ I believe in fact the 'headedness' operator itself to be a problem for Pustejovsky's theory, in addition to the exclusive use of part-of relations. My theory of stage salience recognises two degrees of salience, whereas Pustejovsky's only recognizes one – this results in substantial differences in their respective expressive powers. I will not discuss in this section the empirical consequences of this difference, but by and large, it makes it impossible for event-headedness to capture certain aspectual phenomena. I take this to be a point against the notion of event-headedness rather than against mereological approaches in general, but it is worthwhile noting it.

Crucially, rather than aspect-shift operators or aspect-sensitive operators (cf. de Swart 1998), the aspectual contribution of tenses will be viewed as viewpoint operators (a move which does not preclude the use of aspect-shift operators in certain cases, as for the treatment of the inchoative reading of perfective viewpoint tenses¹⁹ ; it merely reduces the extent of their legitimate field of application) interacting with lexical stage structure and salience information. The main difference between these two types of operators is that aspect-shift operators ‘create’ new stages from existing lexical material, whereas viewpoint operators act as ‘aspectual focus’ operators selecting stages, in relation with their salience.

Let us define imperfective and perfective viewpoint operators as two DRS operators respectively called *Imperf* and *Perf*. *Imperf* and *Perf* map an aspectual DRS K_A onto an aspectuo-temporal DRS K_I . The following viewpoint axioms hold about them (e_K noting the main event associated with a DRS K , and $<$ noting DRS-subordination ; thus $K < K'$ indicates that K is subordinated to K') :

(40) **Axiom on imperfective viewpoints :**

$$K_I = \text{Imperf}(K_A) \rightarrow (K_A < K_I \wedge e_{K_I} \subseteq e_{K_A})$$

‘When an imperfective viewpoint applies, then (i) the aspectual interpretation DRS K_I subordinates the lexical aspectual DRS K_A and (ii) the aspectual interpretation interval e_{K_I} is a subpart of the lexical aspectual interval e_{K_A} ’

(41) **Axiom on perfective viewpoints :**

$$K_I = \text{Perf}(K_A) \rightarrow (K_I = K_A \wedge e_{K_I} = e_{K_A})$$

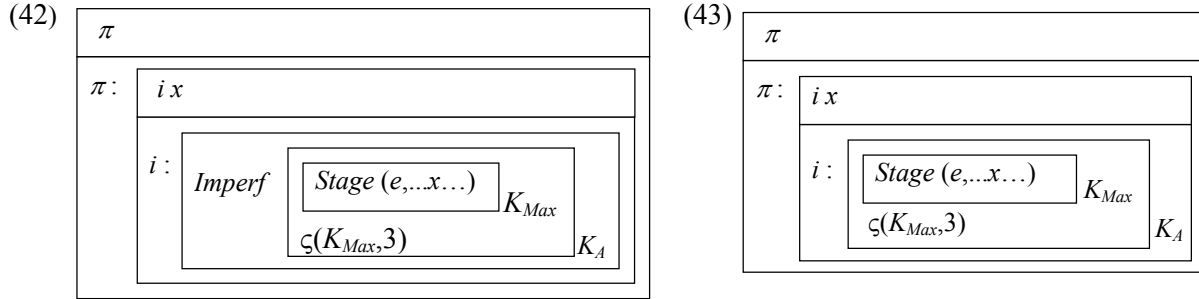
‘When a perfective viewpoint applies, then (i) the aspectual interpretation DRS K_I is identical with lexical aspectual DRS K_A and (ii) the aspectual interpretation interval e_{K_I} equals the lexical aspectual interval e_{K_A} ’

The effect of these two axioms are illustrated in (42) and (43) ; π terms are speech act referents within the SDRT framework (*Segmented Discourse Representation Theory*, cf. Asher & Lascarides 2001), possessing a propositional content modelled as a DRS K . I am moving away from DRT at this point because I assume that the aspectuo-temporal content of an utterance (i.e. the aspectual DRSs constructed in the present theory) must be made available for discursive treatments, through the semantics-pragmatics interface (see Caudal & Roussarie, this conference, as well as Caudal & Veters 2002a,b).

My implementation of imperfective viewpoint operators is reminiscent from de Swart’s treatment for the English *Progressive* (cf. Figure 1) in that it treats *Imperf* as an ‘intensional’ operator in that it makes use of DRS-subordination. Formally, *Imperf* is to a certain extent close to an aspect-shift operator because it *creates* a new aspectual DRS – but it is also different from it, because its input and its output are not entities of the same theoretical nature (this property of viewpoint operators makes it impossible for them

¹⁹ Thus, *Yannig fut malade* means ‘Yannig started being sick/fell sick’. I take this type of aspectual reading to be derived by an aspect-shift operator. The result involves the *Transition* stage relation between a ‘duplicate’ IStage (corresponding to the left part of the non-inchoative IStage, in fact), and the remaining part of the IStage – so as to express the fact that the result of the inchoation of being sick is the state of being sick proper. A similar analysis can be proposed for process-based inchoatives (cf. *Yannig courut*, ‘Yannig started to run’).

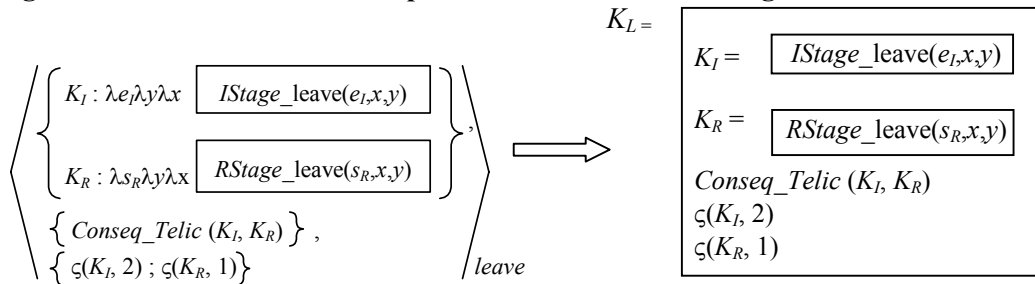
to apply *recursively*; see Laca 2002 syntactic for data in romance languages supporting this view²⁰). Note also that the *Perf* operator vanishes in (43), although it is present at some earlier stage of the aspect construal procedure.



In order to implement a formal treatment of aspect based on aspectual viewpoint operators, stage salience and aspectual focus constraints expressed by VP modifiers, we need to spell out the DRS construction procedure making it possible to construct the lexico-grammatical aspectual DRS K_A appearing in (40) and (41). I call K_A a lexico-grammatical DRS because it contains lexical aspectual information combined with some amount of grammatical aspectual information ; aspectual focus has already been determined at this point of the aspect construal procedure, by combining viewpoint information (contributed by tense morphemes) with other constraints on aspectual focus (contributed by adverbial modifiers, in particular).

The first step taken in this procedure is the construction of a lexical aspectual DRS K_L from the stage structure of a given verb (see Figure 3).

Figure 3 : derivation of lexical aspectual DRS K_L from the stage structure of *leave*



The following set of axioms then apply to the lexical aspectual DRS K_L , from which the lexico-grammatical aspectual DRS K_A is then built on the basis of the aspectual focus effects of tense morphemes and VP modifiers. I assume that although stage saliency cannot exceed 2 in the lexicon, it can reach 3 when tense morphemes and adverbial modifiers come into play and contribute to rendering a stage ‘more visible’ and eventually ‘focused’ (so saliency 3 is equivalent to ‘final visibility’).

²⁰ Laca (2002) showed that aspectual periphrases in romance languages fall into two different classes : ‘viewpoint operator-like’ periphrases, and ‘aspect-shift operator-like’ periphrases. She demonstrated that the former cannot apply recursively, whereas the latter can.

Of course, all these axioms apply only if aspectual typing constraints are respected²¹. I assume for instance that adverbials may be endowed with aspectual typing constraints on their input (thus, manner adverbials like *violently* require dynamic stages, whereas temporal adverbials like *for* require atelic stages, etc.) and that these constraint also determine which stage(s) are accessible to adverbials, depending on the underlying situational entities (e.g., all stative stages are accessible to *for* whereas telic ones are not). Note that a similar reserve applies to aspectually non-vacuous tenses ; they may select for specific types of stages and/or stage relations – thus, the French *passé simple* requires a *Transition* stage relation, and the English *progressive* applies to stative stages only if they meet certain requirements. I call *aspectually specialized tenses* tense morphemes that always select the same type(s) of stage(s) (e.g., the English *perfect* can only select RStages).

(44) **Axiom on aspectual focusconstraints expressed by temporal adverbials :**

$$[adverb_focus(K) \wedge K < K_L \wedge \zeta(K,s) \in Cond_{KL} \wedge 0 < s < 3 \rightarrow \zeta(K,s+1) \in Cond_{KL}]$$

(This axiom stipulates that temporal adverbials can apply only to at least averagely focalised stages K (i.e. have at least salience 1) and merely increase their salience)

(45) **Axiom on aspectual focus constraints expressed by manner adverbials :**

$$[adverb_focus(K) \wedge K < K_L \wedge \zeta(K,s) \in Cond_{KL} \wedge 0 < s < 3 \rightarrow \zeta(K,3) \in Cond_{KL}]$$

(This axiom stipulates that manner adverbials can apply only to at least averagely focalised stages K , and cause a single stage to be visible, since it reaches maximal grammatical salience ; cf. (47b))

(46) **Axiom on the aspectual focus effect of an aspectually specialized tense (English *Perfect*) :**

$$[perfect_focus(K) \wedge RStage(K) \wedge K < K_L] \rightarrow [K < K_A \wedge \zeta(K,3) \in Cond_{K_A}]$$

(Axioms of that type guarantee that aspectually specialized tenses will force the exclusive insertion of certain stage(s) K (which they select) into the grammatical aspect DRS K_A , regardless of all lexical salience ascriptions in K_L ; in the case of the English *perfect*, the only introduced stage is the result stage, regardless of the lexical salience ascriptions in K_L)

(47) **General axioms on visibility and propositional contents of utterances (applies if aspectually neutral or underspecified tense morphemes are used) :**

$$a. [K < K_L \wedge \zeta(K,3) \in Cond_{KL} \wedge \neg \exists K' (K' < K_A \wedge \zeta(K',3) \in Cond_{K_A}) \rightarrow [K < K_A \wedge \zeta(K,3) \in Cond_{K_A}]$$

$$b. [(K < K_L \wedge \zeta(K,2) \in Cond_{KL}) \wedge \neg \exists K' (K' < K_L \wedge \zeta(K',3) \in Cond_{KL})] \rightarrow [K < K_A \wedge \zeta(K,3) \in Cond_{K_A}]$$

(Axiom (47a) ensures that if a stage K reaches a salience 3 in K_L , it will be incorporated into the grammatical aspectual DRS K_A **unless** another stage K' reaching salience 3 is already present in K_A (that is, unless an aspectually specialized tense already previously introduced another stage K' into K_A , see (46)) ; if no such a salience 3 stage exists in K_L , axiom (47b) guarantees that every stage reaching salience 2 in K_L will be incorporated into K_A . Other stages are not part of the propositional content of an utterance).

Crucially, temporal adverbials and manner adverbials are not predicted to have the same impact on the calculus of aspectual focus : manner adverbials ‘single out’ one stage at the expense of all others²², whereas temporal adverbials merely increase a stage salience/visibility. In appropriate semantic contexts, several stages can be realised (i.e. rendered visible) if only a temporal modifier is used, whereas adverbial modifiers select a unique stage. Note that the existence of syntactic differences between these two classes of adverbials (as shown in Tenny 2000) supports the existence of such semantic differences²³.

²¹ Whether or not these typing constraints can cause coercion operators to apply will not be envisaged here.

²² However, see examples (59)-(61) below ; manner adverbials can also leave aspectual focus unaffected.

²³ This reference gives a thorough review of syntactic issues concerning the relationship between types of adverbial modifiers and aspectual interpretation.

Note as well that other axioms concerning aspectually underspecified tenses (e.g. the English *past progressive*, which may either select PStages or IStages when they co-exist in a stage structure, see the two possible readings we can assign to *Yannig was winning*) seem to be necessary. In some cases, given appropriate contextual information, they appear to increase the visibility of a specific stage at the expense of other normally accessible stages (thus, if context tells us that a race is not nearly over, *Yannig was winning* should describe a PStage rather than an IStage, although the latter stage is lexically most salient).

I do not assume at this point that adverbial-related aspectual focus axioms (i.e. (44)/(45)) and tense-related aspectual focus axioms (i.e. (46) and (47)) apply in an inherently fixed order. Rather, I assume that they apply in such a way that semantic incompatibilities should be resolved or at least minimized (given specific lexical constraints ; certain adverbial modifiers may always apply *after* tenses). Thus, if (44)/(45) apply first, the semantics of tense morphemes will take scope over that of adverbial modifier²⁴. Contrariwise, if (47) or some tense-specific axiom such as (46) applies first, then reverse will hold true. I am discussing below (see section 4.4) data that justifies this ‘free order’ approach.

The above axioms form the backbone of the required aspectual interpretation procedure ; they all contribute to calculating aspectual focus (i.e., to determining which stage(s) is (are) eventually visible and become the object of a speech act). To sum it up, our aspect construal procedure goes through three steps :

1. Convert stage structure into a lexical aspectual DRS K_L ; all stages are still present within the representation ;
2. Map lexical aspectual DRS K_L onto a lexico-grammatical aspectual DRS K_A by determining the effects of adverbial modifiers and tense morphemes on aspectual focus ; at this point, only ‘focused’ stages are present within the representation ;
3. Construe the final aspectuo-temporal DRS K_I (corresponding to the ‘output’ of the aspect construal procedure) from K_A , applying viewpoint (DRS) operators if needed (e.g., *Imperf* or *Perf*).

4.4 Applying the theory

To illustrate the way this procedure produces aspectual interpretations as its output, let us turn to the treatment of examples such as (8) and (9).

- (8) *Yannig left for two days.* (focus on result stage possible)
 (9) **Yannig left slowly for two days.* (conflicting focal information)

Since *leave* has an averagely salient (atelic) RStage, the theory predicts that the aspectual focus operator contributed by the *for*-phrase can access it. Axiom (44) applies, causing the RStage to have (lexically) maximal salience in the lexical aspectual DRS K_L . The *simple past* being an aspectually underspecified tense (cf. Caudal 2000a), one of the two axioms given in (47) must apply. Since both the IStage and the RStage have salience 2 in K_L , (47b) is applied twice (and not (47a)), introducing them both into the lexico-grammatical DRS K_A . In other words, they are both treated as ‘focused’, ‘visible’ stages This corresponds to the intuitive interpretation of (8), which describes (i) Yannig’s departure and (ii) Yannig’s absence, in sequence.

Now why is (9) unfelicitous ? Axiom (44) applies because of the *for*-phrase, and axiom (45) applies because of *slowly* (order does not matter). It follows that the IStage receives salience 3 in K_L , whereas the RStage merely receives salience 2. The result is that only the IStage is incorporated into K_A when axiom (47a) applies. The trouble is then that the temporal semantics of *for* cannot be interpreted anymore in the resulting aspectual reading, since it is incompatible with such a telic IStage. This is a case of conflicting aspectual focus – the temporal semantics of *for* quantifies over a stage which *slowly* rendered ‘invisible’.

²⁴ See Tenny & Pustejovsky (2000) for a study of related issues.

I would like to stress the fact that axiom (47b) makes it possible to introduce *several* stages into the lexico-grammatical aspectual DRS K_A . This is notably the case if two stages reach or inherently possess salience 2. As opposed to the ‘liberal’ (47b), the ‘conservative’ axiom (47a) guarantees that stages whose ‘visibility’ becomes grammatically maximal (salience 3) render other stages invisible (this is always the case with manner adverbials, as axiom (45) implies). To illustrate how (47a) and (47b) function in a complementary fashion, let us consider examples (48) and (49). Some of these utterances are either ‘vague’ or ambiguous, while others are not.

Thus, while (48a) may describe a situation of Yannig arriving at the summit – a reader involving the IStage – or a situation of Yannig still being some distance away from it – a reading involving the PStage – (the difference does not seem to matter), (48b) can only describe a preparatory stage (Yannig must be still some distance away from the summit). In (49a), it is hard to tell whether we want to stress the fact that the submarine has surfaced (RStage-reading), or that it is still in the process of emerging (IStage-reading) ; both stages seem to be involved, at least to some extent. And contrary to (48b), (49b) does not really dissipate this vagueness or ambiguity. Why is that so?

- (48) a. *Yannig was **reaching** the summit.*
 b. *Yannig was **slowly reaching** the summit.*
 (49) a. *The submarine was **emerging** from the dark waters of the Ocean.*
 b. *The submarine was **just emerging** from the dark waters of the Ocean.*

Let us expose the predictions the theory makes about those examples. *Reach* has the following stage salience ascriptions : PStage=1/IStage=2/RStage=0. If contextual knowledge makes it clear that Yannig is still reasonably far away from the summit in (48a), the salience of the PStage should be increased, causing it to reach salience 3. In this case, axiom (47a) applies, so that only the PStage participates into the aspectual interpretation of (48a). In the absence of such contextual information, axiom (47b) applies, so that only the IStage becomes visible (since it is the only stage reaching salience 2). In short, the theory predicts that (48a) is ambiguous, depending on context. In contrast, the interpretation of (48b) is correctly predicted to be unambiguous. By the application of axiom (45), the use of *slowly* (selecting a dynamic stage) will cause the IStage to reach salience 3, producing an aspectual reading involving only the IStage, since axiom (47a) would apply. (48b) would be ambiguous if *slowly* could apply to the PStage (in which case the PStage would be made visible, and not the IStage) ; but since it cannot (*slowly* requires a dynamic stage), (48b) is unambiguous.

Let us consider now examples (49a) and (49b). *Emerge* has the following stage salience ascriptions : IStage=2/RStage=2 (no PStage). If we put aside contextual preferences, only axiom (47b) should apply in (49a), causing both the IStage and RStage to be involved in the aspectual interpretation of this sentence. In (49b), the presence of *just* triggers axiom (44). The semantics of *just* either causes the IStage to reach salience 3 (in which case this sentence only describes an IStage) or the RStage to reach salience 3 (in which case it rather describes an RStage) – *just* being compatible with the aspectual types contained in either type of stage. The theory thus predicts that the indeterminate aspectual meaning of (49a) is essentially preserved in (49b) (although an aspectual *vagueness* might have been turned into an aspectual *ambiguity*, if my analysis is correct). The aspectual indeterminacy of (49a/b) also accounts for the merely partial equivalence of such sentences in the *simple past* with sentences in the *pluperfect* : the *pluperfect* would bar any indeterminacy, causing only result stages to be involved in the final aspectual interpretation – and therefore producing a slightly different meaning.

Let us move to more difficult cases, and consider the aspectually ambiguous example (50) ; (50) either entails that John still lives in London (Reading 1), or that he does not (Reading 2):

- (50) *John has lived in London for 30 years.*
 Reading 1 : entails *John still lives in London.*
 Reading 2 : entails *John lives somewhere else now.*

Live has a stative stage structure consisting in two stages with a (lexically) maximally salient IStage (salience 2), and a minimally salient RStage (salience 0). Both interpretations yield the following lexical aspectual and lexico-grammatical DRSs (respectively K_L and K_A) :

$$K_L = \begin{array}{l} K_I = \boxed{IStage_live(s_I, x)} \\ K_R = \boxed{RStage_live(s_R, x)} \\ \text{Conseq_Atelic}(K_I, K_R) \\ \zeta(K_I, 2) \\ \zeta(K_R, 0) \end{array} \quad K_A = \begin{array}{l} K_R = \boxed{RStage_live(s_R, x)} \\ \zeta(K_R, 3) \end{array}$$

Despite this apparent analogy, the interpretation procedure arrives at those similar DRSs by different routes, and yields different temporal interpretations for the *for*-phrase. In the first reading, the *for*-phrase seems to apply to the RStage ; it expresses the duration of John's stay in London up to the present time. Since the RStage is initially minimally salient, this can be achieved only if the semantics of *for* applies (axiom (44)) after the semantics of the *perfect* has applied (axiom (46)) – in other words, if it takes scope over it, and takes K_A rather than K_L as its argument. Under this reading, *for* measures the duration of the result state reading constructed by the *perfect*. In the case of Reading 2 ('John has lived in London for 30 years but he now lives somewhere else'), the *for*-phrase rather seems to apply to the IStage – it measures the duration of John's stay in London, but not the duration of the result state of John's having lived in London. In this case, the semantics of *for* (axiom (44)) applies *before* that of the *perfect* (axiom (46)) (the latter taking scope over the former), so that it takes K_L (and not K_A) as its argument, this time. Since the IStage is maximally salient (salience 2), it is predicted to be accessible to *for*. Therefore, the semantics of *for* applies to the RStage (after the *perfect* rendered it visible) in the case of Reading 1, whereas it applies to the IStage in the case of Reading 2 (preceding the application of the *perfect* to this modified IStage), yielding two different readings. Note that this very ambiguity is not possible with telic predicative structures because their inner stages are incompatible with the *for*-aspectual focus operator (which requires an atelic stage as its input)²⁵.

4.5 Directions for future research

Many directions for future research seem to be open ; the following list is non-exhaustive, of course.

First, precise aspectuo-temporal constraints associated with adverbials (and in particular temporal adverbials) need to be spelt out case by case, in order for the theory to make correct predictions concerning the compatibility of a given temporal modifiers with different stage types. (51), (52) and (53) illustrate the need for such a precise semantics of temporal modifiers. The contrast between (51) and (52) shows that the French temporal adverbial *depuis* requires a non-atomic stage as its input ; it cannot bear on the IStage of *partir* in (51), but it can bear on the IStage of *manger* in (52). Note that it cannot bear on the corresponding RStages because they are minimally salient (salience 0). (53) suggests that *depuis* is always compatible with resultative readings. This can be explained as follows : the French *passé composé* arguably causes the RStage to be aspectually focused²⁶ (since it contributes an aspectually specialized viewpoint operator), forcing *depuis* to apply to it (note that RStages always meet the aspectuo-temporal requirements of *depuis*, namely that a stage should not be atomic and should have an initial boundary).

²⁵ It is not possible to get a similar ambiguity with dynamic, atelic predicative structures either, but for reasons too complex to discuss here.

²⁶ Along with the IStage ; as argued in Caudal (2000a), the French *passé composé* describes both an IStage and a RStage. This explains why this tense is compatibly with temporal adverbial markers that select the IStage, whereas the English *perfect* is not – this latter tense always focuses on the RStage, rendering the IStage 'invisible', thus blocking the use of temporal modifiers requiring such a stage.

- (51) #Yannig **part** depuis une heure. (modal and iterative readings OK)
Litt. ‘Yannig leaves for an hour’
‘Yannig has been leaving for an hour’.
- (52) Yannig **mange** depuis deux minutes.
Litt. ‘Yannig eats for two minutes’
‘Yannig has been eating for two minutes’.
- (53) Yannig **est parti+a mangé** depuis une heure.
Litt. ‘Yannig has left/eaten for an hour’
‘Yannig left/ate an hour ago’

However, (54) suggests that *depuis* can never take scope over a preparatory stage, even if the PStage ‘averagely salient’ (saliency 1). A rather obvious explanation for this phenomenon would be to consider that preparatory stages do not have an appropriate aspectuo-temporal structure meeting the requirements of the semantics of *depuis*. PStages should obviously be classified as ‘dynamic’ situational entities ; but little information seems to be available about them besides. While it is obviously sufficient to make them compatible with manner adverbials such as *lentement/slowly* (cf. (48b)), this is apparently not enough to provide *depuis* with an appropriate domain over which it can quantify. In particular, it seems hard to conceive of PStages as having a ‘visible’ first point, which *depuis* requires ; the temporal structure of PStages seems to be too indeterminate to offer this kind of temporal information.

- (54) #Yannig **arrive + gagne** depuis une heure. (modal and iterative readings OK)
Litt. ‘Yannig is arriving + winning for an hour’.
#Yannig *has been arriving + winning for an hour.*

Besides temporal and manner adverbials, other types of VP adverbials should also be taken into account in the analysis, and appropriate axioms should be proposed about them. For instance, *degree* adverbials seem to interact with stage structure in many different ways. Thus, adverbials involving a measure on a closed scale²⁷ (e.g., *completely, partly*) can only apply to a telic IStage for obvious reasons (only telic IStages can offer a *closed* temporal domain), and *nearly* selects only Pstages for equally obvious reasons. On the contrary, other degree adverbials can apply to many different types of stages. For instance, *almost* can either apply to a PStage (cf. *Yannig almost reached the summit*) or an IStage (cf. one of the readings of *Yannig almost ate his pancake* ; see Dowty 1979). Similarly, degree adverbials like *à peine* (*hardly/barely*) in French exhibit a variety of aspectual interpretations that have passed unnoticed in the literature (see Caudal 2000a for a study of the aspectual interpretations of *à peine*). *A peine* applies to the situational entities underlying RStages in (55) and (56), whereas it applies to the the situational entities underlying IStages in (57) and (58). See Caudal (2000a,b) for more on related issues.

- (55) Yannig **s’absenta à peine**.
Litt. ‘Yannig was hardly away’
‘Yannig wasn’t away for a long time’.
- (56) *Nous nous remettons à peine de cette situation dans le secteur de l’agriculture.*
We are still recovering from that as a farm community.
(Hansard Corpus)
- (57) Yannig **mangea à peine** sa crêpe.
‘Yannig hardly ate his pancake’.

²⁷ I am borrowing the notion of *closed (degree) scales* to Kennedy & McNally (1999) and Hay et al. (1999) ; those scales can somehow help measure the internal structure of situations. See also Caudal (2000a,b).

- (58) *Yannig nagea à peine.*
 Litt. ‘Yannig hardly swam’.
 ‘Yannig didn’t swim for a long time’

A rather different type of uses of adverbial modifiers in predicative structures (exemplified in (59)-(62)) hasn’t been accounted for so far : it involves some kind of ‘incorporation’ of the adverbial into the lexical semantics of the predicative structures in question. Indeed, they do not bear onto an aspectually *visible* stage in any of those examples. *Violently*, *slowly* and *quickly* require dynamic stages²⁸ as their input, and therefore cannot bear on a result stage in (59)-(61). Similarly, *for* in (62) does not modify the duration of the described RStage, but rather the duration of the intended absence of the teacher. The interpretation we get is roughly ‘Dan’s teacher is in the result state of a leaving-for-three-days event’ (and not ‘Dan’s teacher has been for three days in the result state of a leaving-event’ ; (62) does not necessarily imply *Dan’s teacher left three days ago*)²⁹.

- (59) *We expect the EU to seriously examine the case of one of its members which **has violently opposed** the organisation's charter, commitment and obligations.* (*The Guardian*, 22/02/99)
- (60) *The row **has quickly picked up** the inevitable overtones of older animosities.* (*The Guardian*, 14/05/2002)
- (61) *From being a prophet in the wilderness a year ago, his cause **has slowly won** a gathering band of recruits.* (*The Guardian*, 12/09/99)
- (62) *Dant is a students teacher in an ap class that the regular teacher **has left** for three days and wants Dan to take over the class while he is gone.* (web corpus : <http://www.acusd.edu/~deroche/group2p/messages/30.html>)

One solution to this problem would be to *alter* the content of the VP head so as to incorporate the meaning of these adverbials. Thus (59) describes the RStage of a *violently-opposing*-situation rather than merely the RStage of an *opposing*-situation, and (62) describes the RStage of a *leaving-for-three-days*-situation rather than merely the RStage of a *leaving*-situation. How this kind of ‘semantic incorporation’ should be modelled remains to be worked out precisely.

Finally, *contextual* factors should be taken into account, as suggested in sections 4.3 and 4.4, as they seem to affect the aspectual focus effect of certain tenses (see for instance the analysis of (48a)). The aspect construal procedure should comprise appropriate axioms to take those effects into account. How precisely they should be implemented is yet to be determined. *Discourse constraints* in general have been put aside in the present paper, although they seem to play an important role in determining aspectual focus. Note also that the present theory to *aspectual* focus might have to be related in some way to a *general* theory of focus and information structure. Consider (63a) ; it either translates as (63b) (if the *imparfait* receives a so-called ‘narrative’ interpretation, more or less akin to the aspectual meaning of the *passé simple* ; see Caudal & Veters 2002a,b) or as (63c) (if the *imparfait* retains its standard imperfective viewpoint reading). This very sentence only retains its narrative use if it is inserted in a narrative context, as in (64). In contrast, (65a) only translates as (65b) ; the ‘narrative’ reading is ruled out if we insert a manner adverbial selecting the inner stage. Surprisingly enough, though, this very ‘narrative’ reading arises again if one inserts the same sentence in a narrative context (cf. (66)).

²⁸ I am putting aside the merely temporal uses of ‘speed’ adverbials, cf. *I was quickly sick of eggs and bacon.*

²⁹ To explain in a model-theoretic fashion the difference between these two readings, one would need to spell out the respective temporal effects of the *perfect* and *for*. I will not do so here for want of space.

- (63) a. *Une heure plus tard, Yannig mangeait.*
 b. *Yannig ate an hour later.* ('narrative' reading)
 c. *An hour later, Yannig was in the process of eating.* (standard imperfective reading)
- (64) a. *Une heure plus tard, Yannig mangeait, puis partait de chez lui.*
 b. *Yannig ate an hour later, and then left his home.* ('narrative' reading)
- (65) a. *Une heure plus tard, Yannig mangeait lentement.*
 b. *An hour later, Yannig was in the process of eating slowly.*
- (66) a. *Une heure plus tard, Yannig mangeait lentement, puis partait de chez lui.*
 b. *Yannig ate an hour later, and then left his home.* ('narrative' reading)

Note that Wickboldt (2000:364) argues that manner adverbials such as *slowly* act as aspect-shift operators 'detelicizing' situations ; thus she observes the following contrast between the interpretations of the verb *die* in (67a) vs. (67b). She takes this difference to be one of telicity.

- (67) a. *John died.* (?For hours he struggled for breath). (Wickboldt 2000 :364)
 b. *John died slowly.* For hours he struggled for breath.

While I agree with J. Wickboldt that there is an aspectual difference between these two sentences, I don't think it is one of telicity, strictly speaking. For one thing, the very type of discourse structure exhibited in (67b) also arises without the help of a manner adverbial provided they involve a *non atomic* telic predicative structure, cf. (68). In the SDRT framework, the type of rhetoric relation connecting speech act referent π_1 with π_2 and π_3 is known as *Elaboration*. The verb *tidy* undoubtedly receives a telic reading in (68) in spite of the presence of an *Elaboration* discourse relation, so there is no reason to suppose that the presence of the same rhetoric relation in (67b) necessarily entails that the situation described by *John died slowly* is atelic (and conversely that *Elaboration* fails to be established in (67a) because *John died* is telic). *Elaboration* simply does not require atelic utterances.

- (68) *Yannig tidied his desk(π_1). First he filed away a bunch of loose sheets of paper(π_2). Then he cleared the drawers of all the remaining junk (π_3).*

The temporal conditions proposed by Asher & Lascarides (cf. Lascarides & Asher 1993) about *Elaboration* seem to confirm that the problem with (67a) is one of atomicity rather than telicity :

- (69) **Temporal consequence of *Elaboration* :**

$$\varphi_{Elaboration(\alpha,\beta)} \Rightarrow Part-of(e_\beta, e_\alpha)$$

'If *Elaboration* holds between speech act referents α and β , then the situation e_β underlying β is a part of the situation e_α underlying α .'

The inner stage described by *John died* in (67a) being atomic, it is impossible for axiom (69) to apply, and *Elaboration* is ruled out, so that the corresponding discourse is incoherent. To put it short, the aspectual effect achieved by *slowly* in (67b) is a 'de-atomicizing' one rather than a 'de-telicizing' one³⁰.

But this 'de-atomicizing' effect is not the only one associated with manner adverbials such as *slowly*, according to me – at least, this latter effect cannot account for the data given in (63)-(66). Recall now that axiom (45) predicts that manner adverbials will select *only* one stage, at the expense of all others. This

³⁰ There remains that *John died slowly* is not compatible with an *in*-phrase, unless it undergoes some kind of extraposition. I believe that this is a consequence of the semantics of *in*, which requires a transition – namely it has a special affinity with both IStages and RStages, so that a conflict arises with *slowly*, this manner adverbial rendering the RStage invisible to *in*.

might result in ‘minimizing’ the transitional content of telic stage structures ; the selected IStage is so strongly salient that the RStage is comparatively ‘blurred’. I think that the correct analysis for (63)-(66) should involve some connection between aspectual focus and general focus (or generally information structure ; I mean *focus* in the sense of Büring 1999). If a stage is strongly focused (as in the case of manner adverbials), other entailed stages might be so to speak ‘blurred’ (their relative salience being low), but never completely ‘invisible’ (hence the possibility of recovering a transitional, narrative reading of the *imparfait* in (66a)).

Conclusion

Yet to be written.

One important point : although the present theory of aspectual focus and stage salience does not (yet?) make *all* the required correct predictions, and it possibly makes *some* unwanted predictions, it also makes a number of desirable predictions that which no other existing theory makes.

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