

Event Structure vs. Stage Structure and Abstract Aspectual Relations

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# Event Structure vs. Stage Structure and Abstract Aspectual Relations

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## 1. Introduction

The currently dominant neo-davidsonian view on aspect calculus has driven many to define event structure (in the sense of Pustejovsky 1995) using *part-of* relations. It will be argued here that this approach is not appropriate for linguistic reasons, and not just for philosophical ones<sup>1</sup>. We will propose an alternative analysis based on *abstract aspectual relations*, offering a non-mereological treatment of the relations between events, subevents and aspectual viewpoints.

## 2. Preliminary definitions: some basic aspectual concepts

### 2.1. Defining event structure and 'lexical' aspect

We will distinguish three basic event types: terminations (telic, dynamic), processes (atelic, dynamic) and states (atelic, non-dynamic). *Dynamicity* indicates that an event has some causal content. We will moreover define *atomicity* as a property of terminations that cannot be interrupted then resumed; atomic terminations are devoid of proper subparts<sup>2</sup>. Therefore, non-atomic termination sentences allow for the *perfect progressive* (which we take to describe 'intermediary' result states), and are compatible with *completely*, *finish*, cf. (1a), whereas atomic termination sentences reject all those markers, cf. (1a) :

- (1) a. *John finished drawing / has been drawing the circle.* (non-atomic)  
b. *\*John finished leaving / #has been leaving.* (OK only if iterative)

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\*Many thanks to Nicholas Asher for helpful discussions; the present paper owes much to him.

<sup>1</sup> See Asher (1993) & Verkuyl (1993) for such philosophical arguments.

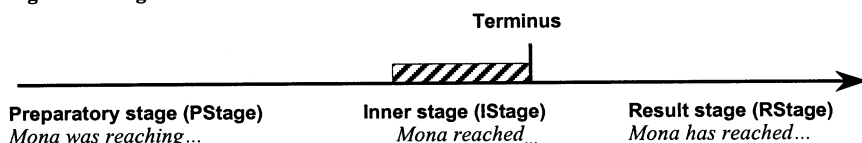
<sup>2</sup> Note that although punctual telic events are always atomic, atomic telic events may not be punctual (*\*the ship has been sinking*, cf. Caudal 1999). Punctuality thus seems to be a complex category combining atomicity and non-durativity.

## 2.2. Event stages

Another central concept we must define is that of *stage structure*, which reflects how events are conceptualized<sup>3</sup> in natural language metaphysics, and more specifically how they are decomposed into distinct *stages* (subevents). We will not be concerned in this paper with ‘real world’ metaphysics, but with a study of event descriptions inasmuch they pertain to natural language metaphysics. We will take stage structure to be more specific than the broad concept of *event structure*, which can apply to any structural property of events. It can be shown that stages admit linguistic realizations, since *predicative structures* (PSs) (i.e., verbs plus their arguments and important modifiers) exhibit different grammatical properties (e.g., the distribution and interpretation of tense morphemes and aspectual modifiers) depending on their stage structure. Specifically, we argue that it is always possible to find some combination of tense and/or adverbial modifiers causing a PS to refer to a stage *in isolation*, i.e., *independently from other stages*. We will distinguish three types of stages<sup>4</sup> (an example of stage structure is worked out in Figure 1, but see Caudal 2000 for details) :

- i) *inner stages* are ascribed to all event types; they are their ‘core’ stages, i.e. what Smith (1991) calls *developments*; they are selected by unmarked uses of the *past progressive*, and if non atomic, by *begin* and *start*;
- ii) *preparatory stages* are causal event stages instantiated for some types of atomic telic events<sup>5</sup>; they are selected under *prospective readings* of the past progressive (cf. *John was winning the race*); moreover, they are *peripheral* to the stage structure (or ‘detachable’ from it, as argued in Smith 1991), having a presuppositional status (they remain valid under negation and modals; thus *John did not win the race* nevertheless entails *John took part in the race*);
- iii) *result stages* are (stative) result subevents; they are ascribed to all event types, although with major differences between telic and atelic ones (cf. Caudal 1999); they can be expressed in English by sentences in the *perfect*.

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



<sup>3</sup> This notion is similar to Moens & Steedman’s *event nuclei* or C. Smith’s *temporal schemata*.

<sup>4</sup> Note that we do not take event terminuses, i.e., endpoints of inner stages, to be stages of their own right, for it is impossible to find any combination of tense and aspectual modifiers focusing exclusively on them.

<sup>5</sup> Indeed, not every type of atomic event has PStages; cf. the durative event described by *John was throwing a ball*, which is clearly atomic (*\*John has been throwing the ball*).

### 2.3. Aspectual viewpoint: grammatical aspect

We are adopting in this paper a two-component approach to aspectual semantics related to that defended in Smith (1991), distinguishing between 'lexical'<sup>6</sup> and 'grammatical' aspect (e.g., tense morphemes in French and English). Broadly speaking, two types of treatments of grammatical aspect have been proposed in the literature: coercion-based (e.g., Moens & Steedman 1988, de Swart 1998), and viewpoint-based approaches (e.g., Declerck 1979, Smith 1991). Let us compare them briefly, in order to decide which of the two should be favoured.

*Coercion-based* analyses argue that tense morphemes can be viewed as *aspectual coercion* operators. For instance, Vlach (1981) treats the *past progressive* as a type-shifting, 'stativizing' operator. Moens and Steedman (1988) generalized this hypothesis, and argued that English tenses contribute aspectual coercion operators, capable of imposing different sets of constraints both on their input and output events, thereby causing *two* coercions. Although we cannot demonstrate here in details why this position is empirically debatable, it is worthwhile noting a few things. First, it is questionable whether tenses should be regarded as 'pure' aspectual coercion operators, since the set of all output categories differs from the set of all input categories. Even in Moens & Steedman's network, most 'terminal categories' are not 'initial' ones (i.e., lexical aspectual categories). In other words, tenses also *add* aspectual information of a non-lexical kind. Consider the sentence *Mona is arriving*. Its aspectual meaning is unlike any *lexical* aspectual meaning, in that it focuses on the PStage while treating the IStage as its possible outcome. Moreover, it has a modal flavour that must also be accounted for<sup>7</sup>.

The *viewpoint-based approach* to grammatical aspect (cf., e.g. Smith 1991) contrasts with the coercion-based one in that it leaves room for non-lexical aspectual information, for it treats grammatical aspect as a device focusing on some subpart of an event, i.e. adopting some particular 'perspective' on it, this perspective being non-lexical in nature. We will defend here a compromise analysis so as to combine insights from both approaches<sup>8</sup>, and will attribute to tense morphemes an aspectual contribution consisting in aspectual viewpoint operators, sometimes capable of coercing their input categories. Furthermore, we will argue that viewpoints act as temporal anchoring devices. Thus, event boundaries (e.g., culminations, or endpoints contributed by *for* adverbials) will turn into *temporal interval boundaries* when mapped by viewpoints onto the time

<sup>6</sup> Mind the inverted comas: we do not claim that event structure info is expressed just by verbs, but by PSs.

<sup>7</sup> Note that there is another problem with Moens & Steedman's approach : they define coercions with respect to only *one* stage, so that there seems to be an implicit 'focus' operation going on.

<sup>8</sup> We will not follow Smith (1991) when she excludes coercion by viewpoints. Consider *inchoative* readings of the French *passé simple*: *Quand il la vit, Yannig aima Mona*. ('*The instant he saw her, Yannig started loving Mona*'). Arguably, the CoS described here is a coerced reading (and does not originate in some lexical ambiguity of states in French, as Smith claims; this would cause countless lexical ambiguities). This fact suggests that viewpoints sometimes coerce events.

domain (cf. Declerck 1979, Depraetere 1995). We will propose the following elementary typology of viewpoints:

- i) *Perfective* viewpoints require their input events to imply a change of state (CoS, henceforth), in conjunction with some form of salient boundary (either initial or final); unless adverbial modifiers are used, the focus remains on the IStages of the input events (see section 4.1);
- ii) *Imperfective* viewpoints can take most or all types of events as their input, and (in their unmarked uses) focus on PStages or IStages, but CoSs and associated boundaries (if any) are disregarded;
- iii) *Resultative* viewpoints focus on RStages (cf. Caudal 1999); input events may be bounded or not, depending on specific resultative viewpoints (cf. the English *simple* vs. *progressive perfect*)<sup>9</sup>.

#### 2.4. Why PStages are *peripheral* whereas IStages are *central*

We will try and show here that IStages should be regarded as *central* to an event's structure, and PStages as *peripheral* to it (we will not discuss RStages, for they are clearly external in many respects). We have already mentioned the *presuppositional* status of PStages. Being presupposed, they should be considered as referentially 'peripheral' to an event<sup>10</sup>. Moreover, PStages can never appear under the scope of aspectual verbs such as *begin* or *start* – which systematically select IStages. We take this as evidence that PStages are not part of the 'core' of an event, while IStages are. Finally, the existence of aspectually *neutral* (Smith 1991) or *underspecified* (de Swart 1998) viewpoints naturally focusing on IStages suggests that the latter are *unmarked*, 'central' stages. Thus, sentences describing telic events in the French *futur* can have two readings : bounded, perfective-like readings (2a), or unbounded, imperfective-like ones (2b). Yet the *futur* cannot focus on PStages in either case; it contributes a neutral, underspecified viewpoint.

- (2) a. *Lorsque tu arriveras* ( $e_1$ ), *Jean lavera la voiture* ( $e_2$ )  
'When you arrive, Jean will wash the car'.  $e_1 < e_2$ ;  $e_2$  telic+bounded trace
- b. *Lorsque tu arriveras* ( $e_1$ ), *Jean dormira* ( $e_2$ )  
'When you arrive, Jean will be sleeping'.  $e_1 \subseteq e_2$ ;  $e_2$  atelic+unbounded trace

In (2a) and (2b), the *futur* focuses on IStages, treating them as "default"/unmarked stages<sup>11</sup>. The same analysis applies to the English *simple past*, which normally

<sup>9</sup> This typology is not exhaustive, and excludes complex viewpoints, such as the one associated with the English *perfect progressive*, which is in fact an *imperfective* resultative viewpoint.

<sup>10</sup> Cf. also Smith (1991), who introduces the related notion of *detachability*.

<sup>11</sup> In fact, accessibility of stages to tenses in general also depends on other factors affecting event structure, like adverbial modification; we will come back to this issue in section 4.

focuses on IStages, and on RStages only in marked contexts<sup>12</sup>. Let us move now to the study of the relations connecting stages.

### 3. How stages and events should be related

#### 3.1. Existing approaches

To this day, two main types of treatments of stage structure have been proposed in the literature: some authors make use of non-linguistic relations between stages (i.e., world knowledge), others of mereology. See Steedman (1996) for a review of the first type of approaches. They present several well-known drawbacks: they are manageable only for small, closed-world models, while falling prey to arbitrariness. We will therefore leave them aside. Let us consider now the second existing type of approach to stage decomposition, namely *mereological* approaches. Indeed, mereology looks *prima facie* like an obvious way of relating stages if one considers it sensible to reify events. Davidson (1967) thus states that events are subject to mereological principles<sup>13</sup>, and Pustejovsky (1995) offers an explicit mereological approach: stages are related via the *RESTR* feature in the *EVENSTR* feature structure of Generative Lexicon (GL) entries, and *RESTR* comprises mostly mereological operators (e.g.,  $\leq$ : exhaustive ordered *part-of*).

#### 3.2. Why stages should not be mereologically related

Unfortunately, a mereological treatment cannot properly take into account the central vs. peripheral nature of stages. It tends to put all stages on an equal footing, since only one type of relation can be used (namely *part-of*) to connect them<sup>14</sup>. It might seem that Pustejovsky (1995) solved this problem by introducing the notion of (*event*) *headedness*. *Headed* subevents are aspectually more salient, and headedness licences adverbial modification, e.g., by durative adverbials (*for*-phrases) for result states. Headed subevents would thus be 'central' stages, whereas non-headed subevents would be 'peripheral' stages. But we will now show that headedness is in fact orthogonal with 'centrality/peripheralness'. Take for instance the stage structure we can ascribe to *reach the summit* and *arrive*. If we follow Pustejovsky's definition of headedness, those VPs describe *left-headed* events, i.e. events with headed causal subevents, allowing for adverbial modification (cf. *John quietly reached the summit/arrived*). Contrariwise, modification of their result states by a *for*-phrase is ruled out (*??John reached the summit/arrived for an hour*), they are therefore *not* headed/salient. Yet *reach* and *arrive*-events obviously have peripheral causal subevents (they have a presuppositional status, and allow for prospective readings in the *progressive*);

<sup>12</sup> See Lascarides & Asher 1993; according to them, the *simple past* licences reverse causal order iff. the 'default' Narration Axiom is overridden by some more specific causal information. And crucially, in such cases, the *simple past* obviously contributes a resultative viewpoint.

<sup>13</sup> Similarly, Parsons (1990) adopts a neo-davidsonian position and implicitly relies on a mereological approach, referring to stages as *portions of events*.

<sup>14</sup> Actually, we found out that a similar point was made in Kamp & Reyle (1993:559, note 27).

these are PStages. Thus, there is an obvious mismatch between headedness and centrality: PStages get headed/salient, whereas we would expect them not to be headed. We believe that Pustejovsky (1995:73) confused headedness with 'centrality' when he classified *arrive* as describing right-headed events, and simply did not notice that this verb fails the tests he defined for right-headedness. We can thus conclude that 'headedness' and 'centrality/peripheralness' are two distinct categories (see Caudal 2000); peripheralness/centrality is captured merely by the distinction between IStages and other stages (PStages in particular), regardless of their respective salience. While a mereological approach to stage structure is compatible with headedness (or *stage salience*), we believe it cannot express peripheralness, because peripheral stages are *not properly* part of an event – this is why verbs such as *begin* cannot take scope over PStages, but only over IStages<sup>15</sup>. In our view, this fact makes it necessary to find an alternative treatment.

#### 4. Stage structure and aspectual viewpoint

We will now turn to the formulation of such an alternative approach. A natural way out of the theoretical puzzle we've been discussing consists in treating stages as separate event descriptions, connected *via* non-mereological relations.

##### 4.1. Viewpoints, adverbial modifiers and stage *salience*

We will argue here that aspect construal involves setting up a hierarchy of salience among stages, starting from lexical information (i.e., a 'default' hierarchy of salience). We have already shown that stage 'centrality/peripheralness' and stage 'salience' are not identical notions. IStages are always central, and PStages are always peripheral (and only them can be peripheral), being presuppositional, etc., even though the latter may not be the least salient stages (cf. e.g., *reach*). We have also implicitly suggested (following Pustejovsky 1995) that some initial salience information is *lexically encoded* (cf. *reach* vs. *arrive* in 3.2). We will therefore attribute *salience hierarchies* to verbal lexical items. We will argue that salience primarily expresses how easily stages can be *selected* and 'brought into focus' by either tenses or adverbial modifiers. A stage with salience 2 will be in focus unless changes about focus/salience information are caused by tenses or adverbial modifiers. Consequently, stages whose lexical salience is equal to 2 (typically IStages) are focused 'by default', and do not require any informative device (i.e. non-neutral tense, adverbial modifier) to be brought into focus. Stages with salience 1 can be brought into focus by either adverbial modifiers or non-neutral viewpoints, but are not focused 'by default'. Finally, stages with salience 3 can be brought into focus only by non-neutral viewpoints (adverbial modification is not licenced for them). If we attribute a 'IStage (2) > PStage (1) >

<sup>15</sup> This does not amount to claiming that mereology does not play any role in the study of *event structure* at all – we are merely claiming that *stage structure* cannot be based on it. Mereology is useful for other *event structure* issues, such as the internal structure of IStages, in particular in order to distinguish between *atomic* and *non-atomic* ones. See Caudal (2000) for details.

RStage (0)' salience hierarchy to *reach* and *arrive*-events, we can explain why their RStages cannot be modified using durative adverbials (or other adverbials), while their PStages can. Contrariwise, *leave* receives a 'IStage(2) > RStage (1) > Pstage (0)' salience hierarchy, thus allowing for adverbial modification of its RStage, but not of its PStage<sup>16</sup>.

Note also that viewpoint can bring into focus stages with lexical salience 0, thus making them accessible to adverbial modifiers if those have scope over tenses. This is for instance the case with the French durative adverbial *depuis* ('since'), which cannot focus on the RStages of events described by *arriver* ('arrive') in the present tense, but can in the *passé composé* (cf. ??*Yannig arrive depuis une heure*, vs. *Yannig est arrivé depuis une heure*, 'Yannig arrived an hour ago'). *Arrive* has a RStage with salience 0, but this stage can be brought into focus by the *passé composé* (thus receiving 'maximal' salience) – in which case it becomes accessible to *depuis*, *depuis* taking scope over tenses. We will call a stage in focus at the end of the aspect construal procedure *asserted*; they are the stage a sentence in context refers to, and temporally anchors. We will argue that non-asserted stages are merely *implied*. Consider the sentence *Yannig partit* ('Yannig left'). A perfective viewpoint is used, involving some form of CoS. An IStage is asserted/brought into focus, whereas a RStage and a PStage are just implied. Note that if we take a sentence with an imperfective viewpoint (e.g., *Yannig partait*, 'Yannig was leaving'), an IStage is also asserted, but it is merely the *possibility* of a RStage that gets implied (so as to account for the well-known imperfective paradox). Finally, in the case of a *resultative* viewpoint, RStages would be asserted and IStages+PStages implied. Furthermore, we believe the implied/asserted distinction to be discursively important, causing stages to have different discursive contributions. The fact that 'event anaphora' is possible for asserted stages but not for implied ones (cf. (3)) supports this view.

- (3) *Fred has broken the carafe* (IStage<sub>i</sub>). ??*It<sub>i</sub> took him five seconds*.

Our theory of stage structure will make it possible to account for both those issues and focus/salience issues. Crucially, it clarifies what should be done about 'non-asserted' stages, whereas it seems to remain a mystery for existing theories.

#### 4.2. Stage structures, stages and abstract relations between stages

We will now outline a formal treatment of stage structures within the DRT framework<sup>17</sup> (Kamp & Reyle 1993). The aspectual domain can be articulated around three types of entities: event discourse referents (EDRs), stages

<sup>16</sup> See Caudal (2000) for a detailed discussion of this point and related issues, in particular for a classification of events along their salience hierarchies.

<sup>17</sup> Although we are using relations not unlike SDRT discourse relations, our treatment pertains to the DRT framework inasmuch our aspectual decomposition is more fine-grained (i.e., clause centered) than the discourse/pragmatics phenomena with which SDRT is usually concerned.

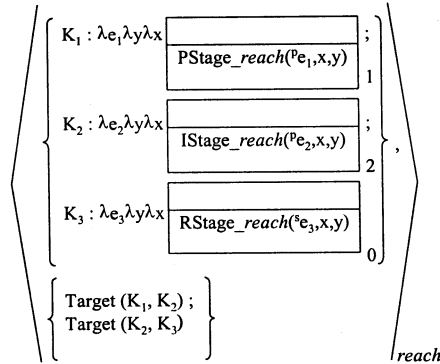


(predications of EDRs, or *event descriptions*) and stage relations. EDRs (noted  $e_1, \dots, e_n$ ) merely convey spatio-temporal information, and allow for ‘event coreference’ (cf. Danlos 1999). Indeed different stages may share the same EDR (or rather, possess EDRs that will be eventually treated as coreferent):

(4) *John is gone* ( $e_1$ ). *He took French leave* ( $e_2$ ).

In (4), the two sentences contribute two different descriptions, but eventually  $e_1 = e_2$ . Ontologically, we will assume that stages are predications of *distinct* EDRs (and not of subparts of *one* EDR). Therefore, they are proposition-like abstract discourse objects, possessing a truth value (e.g.,  $IStage\_leave(e, mona)$  means *it is true that a ‘Mona-leaving’ happened*). Formally a stage is represented as a sub-DRS embedded in the main DRS construing the whole sentence. For a given verb, each available stage is lexically encoded, as shown in Figure 2 for *reach*. Saliency is given using subscripts on the right hand side of DRSs representing stages.

Figure 2: lexical stage structure for *reach*



Note that EDRs within stages are lexically typed – IStage include states ( $^s e$ ) or processes ( $^p e$ ) depending on verbs, PStages processes, and RStages states<sup>18</sup>. Stage structure proper is construed using temporal consecution (*Consec*) or teleonomy<sup>19</sup> (*Target*) to relate stages (i.e., sub-DRSs), depending on stages and verbs (note that formally  $Target(K_\alpha, K_\beta) \leftrightarrow Consec(K_\alpha, K_\beta) \wedge Dynamic(K_\alpha)$ , with the predicate *Dynamic* being a defining property of dynamic event referents). We will not say more about those issues for want of space. Of course, *Consec* gives rise to temporal entailments of the following form:  $Consec(\langle U_1, \{ \dots P(e_1) \dots \} \rangle, \langle U_2, \{ \dots Q(e_2) \dots \} \rangle) \rightarrow e_1 < e_2$ . From a formal standpoint, we are thus augmenting the DRT

<sup>18</sup> This explains e.g., why sentences in the *perfect* describe stative events. Some of the type shifts assumed by Moens & Steedman (1988) can thus be expressed using viewpoints.

<sup>19</sup>  $Target(\alpha, \beta)$  expresses that stage  $\beta$  is *targetted* by the causal/dynamic stage  $\alpha$ . Thus, teleonomy captures what can be intuitively described as ‘dynamically pursued changes of stage’.

model by adding binary predicates of the form  $Consec(K_1, K_2)$  to the set of conditions of a DRS. To sum it up, the aspectual content of lexical entries is a pair  $\langle S, R \rangle^{20}$  consisting in a set of stages  $S$  and a set of abstract aspectual relations  $R$ .

### 4.3. The contribution of stage structure and viewpoint to aspect construal

Our aspect construal procedure relies on the interaction of two theoretical devices: viewpoints, contributed by tenses, and stage structures, contributed by lexical material – *modulo* of course the role of adverbial modifiers. Bearing in mind that i) perfective viewpoints introduce CoSs, and require the asserted stage to be temporally bounded, whereas ii) imperfective viewpoints will not require any salient boundary on the asserted Stage, we will formalize viewpoints<sup>21</sup> as follows:

- (5) *Axiom on perfective viewpoints:*  $Perfective(e) \rightarrow e \subseteq t$   
 (6) *Axiom on imperfective viewpoints:*  $Imperfective(e) \rightarrow t \subset e$

$t$  being a DRT location time (cf. Kamp & Reyle 1993:514 sqq.), and playing a role similar to that of the Reichenbachian reference point  $R$ .

Let  $\langle S, R \rangle$  be a verb's aspectual lexical entry. Viewpoint and adverbial modifiers will first select a stage (using salience) in  $S$  and assert it. Asserting a stage  $\langle \{e_i, u, v, \dots\}, \{Q(e_i, u, v, \dots)\} \rangle$  will cause the context DRS  $K$  to be updated as follows:

$$\begin{aligned} & \text{update}(K, \langle \{e_i, u, v, \dots\}, \{Q(e_i, u, v, \dots)\} \rangle) = \\ & \langle U_K \cup \{e_i, u, v, \dots\}, Con_K \cup \{v(e_i), K_i = \{\emptyset, \{Q(e_i, u, v, \dots)\}\} \} \rangle, \end{aligned}$$

where viewpoint is noted  $v$ . Stages in  $S$  that are related either directly or indirectly<sup>22</sup> to the asserted stage by some relation of  $R$  will then be implied. Standard implication will update  $K$  in the following manner:

$$\begin{aligned} & \text{update}(K, \langle \{e_j, u, v, \dots\}, \{Q(e_j, u, v, \dots)\} \rangle) = \\ & \langle U_K \cup \{u, v, \dots\}, Con_K \cup \{\rho, K_j = \langle \{e_j\}, \{Q(e_j, u, v, \dots)\} \} \rangle \rangle \end{aligned}$$

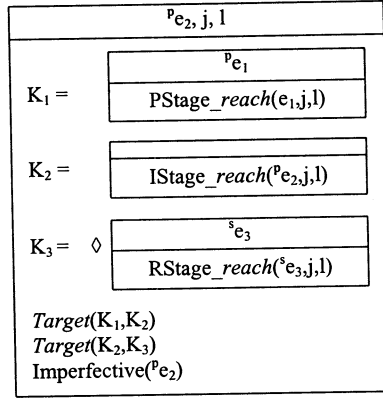
where  $\rho$  represents a relation between  $K_j$  and the asserted stage (e.g.,  $Consec(K_i, K_j)$ ). Note that in the case of resultative viewpoints, PStages are *de facto* implied if they exist, though they are not directly related to the asserted stage. Finally, imperfective viewpoints will cause stages  $K_j$  temporally following the asserted stage to be merely *possibly* implied:  $K_j = \diamond \langle \{e_j\}, \{Q(e_j, u, v, \dots)\} \rangle$ .

**Figure 3** gives a flavour of the final representation of the aspectual meaning of a sentence<sup>23</sup>.

<sup>20</sup> For the sake of clarity, we will reify stage sub-DRSs, noting them  $K_i$ , although they do not belong directly to the universe of discourse referents of the main DRS. *Consec* and *Target* are thus second order predicates.

<sup>21</sup> We will not offer here a formal treatment of resultative viewpoints for want of space to do so, but see Caudal (1999) for a study of their aspectual properties.

<sup>22</sup> Transitivity is nevertheless blocked by the modal operator  $\diamond$  (cf. *infra*).

**Figure 3: Stage structure for *John was reaching the summit***

#### 4.4. Introducing viewpoint operators within DRs

As a matter of fact, SDRT discourse relations (DRs) are aspect-sensitive (Asher 1993, Lascarides & Asher 1993); therefore it sounds sensible to make them viewpoint and stage structure sensitive. Therefore, we will now attempt at redefining how DRs (especially those endowed with an important aspecto-temporal / causal content), stage structures and viewpoints interact. Let us begin with *Narration*. *Narration* causes textual order to mirror temporal and/or causal order (cf. (7)). *Narration* is entailed via a defeasible rule and an axiom (cf. i)). Although *Narration* is usually seen as the most generic entailable DR, it obviously involves a natural sequence of events with CoSs, and therefore requires a *perfective* viewpoint. We will thus replace i) with ii):

- i) *Narration*:  $\langle \tau, \alpha, \beta \rangle > \text{Narration}(\alpha, \beta)$   
 Axiom on narration:  $\nabla(\text{Narration}(\alpha, \beta) \rightarrow me(\alpha) < me(\beta))$
- ii) *Narration*:  $\langle \tau, \alpha, \beta \rangle \wedge \text{perfective}(me(\alpha)) \wedge \text{perfective}(me(\beta)) > \text{Narration}(\alpha, \beta)$
- (7) *Mon fils arriva en retard à l'école. La maîtresse le gronda.*  
 'My son arrived late at school. The teacher scolded him'.

Contrariwise, *Explanation* requires a non perfective viewpoint to allow for reversed causal order, as in

(8). We will therefore replace axiom iii) with iv):

- iii) *Explanation*:  $\langle \tau, \alpha, \beta \rangle \wedge \text{cause}(me(\beta), me(\alpha)) > \text{Explanation}(\alpha, \beta)$
- iv) *Explanation*:  $\langle \tau, \alpha, \beta \rangle \wedge \text{cause}(me(\beta), me(\alpha)) \wedge \neg \text{perfective}(me(\beta)) > \text{Explanation}(\alpha, \beta)$

<sup>23</sup> Note that indicating salience is unnecessary and even irrelevant at this final step of the aspect construal procedure, because an asserted/focused stage has been chosen.

- (8) *La maîtresse a grondé mon fils. Il est arrivé en retard à l'école.*  
'The teacher scolded my son. He arrived late at school'.

Finally, we will stipulate that *Background* requires an imperfective viewpoint to allow for overlap between events, rather than use the coercion-based axiom about 'states overlap', and replace the usual SDRT axiom  $v)$  with  $vi)$ :

- $v)$  States overlap:  $\langle \tau, \alpha, \beta \rangle \wedge \text{state}(\text{me}(\beta)) > \text{overlap}(\text{me}(\alpha), \text{me}(\beta))$   
Background:  $\langle \tau, \alpha, \beta \rangle \wedge \text{overlap}(\text{me}(\alpha), \text{me}(\beta)) > \text{Background}(\alpha, \beta)$   
Axiom on Background:  $\forall (\text{Background}(\alpha, \beta) \rightarrow \neg \text{me}(\alpha) < \text{me}(\beta))$
- $vi)$  Background:  $\langle \tau, \alpha, \beta \rangle \wedge \text{imperfective}(\text{me}(\beta)) > \text{Background}(\alpha, \beta)$   
Imperfective overlap:  $\langle \tau, \alpha, \beta \rangle \wedge \text{imperfective}(\text{me}(\beta)) > \text{overlap}(\text{me}(\alpha), \text{me}(\beta))$
- (9) *Jean ouvrit la porte. La pièce était obscure.*  
'John opened the door. The room was pitch dark'.

## 5. Conclusion

To summarize, the main features of our proposal are the following. Stage structure has been introduced as a representational, linguistic device (encoded in the lexicon, and modified at structural levels); it comprises several EDRs plus non-mereological relations between the associated event descriptions, as well as several theoretical devices (e.g., *salience hierarchies*) accounting for the influence of 'grammatical aspect' as well as adverbial modifiers on stage structure. This move allows for inferences about them (*via* EDRs), as well as subevent anaphora/coreference. It offers an explicit treatment of stage structure, as well as an account of the discourse semantic properties of stages, depending on whether they are asserted or implied, with what kind of viewpoint. The latter feature of our approach makes it possible to enrich and optimize aspect-sensitive SDRT axioms and DRs. But our research remains in need of further investigations, both formal and empirical, e.g. with respect to the role of stages and salience in discourse semantics (cf. so-called *event coreference* phenomena), or aspectual composition (e.g., coercion mechanisms are still very much *terra incognita* in this respect<sup>24</sup>).

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<sup>24</sup> But see Pustejovsky (1995:111) for a definition of coercion by means of function application; one could associate a set  $\Sigma_\alpha$  of 'grammaticized' coercion operators with each viewpoint  $\alpha$ .

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