Punctual Verbs and the Linguistic Ontology of Events

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1. Introduction

The motivation for this research[1] stems from the need of bringing to surface an unrecognized (yet occasionally alluded to in the literature) distinction within the class of non-durative verbs. Although some authors have, more or less incidentally, referred to a finer classification within this category, nobody to our knowledge has directly addressed the issue.

In the present paper we analyse data from Italian, compellingly suggesting that some non-durative verbs show systematic divergences w.r.t. the typical behavior of achievements. These differences may be accounted for by assuming that a subclass of non-durative verbs, that we call punctuals, are non-telic, in the sense that they do not involve a resulting state as part of their semantic endowment.

Here is a list, obviously incomplete, of such verbs: *Incontrare* 'to meet', *fare la conoscenza* 'to get acquainted', *spaventare* 'to scare', *spaventarsi* 'to get scared', *sorprendersi* or *stupirsi* or *meravigliarsi* 'to be astonished', *avere un soprassalto* 'to jerk', *accadere* or *succedere* 'to happen', *succedere a qualcuno* 'to replace somebody', *abdicare* 'to abdicate', *notare* 'to notice', *scorgere* 'to spot', *lanciare un'occhiata* 'to throw a glance', *sbagliare* or *sbagliarsi* 'to make a mistake', *dare una sberla* 'to give a smash', *dare un voto* 'to give a mark', *investire* 'to run over', *esplodere* 'to explode', *lanciarsi dal trampolino* 'to jump from the spring-board', *sfracellarsi* 'to crash', *spezzare* 'to break', *infrangere* 'to crush', etc. The list could be integrated with predicates that are potentially ambiguous between non-durativity and durativity (the latter corresponding to an iterative reading), such as *colpire* 'to strike', *lanciare* or *gettare* or *scagliare* 'to throw', *pugnalare* 'to stab', *sparare* 'to shoot', *lampeggiare* 'to lighten' etc. Note, however, that this sort of ambiguity cannot possibly arise for 'irreversible situation' predicates, such as *spezzare*, *infrangere*, *esplodere* (see above) and the like, for which no iteration is conceivable. Needless to say, when both readings are

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[1] This work was jointly developed by the two authors. However, for academic purposes, Luca Dini is responsible for sections 3-4, and Pier Marco Bertinetto for sections 1-2.

available, the non-durative meaning is the only one relevant for our concern. This also applies to cases such as the following, where the durative reading may be regarded as more prominent than the alternative one: *bussare* 'to knock', *sbattere le ciglia* 'to twinkle', *singhiozzare* 'to sigh', *saltare* 'to jump', *gridare* 'to shout', *starnutire* 'to sneeze' and the like (but consider the unambiguous predicates *spiccare un salto* 'to jump once', *emettere un grido / uno starnuto* 'to shout / sneeze once'). By contrast, with verbs such as *ruttare* 'to burp' the non-durative meaning looks more prominent than the durative one.

Being non-telic, punctuals do not involve a preparatory phase, pragmatically attached to the actual completion of the event. Thus, with the progressive, the event can be viewed only in its actual occurring, rather than (as a possible alternative available to achievements) in the prelude leading up to the event, whose completion brings about the resulting state. Interestingly, we shall also show that the class of punctuals may be further articulated. Namely, we shall partition it into two main types, here called *event-punctuals* (= e-punctuals) and *state-punctuals* (= s-punctuals). As these terms indicate, e-punctuals share features with eventive predicates, while s-punctuals share features with stative predicates.

The reason why punctuals have not received so far the attention they deserve is obviously due to the relatively small number of verbs belonging to this class. Nevertheless, the discussion will prove that several interesting properties can be detected, whose inclusion into the analytic framework brings about a more comprehensive picture, both from a descriptive and from a theoretical point of view (i.e. within a full-fledged ontology of events). It will turn out, in fact, that the two types of puntual verbs represent one missing ring in the general theory of actionality, filling a notable gap in the system. Thus, their recognition is not only descriptively relevant, but also theoretically desirable.

Although the discussion focuses on Italian, our conclusions may easily be extended to other languages as well. Indeed, the hints towards a finer classification of non-durative verbs that are dispersed in the literature concern several other languages, such as English, German and Mandarin (at the very least). We believe that, minor details aside, the picture delineated here should basically apply to most, perhaps all, natural languages.

The structure of this paper is as follows. In 2 we analyse the available evidence, suggesting that punctuals differ from achievements in a number of salient properties. In 3 we present our formal approach to the ontology of events. In 4 we apply our model to account for all relevant contexts, such as the use of the progressive (4.1), or the compatibility with specific temporal adverbials (4.2).

2. The Data

In this section we present evidence that the class of non-durative verbs should be split into two main categories: achievements and punctuals. In addition, we will show that the latter category further devides in two subcategories: e-punctuals and s-punctuals. For the sake of simplicity, in the whole of this section we focus on a comparison between achievements on the one side and the two types of punctuals on the other side, disregarding the remaining classes of predicates. A comprehensive picture of the main categories, based on a cross-classification by semantic features, is shown by the following prospect for ease of the reader:

	durative	telic	stative
states	+	-	+
processes	+	-	-
accomplishments	+	+	-
achievements	-	+	-
punctuals	-	-	-

As may be seen, the feature [+/- telic] opposes punctuals not only to achievements, but also to accomplishments. However, achievements and punctuals together are contraposed to the remaining categories by the feature [+/- durative]. Thus, it will be enough for our immediate purposes to show that punctuals and achievements differ on some relevant properties. Nevertheless, in section 3, when presenting our formal proposal for the treatment of actional categories, we shall provide the basic semantics for all the main classes listed above.

The proposal that we are putting forth here is not new in itself. It has been creeping in the literature for quite a while, although it never gained general attention. Obviously, this is a minor distinction, within the general problem of actionality, for it concerns a relatively small number of predicates. It is thus no wonder that even the authors who allow for it, do not always mention it in their writings. Despite this, we would like to claim that the full aknowledgement of this particular class has far-reaching theoretical consequences. As a first step, we shall review a selection of works containing explicit indication of the existence of punctual verbs (whatever is the name they are called with in each case). This may be regarded as the background of our analysis, for it proves that the problem we are dealing with here has been (at least implicitly) faced by a number of scholars in this field.

Vlach (1981) observes that:

> There is a class of achievement sentences that do not report the completion of any accomplishment and such that there is no process that characteristically leads to their truth. Presumably for this reason, progressives of sentences in this class are unusual. *I am astonishing Max* is distinctly odd, although *I am doing something that will astonish Max* is acceptable. Some other mental verbs, like *realize*, belong with *astonish*, as do some verbs that designate instantaneous physical events, like *explode* and perhaps *hit.*
> (p. 290)

Edgren (1985, 68-69) notes that while typical achievements with the progressive often express an imminential meaning, a related class of non-durative verbs, that she calls "strictly punctual verbs", denote the actual occurrence of the event or its iteration. As examples of this, she proposes *reach*, *stab*, *hit*, *yell.* Essentially the same position is expressed by Smith (1991, 65-67), who proposes examples such as *cough* or *flap* (*one's wings*). In her terminology, punctuals are called "semelfactives". This view (and terminology) is also adopted by Yeh (1991, 263-264), who explicitly quotes the previous work. This author claims that semelfactives, such as *knock*, differ from achievements inasmuch as they "have no associated process and result state". Just as in English, in Mandarin these verbs may take a purely iterative (as opposed to imminential) meaning, when the progressive marker *zhe* is employed.

Very much in the same vein, Kearns (1991, 22) writes:

> I add here a fifth [scil., w.r.t. the four Vendlerian categories] class of predicates describing events which may be momentary and apparently bounded, but are not classed as telic by the usual tests; these are the activity predicates such as *touch*, *cough*, *sneeze*, *kick*, *punch*, *hit*, *slap*, etc. on their semelfactive reading.

Later on (p. 276-277), this author repeats the argument that punctual verbs, as opposed to achievements, have no *prelude*, so that when the progressive is applied to them, they cannot develop an imminential meaning, and it is hard to use the progressive in general.

Mittwoch (1991) observes that verbs such as *notice* or some synonyms of *die* may not be used in the progressive (**he is noticing / passing away / popping off / kicking the bucket*). These verbs obviously belong to the set of predicates under analysis here.

Vater (1989) presents a classification of actional categories in which punctual verbs, or "Semelfaktive" in his terms, occupy a specific place. As examples he indicates *husten* ('cough') and *aufschrecken* ('jerk'). These are contraposed to "Vorkomnisse" (i.e. achievements) by the

feature [-RES], "resultativ" (that we may interpret as *telic*). Similarly, Jackendoff (1991, 40) isolates the class of "point-events", which includes *flash* and *click*, characterized by their boundedness and by their lack of dimensionality (which translates as lack of duration in the time domain). The same observation is made by Kiefer (1992), who speaks of "momentary events which lack an internal structure" with reference to predicates such as *having a sudden quiver* or *snapping* (by a string).

   Egg (1995b), suggests that verbs such as *to cough* and *to flash* should be assigned the category *intergressive*. They are opposed to *change* predicates, which include standard achievements and accomplishments. The main feature distinguishing these two classes is telicity: change predicates are telic and bounded, whereas intergressive predicates are bounded without being telic. Unfortunately, Egg fails to recognize punctual predicates as a class in itself. Indeed, in his approach the class of intergressives also contains predicates which are not standardly identified with punctuals, such as *playing a sonata* or *coughing for two hours*. Egg thus rejects the distinction between punctual and non punctual predicates, which will be crucial in this work. Neverteless, his work is important in that it provides clear motivations for distinguishing telicity from boundedness.

   Engelberg (1998, 363-78) observes that non-durative verbs ("punktuelle Verben") divide into verbs "mit" vs. "ohne Nachzustand" (i.e., atelic vs. telic), which seems to neatly correspond to our distinction between punctuals vs. achievements. Unfortunately this author does not provide explicit criteria to distinguish between these two classes, so that his position is not always consistent. For instance, verbs such as *recognize*, *spot*, *notice*, *astonish* are included among the category of "Nachzustandverben" (p. 75) simply on the ground that, e.g., after noticing x one inevitably knows that x. But as we shall see, this purely intuitive criterion is not a viable one. The discrimination must ultimately rest on the differential compatibility (also in terms of diverging interpretations) with selected adverbials and syntactic constructions. Otherwise, one might easily jump to the conclusion that *to have a dream* is telic, simply due to the fact that once a dream has been experienced, a state of dream-experience is for ever instaured. Yet, anybody would agree that this predicate fails to pass any of the usual telicity tests. The only explicit criterion provided by Engelberg concerns the effect of phasal verbs such as *begin / start* or *finish / stop*, as in **John began / finished noticing the painting vs. John began / finished jumping*. According to the author, the former sentence is ungrammatical because it contains an achievement, whereas the latter is grammatical because it is based on a punctual verb. According to our view, however, both verbs are punctual; the reason of the diverging behavior simply lies on the

fact that *notice*, being an 'irreversible situation' predicate, is obviously incompatible with iterativity, hence *a priori* incompatible with phasal verbs presupposing durativity (be it inherent durativity or durativity derived via iteration).

Both Dahl (1999) and Lehmann (1999) refer to the type of punctual verbs exemplified by Russian verbs such as *kaSljat'* 'cough' vs. *kaSljanut'* 'cough once', *pugat'* 'scare' vs. *pugnut'* 'give a scare'. Dahl quotes similar (i.e., morphologically related) pairs in Navajo and Hopi; Lehmann quotes Portuguese examples such as *olhar* 'look' vs. *dar uma olhada* 'throw a glance', *gemer* 'sigh' vs. *dar um gemido* 'heave a sigh' (for similar Italian examples, see above in our initial list of candidates; e.g., *lanciare un'occhiata*). Johanson (2000, 61-62) includes in his classification of actional types the class of "momentaneous finitransformatives", which seem to correspond to our punctuals. He states that it is "highly dubious whether the actions denoted by these [verbs] might be regarded as telic". By contrast, "non-momentaneous finitransformatives" (such as *die*), corresponding to fully-fledged achievements, involve telicity, and most notably imply some temporal development leading up to telos. In our view, this temporal development is to be understood as a preliminary phase, pragmatically connected to the event proper, but distinct from it in terms of intrinsic content (see below for further details).

A specially interesting case, according to Yoshimoto (1998, 46), is offered by Japanese. This author notes that Japanese presents a class of verbs that he calls "non-effective punctuals" (to be interpreted as 'non-durative atelic' in our terminology), i.e. precisely the class of punctuals under discussion in this paper. Among these, we find verbs such as *ichibetsu-suru* 'cast a glance', *mabataki-suru* 'blink', *tobidasu* 'spring out'. Japanese punctuals exhibit an interesting characteristic when used with the form *-te iru*. In order to understand the point, some background should be provided. The form *-te iru* receives a different range of readings with different types of verbs. Leaving many details aside, including the somewhat idiosyncratic behavior of some minor classes, the situation may be summarized as in the following table (where the behavior of stative verbs is ignored), which spells out the interpretation of the form *-te iru* with different types of predicates (cf. Yoshimoto: 58):

	DURATIVE	NON-DURATIVE
TELIC	*progressive*, **resultative**, experiential,habitual	**resultative**, experiential,habitual
ATELIC	*progressive*, experiential,habitual	experiential,habitual

In short: with durative verbs (activities and accomplishments) the form *-te iru* may get a progressive reading; with telic verbs (accomplishments and achievements) it may have a resultative reading; with punctuals, however, the only available readings are the experiential and habitual ones, which are also available to the other types of predicates listed in the table. Thus, Japanese punctuals lack not only those properties that would legitimate them as durative, which is self-evident, but also as telic, which is precisely the issue we are addressing here.

Rothstein (2003, 184-187) presents an entirely original view. "Semelfactives" are regarded as intrinsically ambiguous predicates. Depending on the context, they may be used as semelfactives proper (namely, punctuals) or as activities. This is in itself no new observation, except that the author considers this to be systematically the case. Non-ambiguous predicates such as *to notice* and *to spot*, are regarded as achievements.[2] In contradistinction to Smith and others, Rothstein considers semelfactives to be telic predicates. They are obtained from the corresponding activity by means of a 'natural atomic function', which singles out the minimal set P^{min}. Within activities which may not be used as semelfactives, P^{min} picks out a singular and non-atomic set, whereas within activities which may be used as semelfactives P^{min} picks out an atomic set. This captures the intuition that two minimal events of walking may overlap, whereas two minimal events of jumping will not.

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[2] The ungrammaticality of the progressive construction with these two predicates (as in: **John was spotting/noticing the sheet on the desk*) is considered to be a consequence of non-agentivity (p.52). This, however, cannot be the actual reason. In fact, the author contradicts herself, since a few pages earlier she admits that achievements may be non-agentive (p. 49). As we shall show in section 2.1, the reason for the unavailibility of the progressive with these predicates is quite different. We shall claim that they are true punctuals, rather than achievements; but in addition, and crucially, they are stative. As such, they obviously are non-agentive; but non-agentivity cannot be the reason for the exclusion of the progressive, for this construction is perfectly available to non-agentive achievements (as in: *The pizza is finally arriving*), just as it is available to non-stative punctuals (see section 2.1). Needless to say, even sentences like the ones cited above become acceptable in a 'slow-motion' context, where the event is described, and carefully analysed, is a post-hoc situation, as in: *Right at this point, John is spotting the sheet on the desk: Look at his face!*. These are, however, extralinguistic situations, which should not be treated on a par with normal ones.

According to Rothstein's model, atomicity is the defining property of telic predicates, which explains her decision to treat semelfactives as telic. Accomplishments are atomic, despite durativity, because they are (so to say) atomized in the appropriate context, namely with respect to a time index t and a measure M, measuring out the atomicity of the predicate's theme. In what follows, we shall provide a fairly different view concerning accomplishments. Besides, and crucially, we shall claim that punctuals (i.e. semelfactives) are non-telic. Finally, and in agreement with the tradition, we shall claim that both punctuals and achievements are non-durative. According to Rothstein, instead, semelfactives are durative predicates, inasmuch as they are atomic minimal parts of their activity cognates. Achievements, by contrast, are non-durative, inasmuch as they convey the meaning of change-of-state, from *not(P)* to *P*. This does not apply to progressive achievements, for they are considered to be derived accomplishments. Interestingly, in Rothstein's account telicity does not depend on the presence of the change-of-state, but rather, as noted above, on the atomic nature of the predicate. There seems to be a problem, though. Rothstein states that "accomplishements and achievements are telic because the BECOME event provides the criterion for individuating atoms" (p. 171), where BECOME is to be understood as an abstract meaning component, essentially as in Dowty's model. In semelfactives, however, this meaning component is not present, so that their purported telic nature remains unexplained. Note that one could not say that they are naturally atomic, because this is what achievements are claimed to be (p. 171).

On the computational side, the presence of punctual verbs has been explicitely recognized by Moens and Steedmann (1988):

> The point may perhaps best be made by noting that there is another class of punctual expressions that is *not* normally associated with a consequent state. For example,
>
> 6. John hiccupped
>
> is not usually viewed as leading to any relevant change. It typifies what we call a point expression. A point is an event (not necessarily an instantaneous one) that is viewed as an indivisible whole and whose consequences are not at issue in the discourse - which of course does not mean that *de facto* consequences do not exist.
>
> (p. 16)

As we will see in 3.3, we share with Moens and Steedmann this view of punctuals, even though the formal machinery we assume differs radically from theirs.

Finally, Bertinetto (1986) opposes punctuals ("puntuali") to achieve-ments ("trasformativi"), on the ground of a number of parameters,

such as their behaviour with specific tenses (namely, the Compound Future and the Pluperfect II), or with a selected series of temporal adverbials (*in*-adverbials, *for*-adverbials, etc.). We shall examine this kind of evidence in 4.2, explicitly elaborating on the issues that are only left implicit in the work cited, and correcting details in the analysis.

Summarizing the above discussion, it appears that several authors have put forth a plea for the official recognition of the class of punctual verbs. The table below is an enlarged version of the Vendlerian classification, where the two types of punctuals to be formally analysed in the remaining of this paper are accomodated.

	durative	telic	stative
states	+	-	+
processes	+	-	-
accomplishments	+	+	-
achievements	-	+	-
event-punctuals	-	-	-
state-punctuals	-	-	**+**

As a general remark on the brief survey reported here, we would like to observe that the hints to the existence of punctuals, that we may find dispersed in the literature, have so far been fairly incidental in nature. No one, to our knowledge, has taken up the task of working out a full-fledged analysis of this actional category. We believe this to be a disconcerting fact, given the implicit (even though marginal) recognition that punctuals have received in a number of cases. Thus, the enterprise attempted here is not only worthwhile (as we hope to show) in the light of the general theory of events, but highly desirable as a test of a hypothesis that has often been advanced without proper demonstration.[3]

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[3] Before turning to the core of our topic, it is useful to clarify our position with respect to the issue of aspect and its relation to actionality (or Aktionsart). Although some authors do not make a sharp distinction between these two domains, we believe there are strong reasons to keep them separate (Bertinetto and Delfitto 2000). By aspect we refer to notions such as perfective vs. imperfective and their subspecifications (progressive, habitual, and the like). By actionality we refer instead to classes of predicates in the Vendlerian style. This paper is cheafly devoted to actionality, but the discussion of our examples necessarily involves aspectual phenomena. As will soon become clear, the different actional categories react differently to the various aspectual values, and this is in itself good evidence that both aspect and actionality

2.1. Progressive

In the literature concerning the *progressive* aspect the inability of English non-durative verbs to appear with the progressive has sometimes been emphasized. For instance Piñon (1995) claims that a sentence such as

(1) ? Basia was noticing Piotr when I noticed her

is acceptable only under an iterative interpretation, thus, basically unacceptable as a genuine progressive.

Other authors, for instance Parsons (1990, 34-37) dispute the validity of the progressive test in order to distinguish accomplishments from achievements, providing as evidence a sentence such as (2), which is just as acceptable with the progressive as a standard accomplishment:

(2) Grandpa is dying

The explanation most commonly put forth is that the *progressive* shifts the meaning of the verb in such a way that it denotes an extended event (as if it were an accomplishment) by adding a *preparatory* phase, precisely the one for which the progressive holds (*extended progressive reading*). Hence the imminential meaning usually attached to these sentences.

By contrast, authors such as Kearns (1991) claim that the progressive with non-durative verbs does not imply any category shift, and explain the resistence of many speakers to accept it as a function of the difficulty to determine the precise time of occurrence of a momentaneous event. For instance a sentence such as

(3) He's touching the desk

could be accepted only in a very particular scenario, such as the slow motion playing of a videotape thriller, where the action is temporally expanded so as to allow the determination of the exact instant (*momentaneous progressive reading*).

In our view, these differences of interpretation can be traced back to the failure to recognize a finer grained distinction within momentaneous events. First, every genuine achievement can appear in the progressive:

(4) Gianni sta uscendo/   morendo.
    Gianni is   going out/ dying.

    'Gianni is going out/dying.'

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are independently relevant, and must be kept apart from one another. However, whenever aspect is not a relevant factor in the analysis, we shall shape our examples in the most neutral form, using the perfective past, which may be regarded as the least compromising value in the aspectual domain.

Second, given an appropriate context, these verbs are always ambiguous between an *extended progressive reading* and a *momentaneous progressive reading*. For instance, (4) could be uttered either while Gianni is tying his shoe laces just before going out, or right when he is passing through the exit door.

The behaviour of punctuals, is, however, more restricted. First, a subclass of punctuals, namely 'e-punctuals', are acceptable only under a *momentaneous progressive reading*. Thus a sentence such as

(5) Leo sta facendo un salto.
    Leo is doing   a jump

    'Leo is performing a jump.'

can be uttered only when Leo is actually jumping[4], not while he is preparing for the jump. In this sense, we agree with Kearns' intuition that the context has to be such, that the time of occurrence of the event can be exactly determined, otherwise the use of the progressive sounds weird. For instance the oddness of a sentence such as

(6) ?? Il   proiettile lo   sta colpendo.
       The bullet   him-Clitic is hitting

    'The bullet is hitting it/him'

could be pragmatically explained in the sense that very few natural contexts can be found, such that they coincide with the moment when the bullet reaches the target.

Second, many e-punctuals have, as we will see, a second reading as processes. If this is the case, whenever the progressive is used, the latter reading is favoured. For instance, since the verb *bussare* ('knock') is ambiguous between 'knocking at the door once' and 'knocking at the door repeatedly', a sentence such as (7) is more readily interpreted under a repetitive reading, ultimately to be understood as a process:

(7) Leo sta bussando.
    Leo is   knocking

    'Leo is knocking'

This explains Pinõn's observation, among others, that achievements are interpreted as iterations in progressive contexts. This, however, is true of a subclass of punctuals, rather than of achievements in general.

Third, another subclass of punctuals, i.e. 's-punctuals', are never grammatical with the progressive. Sentences such as

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[4] When used to describe sport events (such as high or long jump), *saltare* can be characterized as a telic verb, for there is a clear preparation phase, as well as a resulting state. Here we only consider the standard meaning.

(8) * Quando Leo entró,   Lia si   stava stupendo/spaventando.
       When   Leo entered, Lia SI-Clit was   amazing/scaring.

   'When Leo came in, Lia was getting amazed/ getting scared.'

are rejected by any Italian speaker. The mention of this kind of verbs (cf. also *noticing* in (1)) as prototypical achievements might thus have been at the origin of the traditional claim that achievements are not compatible with the progressive. In fact, only this particular subclass of momentaneous events (s-punctuals) is radically incompatible with the progressive.

2.2. *in/for* ADVERBIALS

Traditionally, *in-* and *for*-adverbials are considered a basic test to distinguish telic from atelic events. Their behaviour w.r.t. the traditional Vendlerian classes can be summarized as follows:

— *In*-adverbias are compatible with:

  - Accomplishments: the adverbials measure the length of the process preparing the final state:

    (9) Ha   mangiato la   torta in dieci minuti.
        Has eaten   the cake in ten   minutes
        'S/he has eaten the cake in ten minutes

  - Achievements: the adverbials measure the length of some contextually determined process, whose completion brings about the resulting state:

    (10) Il   colonnello lasció la   caserma in due ore.
         The coronel   left   the barracks in two hours
         'The coronel left the barracks in two hours.'

— *For*-adverbials are compatible with:

  - States:

    (11) Leo ha abitato a Pisa per tre   anni
         Leo has lived   in Pisa for three years
         'Leo lived in Pisa for three years.'

  - Processes:

    (12) Leo ha camminato per dieci minuti
         Leo has walked   for ten   minutes
         'Leo walked for ten minutes.'

- Accomplishments: the adverbials measure the length of an unfinished event, giving rise to an instance of the *imperfective Paradox* (Dowty, 1979):

(13) Leo ha mangiato la   torta per dieci minuti
Leo has eaten   the cake for ten   minutes

'Leo ate the cake for ten minutes.'

- Achievement and accomplishments: under certain conditions, the adverbials measure the length of the resulting state:

(14) a. Leo è uscito   per dieci minuti.
Leo is gone out for ten   minutes

'Leo went out for ten minutes.'

b. Leo è corso a casa   per dieci minuti.
Leo is run   at home for ten   minutes

'Leo ran home for ten minutes.'

The reference of *for-* and *in*-adverbias to concepts such as *resulting state* and *preparatory phase* makes them good candidates to distinguish among different classes of non-durative events (namely, achievements vs. punctuals). In particular, we should expect *for*-adverbials to be unsuitable to appear with punctuals, which have no resulting state to be measured. Similarly, *in*-adverbials should also be ungrammatical, since the notion of *preparatory process* is always interpreted as *preparatory process leading up to the completion of the event, thus to the resulting state*. Indeed, the incompatibility of *in-* and *for*-adverbials with punctuals is confirmed by the Italian data[5]:

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[5] It goes without saying that whenever punctuals have a homophone with a process reading, as in (i), the sentence is grammatical with *for*-adverbials (cf. 4.3):

(i) Leo ha bussato per dieci minuti.
Leo has knocked for ten   minutes

'Leo knocked for ten minutes.'

For-adverbials can thus be used with punctuals whenever an iterative reading can be forced. For instance a sentence such as (15b) could be marginally accepted by certain speakers with the meaning 'kept on becoming amazed' or (more markedly) 'became more and more amazed'. These readings are not excluded by our treatment (see sect. 3). What our treatment would exclude is a reading of (15b) such that something made Leo amazed and Leo remained amazed for ten minutes.

As for *in*-adverbials, it must be said that the judgments are made fuzzier by the fact that, in Italian, *in*-adverbials are sometimes used as time location adverbials. Thus, a sentence such as (ii) is grammatical if it is interpreted with the meaning: 'after five minutes (from now) you will notice it' (cf. 4.2.1):

(ii) In cinque minuti te   ne   accorgerai
In five   minutes you-Clit of-it-Clit will realize

'In five minutes you will realize it.'

(15) a. * Leo ha battuto un   colpo sul   tavolo in/per cinque
        Leo has tapped on the table in/for five   seconds
        secondi. /=e-punct/

    'Leo tapped on the table in/for five second.'

   b. * Leo si   è stupito in/per venti   secondi. /=s-punct/
        Leo SI-Clit is amazed in/for twenty seconds

    'Leo became amazed in/for twenty seconds.'

3. The Formal Approach

We assume a kind of event semantics in which events can be arbitrarily composed in order to form complex events. The approach is mereological in nature (Hinrichs 1985, Bach 1986, Link 1987, Krifka 1989, among others). Actional distinctions are encoded as *the way in which atomic events are composed*. By imposing some minimal contraints on the composition operation, we obtain necessary and sufficient conditions to identify both the traditional Vendlerian classes and the two classes of punctual events described in the preceding sections.

3.1. Kinds of Events in the World

In this section we will try to identify the minimal ontology needed to build a semantics for events which is fine-grained enough to capture all the relevant actional distinctions. All we need is a sortal distinction between *atomic changes* and *atomic states*.

   Atomic changes are those situations at which a certain predicate is true, without being true at smaller situations. [6] Take for instance a hammering situation. It is possible to isolate sequences which can be defined as *hammerings*. However, a hammering situation will also contain situations which cannot be defined as *hammering*. For instance the action s' of raising the hammer, while being part of a situation of

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[6] In the following, we will indifferently use the terms *event* or *situation* to refer to individuals appearing in the denotation of verbal predicates, irrespective of their actional class. The variables e and s will also be used interchangeably, even though, when relevant, we employ e for complex events and s for their parts. Note, further, that the notion 'change' should not be intended as referring to telic events, as in the expression 'change of state', frequently occurring in the literature. This word is used here to refer to events characterized by internal dynamism, as opposed to purely static situations

hammering, cannot be properly defined a *hammering*. We consider an *atomic change* a situation such that there is at least a predicate which is true of that situation, without being true of its parts. Let's call D (from dynamisms) the set of all atomic changes in a given model[7].

By contrast, there are predicates denoting situations which can be infinitely divided. These are the *stative* predicates. Take for instance the situation of me sitting on a chair: this situation holds at a certain interval: one can pick up any subinterval i' of this interval and it is guaranteed that there is a situation s' which holds at i' such that s' is again a situation of me sitting on a chair. The only division in parts which can be achieved with states is one which strictly depends on temporal structure: the structure of states is completely parasitic on the structure of time. Or, to put it in a different perspective, whereas atomic changes hold at intervals (non singleton, non empty sets of points of time), atomic states hold at instants (singleton sets of points of time). We call Q (from *qualities*) the set of situations which hold at instants.

To see the difference between D and Q, consider that processes will be defined as sums of atomic changes and states as sums of atomic states. Now consider the difference between a process of *hammering* holding at an interval i and a state of *me sitting on a chair* holding at the same interval. Let's evaluate what is happening at the point of time t_1, where both my hammering and my sitting on a chair have already begun. As for the process, it is possible to *count*, in a certain sense, the single hammering sequences (for instance the atomic changes which correspond to the sequence of raising the hammer and driving it down) which already happened before t_1. For instance, one could describe what happened by saying 'he has already hammered 30 times'. In other words, the course of events can be descrived without appealing to the notion of time, just looking at *the changes that occurred in the world*, and counting them. By contrast, when considering a state, there is no way to refer to what is happening in t_1 (with respect to the initial instant t_0), without referring to time: one could say 'he has been sitting here for a couple of hours' but not 'he already sat 150 times'. Identifying atoms of states without the notion of time is an impossible enterprise, while it is possible to identify atomic changes without resorting to the temporal structure.

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[7] There could be some problem of philosophical nature, here, namely the fact that events which are in a mutual part-of relation could be included in this set. Such an issue is extensively dealt with in Dini (2000), where it is proven that, from the point of view of language, the fact that there is a part-of relation between, for instance, an event of stepping and an event of moving, is completely irrelevant.

Atomic changes and atomic states (let's call them *atomic situations*) are organized in such a way as to form complex situations: we can join two or more atomic situations and obtain a new situation. For instance, joining a set of atomic changes which are changes of *running*, we are likely to obtain a bigger (non atomic) situation which is again a *running*. Furthemore, joining this non atomic situation with the state denoted by *being at home*, we are likely to obtain a situation which is in the denotation of the predicate *running home*[8]. Thus all the situations in a world are, in one way or another, built up from the composition of subsets of $D \cup Q$. Let's call this "composition" *join* ($\bigvee$). We want to make sure that there is a situation corresponding to the join of any subset of $E = D \cup Q$, irrespective of the fact that such a situation can be naturally referred to by an expression of English (or Italian)[9]. This can be done by assuming that any admissible domain for event semantics contains members of the free i-join-semilattice $< E', \bigvee, \sqsubseteq_s >$ minimally generated by $D \cup Q$. We can asssume the following constraint (where τ, called *temporal trace*, is a function associating to every event its *time* interval; E' is the minimal set cointaining E and closed under $\bigvee$, and $\sqsubseteq_s$ is a relation between situations ('being a part of') defined on the basis of $\bigvee$, the operation of join.):

(16) **Domain of events for any admissible model:**

- E the set of atomic situations.

- D, the set of atomic changes, defined in the following way[10]:
  $\forall s[s \in D \leftrightarrow \neg inst(\tau(s)) \wedge s \in E]$

- Q, the set of atomic of states, defined in the following way:
  $\forall s[s \in Q \leftrightarrow inst(\tau(s)) \wedge s \in E]$

- $< E', \bigvee, \sqsubseteq_s >$, the free i-join-semilattice minimally generated by E.

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[8] This obviously happens only when considering perfective forms. When telicity suspending operators are introduced (such as the progressive, cf. 4.1) the join operation is suspended as well.

[9] Piñon (1995, 75-78) has an interesting digression concerning the existence of arbitrary sums (for instance the sum of *my cooking of an egg* and *Brutus' stabbing of Ceasar*). Even though we do not completely agree with his conclusions, we purchase the assertion according to which the existence of arbitrary sums is harmless and incurs no ontological expense.

[10] Since we assume a period structure based on a partial order of time points, the definition of the predicate *inst* will be:
  $\forall i[inst(i) \leftrightarrow \mid i \mid= 1]$
  See Landman (1991) for a full fledged definiton.

To put it in more colloquial terms: we can describe the world in terms of atomic situations, without any need to list the individual complex situations. Complex situations just *exist* by virtue of the fact that for any arbitrary set of atomic situations there is a situation which is the join of those situations. Take for instance our situation of running and assume a model containing a set D composed of three atomic changes ($\{d_1, d_2, d_3\}$), each of which is of type *running* (i.e. it is in the denotation of the predicate *run*), and a set Q composed of one atomic state ($\{q_1\}$), which is of type *being at home* (i.e. is in the denotation of the predicate *being at home*). In such a model, E will be the set $\{d_1, d_2, d_3, q_1\}$, whereas E' will be formed by all the bulleted elements of the diagram in fig. 1. In such a structured domain we pick up the denotation for
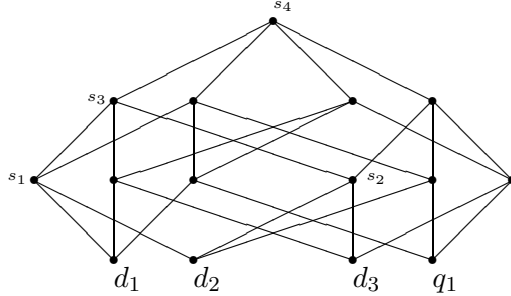

Figure 1.

verbal predicates: for instance the complex events labelled s_1, s_2 and s_3 are in the denotation of *John ran*, whereas the event s_4 is in the denotation of *John ran home*.

We still have to clarify the relation between $< E', \bigvee, \sqsubseteq_s >$, the lattice of events, and the lattice $< I, \bigsqcup, \sqsubseteq_t >$, which we assume as temporal structure (cf. van Benthem 1983, Landman 1991, Kamp 1979). We introduced a join operation between situations as well as a function τ mapping every situation onto an interval, but we did not explicitly state the relationship between the temporal trace of a whole situation and the temporal traces of its parts. As a consequence, in our system it would be perfectly possible, for instance, to have a situation lasting five seconds whose parts last more than five seconds each. To remedy this undesirable consequence we have to impose a stricter relationship between events and intervals. In particular:

(17) τ is a homomorphism from E' into I.

Given the properties of homomorphisms, the following fact holds true (s and s' are variable over situations, i.e. $s, s' \in E'$):

(18) $\forall s \forall s' [\tau(\bigvee\{s, s'\}) = \bigsqcup\{\tau(s), \tau(s')\}]$

Under this condition, the temporal trace of a non atomic situation is equivalent to the temporal sum of the traces of the situations which are parts of it (for instance, its atoms), which exactly corresponds to our intuitions about events and intervals.

3.2. Mereologies of Events and the Traditional Vendlerian Classes

3.2.1. *States*
We define a state as the join of a non singleton contiguous set of atomic states, i.e. of situations which hold at instants (we omit the definition of temporal contiguity of sets of situations ($CONV$-S), which can be trivially derived from the contiguity of sets of intervals):

DEF 1. $\forall e[state(e) \leftrightarrow \exists X[e = \bigvee X \wedge X \subseteq Q \wedge CONV\text{-}S(X) \wedge \mid X \mid > 1]$

Note that the restriction that the set of atomic states be non singleton is crucial to make the difference between states and s-punctuals (see below).[11]

3.2.2. *Processes*
Processes are defined as the join of a non singleton set of atomic changes:

DEF 2. $\forall e[proc(e) \leftrightarrow \exists X[e = \bigvee X \wedge X \subseteq D \wedge |X| > 1]$

where, again, the restriction that the set of atomic changes be singleton is crucial to make the difference bewteen processes and e-punctuals.

Concerning this definition, it is worth spending some words about the so called *subinterval* property of processes. It has been observed (Rescher and Urquhart 1971, Dowty 1977) that processes, contrary to states, admit temporal gaps. For instance, if somebody walked for two hours, there may be an interval within this period when s/he stopped and spent some minutes talking with a friend. More abstractly, a process can be said to hold at an interval even if it does not hold at

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[11] We may wonder whether this definition of states is enough to account for the set of properties usually ascribed to this actional class (cf. Dowty (1979, 55-56) for an exhaustive list), most notably for their incompatibility with agentivity. Our position is that such properties should not be considered as belonging to states *qua* an actional class, i.e. descending from def. 1, but as properties of certain situations *qua* belonging to the set Q. In other words non agentivity, from which most of the alleged 'stative behaviors' stem, could be considered as a general property of atoms of states, irrespective of the way they are actionally composed. Indeed, non-agentivity is not a unique property of states, for it may also attach to processes (e.g., *rain.*

every subinterval of this interval. States, on the contrary, have been claimed to be always homogeneous: if I have been sick from 4 to 6, there is no subinterval included in the interval 4-6 such that it is not true that I was sick in this interval. As Dowty has it:

> If ϕ in an (atomic) activity sentence, then if ϕ is true at interval I, then there is some non-empty initial subinterval of I at which ϕ is true and some non-empty final subinterval of I at which ϕ is true. (Dowty 1977, p.60)

In order to capture this difference between states and processes, we have dropped the contiguity condition for processes in def 2. Since in the temporal structure that we are assuming the join of non contiguous intervals always returns a convex interval (an interval with no gap, Landman (1991, 172)), and since by (17) there is a homomorphism from E' into I, we can be sure that if a process p holds at an interval i (i.e. $\tau(p) = i$) there are at least a change at the beginning of the interval and a change at the end of the interval (cf. also Dowty 1979).

3.2.3. *Achievements*
Achievements are characterized by the presence of an *atomic* change followed by an atomic (resulting) state (cf. also Pustejovsky 1988):

Ma perch atomico, dopo tutto? lo stato risultante una normale situazione stativa, presumibilmente di durata non minima

DEF 3. $\forall e[ach(e) \leftrightarrow \exists s \exists s'[e = \bigvee\{s, s'\} \wedge s \in D \wedge s' \in Q \wedge s \Rightarrow s']$

where $\Rightarrow$ is a relation between situations, whose meaning can be paraphrased as: s' is the state resulting from s. In this paper, we will not discuss such a relation, which we assume to be a primitive. Note that the possible outcomes of a single change can be many, but only one is specified in the lexical semantics of telic verbs, thus determining both their syntactic properties (cf. Dini and Di Tomaso 1995a) and their semantic behaviour (see section 4). For instance, although the result of a *walking* event is either *being in a different place* or *being a bit more tired*, only the former enters into the lexical meaning of the predicate *walk*. Moreover not every event of change lexically specifies the nature of such a resulting state, as we will prove shortly.

3.2.4. *Accomplishments*
Accomplishments are defined in analogy with achievements, with a process instead of an atomic change as the initial event. Thus:

DEF 4. $\forall e[acc(e) \leftrightarrow \exists s \exists s'[e = \bigvee\{s, s'\} \wedge proc(s) \wedge s' \in Q \wedge s \Rightarrow s']$

The presence of a resulting state in the representation of accomplishments is justified by a number of factors. For instance, the fact that they are sometimes compatible with *for*-adverbials quantifying precisely over the resulting state (the reasons why not all accomplishments can, are explored in 4.2.1). See for instance

(19) Leo è corso a casa   per dieci minuti.
     Leo is run   at home for ten   minutes

     'Leo ran home for ten minutes,'

which is standardly interpreted as 's/he ran home, remained there for ten minutes and then came back'.

Further evidence for having a resulting state is provided by verbs which can be interpreted as either processes or accomplishments, depending on their selectional properties. Take for instance the situation of John eating a chicken this morning. This event lasted exactly 15 minutes. One can refer to it by uttering either (20a) or (20b)

(20) a. This morning John ate for 15 minutes

      b. This morning John ate a chicken in 15 minutes

In (20a) a verb denoting a process has been used, while in (20b) the addition of a direct object shifts the actionality towards an accomplishment. If both verbs were to denote the sum of exactly the same situations, there would not be any reason for this difference: (20b) should only contain the additional information that the patient of John's eating was a chicken. Our claim is that the difference between the two sentences is to be found in the fact that the accomplishment in (20b) denotes the sum of situations denoted by the process in (20a), *plus* the situation for which the resulting state holds (in this case, the state of a chicken being completely consumed).

3.3. ON THE NEED FOR PUNCTUALS

Up to now, we have seen how the traditional Vendlerian classes can be "reconstructed" within our system without resorting to *ad hoc* predicates. Assuming that such a classification exaustively covers all verbal predicates in a language such as Italian, we might formulate the following constraint on verbal denotation:

(21) All verbal predicates range over the set E'' such that $E'' = \{e : e \in E' \land \forall s'[s' \in Q \land s' \sqsubseteq_s e \land \exists s''[s'' \in D \land s'' \sqsubseteq_s e] \rightarrow final_i(s', e)] \}$

In prose (21) states that any event appearing as the denotation of a verb is either homogeneous or composed in such a way that the state is always the final[12] part of the event. This is a pretty obvious generalization, as it would be extremely surprising if further changes could follow the state in which a change results. It is easy to verify that the definitions of the Vendlerian classes provided in the preceding sections satisfy the second conjunct of the restrictions over members of the set E''.

The point now is: is (21) restrictive enough? Actually, two "unpredicted" classes of events result from it: (1) events which are simply members of D; (2) events which are simply members of Q. These are exactly the denotation of e-punctual and s-punctual verbs, as we will show in the remainder of this section.

Consider verbs such as *colpire* ('hit') or *starnutire* ('sneeze'). If they were considered achievements, we would find ourselves in the condition of identifying a state resulting from single changes of *hitting* or *sneezing*, which contradicts our basic intuitions about events of this kind. As a matter of fact, an event of *sneezing* is just a change with very poor consequences. If someone in a room goes out, we are immediately able to understand that a change of state occurred in the room: the world is significantly changed. If, however, someone in a room sneezes, there is no difference (at least not necessarily) between the world before and after such an event: no new state has been introduced, it is simply the case that something happened. In our approach this difference is expressed almost literally: achievements, such as *partire* ('go out'), are the join of a change and a state, while e-punctuals, such as *starnutire* ('sneeze') are just atomic changes.

We do not want, however, to stress too much the *realistic* nature of this analysis. The difference between achievents and e-punctuals is *tendentially* a difference in the nature of the described event, but in fact it is only language use which decides which verbs are classified how[13]. To see this, consider that there are pairs of almost synonymous verbal expressions which are conceptualized in different ways. A good example is represented by the difference between *saltare giú* and *scendere* in sentences such as:

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[12] $final_i(s,e)$ is trivially defined as

(i) $final(s,e)$ *iff* $\neg\exists s'[s' \sqsubseteq_s e \rightarrow \tau(s) \prec \tau(s')]$

where $<$ is a standard relation of complete precedence.

[13] This is particularly evident if one considers that every event has at least an obvious consequence (which we label *trivial consequence*): the fact of having happened, or better, the state of being part of the history of the world. However, since these consequences have no linguistic influence, they will never be referred to when we speak of *resulting* or *consequent* states.

(22) a. Giovanni è sceso   per dieci minuti,   poi   è
          Giovanni is gone down for ten   minutes, then is
          risalito.
          gone up again

          'Giovanni went down for ten minutes, then he climbed up
          again.'

      b. * Giovanni è saltato giú   per dieci minuti,   poi   è
            Giovanni is jumped down for ten   minutes, then is
          risalito.
          gone up again

          'Giovanni jumped down for ten minutes, then he climbed up
          again.'

The descriptions in (22) can surely denote the same event in the real
world with the same consequences (think of a situation where we are
considering Tarzan leaving his house on the tree for a short while).
Yet, the event is linguistically seen from two different points of view,
one also considering the result (22a), the other merely focussing on the
change (22b). Hence, the ungrammaticality of a *for*-adverbial measur-
ing the resulting state in (22b)[14]. To see another example consider the
difference between (23a) and (23b)

(23) a. Giovanni è uscito   dalla stanza.
          Giovanni is gone out from the   room

          'Giovanni went out grom the roon.'

      b. Giovanni è uscito   dalla finestra.
          Giovanni is gone out from the   window

          'Giovanni went out through the window.'

It goes without saying that the sentences in (23) may describe the
same event, and we can also say that the same consequent state can
be inferred, namely the state of Giovanni being absent. However, they
are linguistically different, for (23a) can focus both on the change and
the resulting state, whereas (23b) only says that an event of a certain
type occurred. Thus (23b) is impossible with *for-* and *in-*adverbials and

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[14] It could be objected that we miss the inference according to which every *jump-
ing down* is followed by a state of being down. This is certainly true (cf. footnote
13), but our opinion is that one should avoid to unnecessarily complicate linguistic
representations with the only purpose of capturing inferences. In cases such as the
ones we are examining, meaning postulates can do the job.

can occur with the progressive only under a *momentaneous progressive reading*[15]:

(24) a. * Giovanni è uscito   dalla   finestra per dieci minuti.
          Giovanni is gone out from the window for ten   minutes

      'Giovanni went out through the window for ten minutes.'

    b. ?? Giovanni è uscito   dalla   finestra in dieci minuti.
          Giovanni is gone out from the window in ten   minutes

      'Giovanni went out through the window in ten minutes.'

    c. Giovanni sta uscendo   dalla   finestra. /one reading only/
       Giovanni is   going out from the window

      'Giovanni is going out through the window.'

The representation of an e-punctual verb such as *saltare* is:

(25) $\lambda x \lambda e^-.jumping(x, e^-)$

where e^- is a sorted variable referring to individuals belonging to D.

Similarly, consider s-punctuals such as *meravigliarsi*, *stupirsi* ('become amazed'), *spaventarsi* ('become scared'). They intuitively denote a change of state and nothing more. By contrast, verbs traditionally considered as achievements, such as *uscire* ('go out'), have more in their semantics than a simple change of state. In fact, when we pass from a state of *being in* to a state of *being out*, what we get does not necessarily instantiate a change that is in the denotation of *uscire*. For instance, a situation such as the one described in (26) is a situation where a piece of forniture undergoes a change from *being in* to *being out*, but it would be improper to describe such a situation as *il mobile uscí* ('the piece of forniture went out'):

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[15] Although the native speakers' intuitions are fairly sharp in this case, it is worth noting that the difference between achievements and punctuals sometimes depends on the conventionalization of their meaning. Indeed, one could easily imagine a situation where people are engaged in a specific game, consisting in getting out of the window for some time while performing a series of actions. In such a case, (24b) could be uttered to express satisfaction with respect to the excellent performace of competitor A, while (24c) could be uttered to express disappointment with respect to the poor performance of competitor B. It is part of everybody's pragmatic knowledge that a verb such *to leave* may evoque by conventionalized implicature a series of preparatory acts leading up to its completion (the so-called preliminary phase, whose actual content differs from case to case), while *to get out of the window* does not normally have this property, unless in exceptional cases such as the one sketched above.

(26) Il   mobile   fu   trasportato fuori dalla   stanza
     The piece of forniture was moved   out   from the room

'The piece of forniture was moved out of the room'

However, whenever we pass from an emotionally neutral mental state to a state of amazement, it is appropriate to say that an event of *meravigliarsi* has occurred. As a consequence, it is intuitively correct to claim that verbs belonging to this class denote *the first atomic state when a certain state comes true* (i.e. the first atomic state of a (possibly) continuing state). Thus, from an actional point of view they simply denote an atomic state, this state being preceded by a state where the relevant predicate does not hold. For instance a verb such as *meravigliarsi* will have the following denotation (where $\prec\prec$ stands for *immediately precedes*):

(27) $\lambda x \lambda s[astonished(x, s) \land \neg \exists s'[\tau(s') \prec\prec \tau(s) \land astonished(x, s')]]$

4. An Explanation of the Data

In the following sections, we will try to sketch a semantic treatment of the progressive aspect (4.1)and *in-* and *for*-adverbials (4.2.1), showing how the distinction between achievements and punctuals (and their further subclassification) allows us to shed light on these phenomena. Finally, in section 4.3 a principled explanation is given of the fact that a large set of punctual verbs have a homophonous form denoting a process.

4.1. PROGRESSIVE

The semantics of the progressive aspect has received a great deal of attention during the last four decades by researchers working in the framework of either interval semantics or event semantics. The main issues can be summarized as follows:

- Determination of the aspectual import of the progressive (i.e. its relation to the reference time).

- Solution of the so called "Imperfective Paradox", i.e. the well known fact that the truth of *I was building a house* does not entail the truth of *I built a house*, whereas the truth of *I was walking* entails the truth of *I walked*.

- Determination of the actional class to which verbs in the progressive form should be ascribed.

The last two problems have always been considered as intrinsecally connected. In particular, we can roughly distinguish among: (i) approaches which retain the actional nature of the basic predicate and consider the imperfective paradox as a kind of modalizing operator (most notably Dowty (1979)); (ii) approaches which demote the imperfective paradox to the realm of pragmatics and consider the progressive as an 'actionality sensitive operator' shifting the actionality of a predicate from telicity to atelicity (most notably Parsons (1989) and Parsons (1990)). Here we will sketch an analysis which tries to combine both approaches. In particular, we will try to remedy an oversimplification which is intrinsically connected with the 'progressive as actionality sensitive operator'. Consider for instance the point of view of Parsons (1990):

> Semantically, changing an event verb to the progressive form requires that it be treated as a state verb; the sentence in question thus requires for its truth that the event in question *hold*, not that it *culminate*.

This intuition is implemented through the use of the two predicates *cul* and *hold*, which range over the event variable at the perfective and progressive form, respectively. Two main objections can be raised against this treatment. First, as Bertinetto (1994) shows, the idea that the progressive turns every event into a state is untenable in many respects. Second, in such an approach the relation between *cul* and *hold* is left completely underspecified. Since these predicates have no precise model-theoretic interpretation, we could associate to them every kind of implausibile meaning. In other words, what Parsons' approach misses is the possibility of drawing an inference such as:

(28) Sto correndo a casa → ho corso
     I am running home → I ran

In our treatment, as we will see, we solve this problem way by substituting the primitive predicates *cul* and *hold* with independently motivated type-shifting operators. Moreover, rather than rejecting the modal approaches to the semantics of the progressive, as Parsons does, we will limit their scope to the final part of telic events, thus avoiding any resort to pragmatics in order to explain the well known 'goal

oriented' semantics of the progressive[16]. Let us start from the simple case, i.e. the semantics of the progressive with homogeneus events.

Assuming the interval i_r as the reference time in a Reichenbachian sense, we propose the following semantic representation for the progressive operator (from here on, variables with a superscript '$-$' are restricted to range over members of the set $D \cup Q$ (atomic events), whereas variables with a superscript '$+$' are restricted to range over members of the set $E' - (D \cup Q)$ (non atomic events); moreover we assume that in Italian i_r (the reference interval involved in the progressive) is always an instant, as shown in Bertinetto (1986, 2000)):

(29) $prog(e, i_r)$ iff $hom(e) \wedge \forall i [i \sqsubseteq_t i_r \wedge inst(i) \rightarrow \exists s^- [i \sqsubset_t \tau(s^-) \wedge s^- \sqsubseteq_s e]]$

In prose, (29) states that a progressive event is true at an interval i_r (instantiated by the reference interval) if and only if the event is homogeneus and for every intantaneous subinterval i of i there is an atomic part s^- of that event such that $\tau(s^-)$ (i.e. the temporal trace of s^-) is bigger than i'[17]. The predicate imposing homogeneity is defined as follows:

(30) $hom(e)$ iff $\neg \exists s \exists s' [s \sqsubseteq_s e \wedge s' \sqsubseteq_s e \wedge s \in Q \wedge s' \in D]$

Note that the crucial difference w.r.t. Parsons' approach is that the semantics of the progressive *requires* the event to be of a certain type (homogeneus), but it does not *change* it into either a state or a process. As we will see, in our approach such a change is performed by a type-shifting operator.

At this point, we are in a situation such that: [18]

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[16] Kearns (1991), embracing with some modification Parson's approach, claims:

The counterfactual analysis can now be seen, not as a truth condition for the progressive, but as a highly productive predicate formation rule generally used for purposeful human activity or processes where custom and experience support the classification of a process as of a typically goal directed kind.
(p. 299)

[17] The reason why we mantain the possibility of having *prog* ranging over an interval, rather than an instant, is that we want our semantics for the progressive to handle cases such as the following (from Kearns (1991)):

(i) John was playing the piano from ten to eleven

Since examples such as (i) are at least substandard in Italian, we conclude that in this language the progressive can only range over instants. Thus, in Italian, (29) reduces to (ii)

(ii) $prog(e, i_r)$ iff $hom(e) \wedge \exists s^- [i_r \sqsubset_t \tau(s^-) \wedge s^- \sqsubseteq_s e]$

[18] It should be noted that the definition of the progressive proposed above does not refer the progressive aspect as such, but rather to the meaning of the progressive

1. Processes are admitted as they are homogeneus and have atomic parts bigger than instants (by definition, cf. 3.2.2):

   (32) Lia sta camminando.
        Lia is   walking

        'Lia is walking.'

2. States are axcluded as they are homogeneus but have no atomic part bigger than an instant (by definition, cf. 3.2.1):

   (33) * Il   cadavere sta giacendo a   terra
          the corpse   is laying   on ground

        'The corpse is laying on the ground.'

3. e-punctual verbs are admitted, as they satisfy homogeneity and have an atomic part (in fact they *are* an atomic part, cf. 3.3) bigger than an instant. Note that the difficulty found by some speakers to use punctual verbs with the progressive aspect can be explained by the difficulty of including the reference time within a temporal trace barely bigger than an instant. In fact, the partial acceptability of (34a) vs. the full acceptability of (34b), can be explained by the fact that the temporal trace of the bullet hitting the target is barely more than an instant, whereas the explosion of a bomb can last several seconds (note that in our system punctuality does not mean lack of temporal extension):

   (34) a. ? Quando entrai,   il   proiettile stava colpendo il
             When   entered, the bullet   was   hitting   the
           bersaglio.
           target

        'When I enterd the bullet was hitting the target.'

---

periphrasis. The reason for this is that while the progressive periphrasis is not available to stative verbs (except for special circumstances, as discussed in Bertinetto 1994), the progressive aspect is, as shown by utterances like:

(31) When I came, Mary was (* being) sad.

which present all the features of a well-behaved progressive sentence, including the possibility of abrupt interruption of the state of affairs. Presumably, in the case of the progressive aspect (as opposed to the progressive periphrasis) the restriction concerning the fact that the temporal trace of the event should be longer than a single instant does not apply. What matters is rather that the event is longer than a single instant, in order to exclude stative punctuals from such contexts. We shall not dwell into this here. Note, however, that this is far from surprising, considering that progressive periphrases often originate from locative expressions conveying a mere idea of durativity (Bertinetto 2000). Thus, it is not unlikely that, in their path towards grammaticalization, these periphrases develop more specific constraints.

  b. Quando guardai a Nord, la casa stava espodendo.
     When   looked to North, the house was   exploding

     'When I looked North, the house was exploding.'

4. S-punctual events are excluded as they are homogeneus but have
   no atomic part bigger than an instant (by definition):

  (35) * Quando entrai, Lia si   stava stupendo.
          When   entered, Lia SI-Clit was   amazing

       'When I entered, Lia was getting amazed.'

5. Accomplishements and achievements are excluded, as they are not
   homogeneuos

Obviously, the last consequence of our formulation of progressivity is
wrong, as we have seen that both classes can be used with the pro-
gressive aspect. In order to fix this problem, we should address some
questions concerning the meaning of the progressive with acomplish-
ments and achievements. When one says *John is running home*, what
can be understood is more or less the following: *John is running and
maybe John will be at home*. In other words the meaning of a telic
progressive form can be divided into two parts: (i) an *extentional* part,
stating what the actors are actually doing; (ii) a *defeasible* part stat-
ing what is the most likely conclusion of the extentional part. There
have been several proposals in order to capture the notion of 'possible
outcome of an event': *inertia worlds* (Dowty 1979), *default reasoning*
(Asher 1992), *Continuation branches based on the concept of event
stage* (Landman 1992), and so on. However, since we are not concerned
with the problem of the defeasibility of the continuation of progressive
events, we are simply going to assume here that the second part of a
progressive sentence is embedded within the scope of a modal *possibility*
operator, without caring about the cases where such an operator is
unable to do the proper job. All we want is that the following fact be
true in our semantics:

(36) I was building a house $\not\rightarrow$ I built a house

   A more crucial problem is whether the modalization of the second
part of the progressive semantics is due to the progressive operator or to
an independent operator which is active in certain syntactic/semantic
contexts. On this respect, we agree with Kearns (1991) in that we
consider the *imperfective paradox* not to be a peculiar feature of the
progressive semantics. At least the following cases can be identified,
where an 'unfinished event' (i.e. an event with an "uncertain" resulting
state) has to be assumed:

–   Aspectual (or phasal) verbs such as *start, begin* and *continue* take
    an atelic event (i.e. a process or an unfinished accomplishment) as
    their complement, as the following pattern (from Kearns (1991))
    exemplifies:

(37) a. John started to move → John moved

      b. John started to build a house ↛ John built a house

–   Accomplishments within the scope of *for*-adverbials are interpreted
    as unfinished. For instance in a sentence such as (38) no inference
    can be drawn whether the house was finished or not:

(38) Leo ha   costruito una casa   per due anni.
      Leo has built   a   house for two years

      'Leo built a house for two years.'

–   The same effect is obtained using a temporal specification intro-
    duced by the preposition *fino a* ('until'). For instance, from (39)
    we cannot infer that Lia finished reading Leo's thesis:

(39) Lia ha letto la   tesi   di Leo fino a mezzanotte.
      Lia has read the thesis of Leo until to midnight

      'Lia read Leo's thesis until midnight.'

As a consequence, it seems that a kind of operator producing 'unfin-
ished events' out of telic ones has to be present anyway in the semantics.
Whenever a certain predicate requires an event of a homogeneus type
(like processes or states), such an operator would be resorted to in
order to make the derivation possible, as in standard cases of type
coercion (Moens and Steedmann 1988, Pustejovsky 1991). Let's call
this operator 'UNFINISHED'
   To see how 'UNFINISHED' can be naturally introduced in our sys-
tem, we should again consider the operation of event composition. Are
complex events already complex in the lexicon (*static event composi-
tion*), or are they formed as the join of objects which are present in
syntax (*dynamic event composition*)? There are reasons, so it seems,
urging for the second option. Consider for instance a verb such as *run.*
When used alone, it behaves like a process, whereas with a goal phrase
it behaves as an accomplishement, as the following pattern exemplifies:

(40) a. John ran for/# in three hours

      b. John ran to the office # for/ in three hours

Moreover, in a language like Italian (and in the other languages which fit the PATH incorporation type of Talmy (1985)) the preposition introducing the goal place is always non distinct from the corresponding static locative preposition. For instance, the preposition *a* used in (41a) is the same which is used in the static locative relation in (41b):

(41) a. Leo è corso a casa.
          Leo is run   at home

          'Leo ran home.'

      b. Lia è a casa.
          Lia is at home

          'Lia is at home.'

Crucially, this fact led Dini and Di Tomaso (1995a) to assume that, in Italian, the denotation of the alleged goal-PP *is* a state acting as the resulting state of a process. If this is the case, we must assume (with several other authors) that actionality is not lexically specified, but is determined at a phrasal level by the application of certain aspectual operators introducing a join operation between changes and states (in Krifka (1989) and Verkuyl (1993) this "bridging" function is taken over by θ-roles). The same applies to all transitive accomplishments, such as *read*, whose actionality depends on the presence vs. absence of a duly specified complement (bare plurals and mass nouns, not dealt with in this paper, consitute a different case). With these verbs, the resulting state is not overtly realized by, say, a preposition, as in (41a), but by virtue of the relevant direct object[19].

If process/changes are to be joined with states in syntax, we need an operator to perform such a task. Let's call such an operator 'TELIC'. TELIC and UNFINISHED are operators which range over the same arguments, the former originating a *finished event*, the latter an *unfinished event*. They are defined in the following way:

(42) TELIC: $\lambda P.\lambda S.\lambda x\lambda e.\exists d\exists q^-[P(x,d) \wedge S(q^-) \wedge e = \bigvee\{d, q^-\} \wedge d \Rightarrow q^-]$

(43) UNFINISHED: $\lambda P.\lambda S.\lambda x\lambda d.[P(x,d) \wedge \Diamond\exists e\exists q^-\exists d'[S(q^-) \wedge d \sqsubseteq_s d' \wedge e = \bigvee\{d', q^-\} \wedge d' \Rightarrow q^-]]$

---

[19] In some sense, we go in a direction similar to the one of Larson (1988) in admitting that certain VPs are in fact 'layered', i.e. contain a further nested VP. Our proposal differs, however, from Larson's in three respects: (i) only telic events have a layered structure; (ii) all telic events have a layered structure, irrespective on the presence of a direct object; (iii) we do not assume any light verb: all verbs in our layered structure bear a semantic contribution. See also Hale and Keyser (1993) and McClure (1994) for similar approaches.

The operator TELIC is in some sense the default operator for composing a (possibly plural) change with a state. In fig. 2 a part of the derivation of *correre a casa* ('to run home') is provided, where this operator applies to join the state of *being at home* with the process of *running* (we neglect here the identification of the variable x_1).
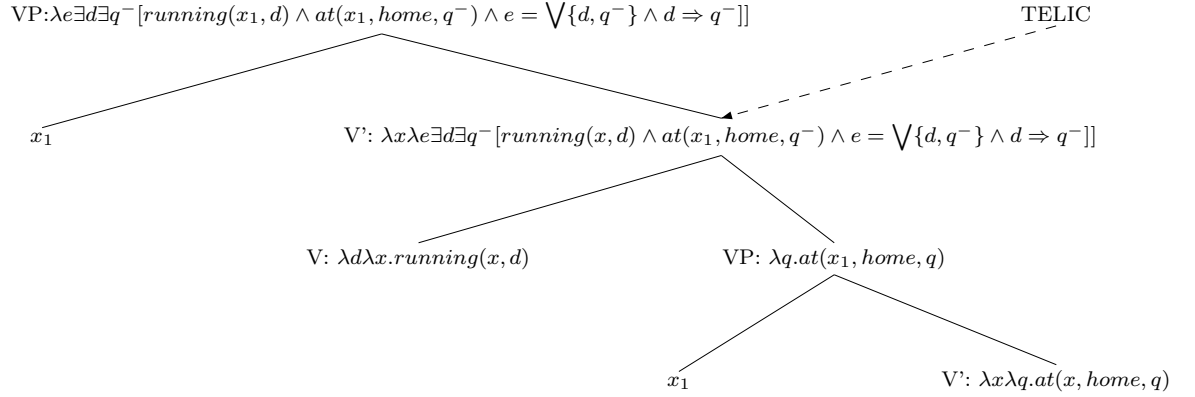
VP:$\lambda e \exists d \exists q^- [running(x_1,d) \wedge at(x_1,home,q^-) \wedge e = \bigvee\{d,q^-\} \wedge d \Rightarrow q^-]]$ TELIC

x_1 V': $\lambda x \lambda e \exists d \exists q^- [running(x,d) \wedge at(x_1,home,q^-) \wedge e = \bigvee\{d,q^-\} \wedge d \Rightarrow q^-]]$

V: $\lambda d \lambda x. running(x,d)$ VP: $\lambda q. at(x_1,home,q)$

x_1 V': $\lambda x \lambda q. at(x,home,q)$

Figure 2. Relevant part of the derivation of *correre a casa* thorough the TELIC operator.

The operator UNFINISHED, conversely, is advocated only when something crashes in the derivation, in the same fashion as a type shifting operator. This is exactly the case of the progressive: since both accomplishments and achievements are non homogeneus, their standard event composition through the operator TELIC cannot be mantained and the operator UNFINISHED is activated. For instance, the crucial part of the derivation of *Leo sta correndo a casa* would go as in fig. 3.

Let's now consider again the case of achievements and e-puntuals. In principle, they are both compatible with the semantic of the progressive, the former through the application of UNFINISHED, the latter by virtue of the fact that they are homogeneus by definition. In both cases, the progressive suggests that the atomic change is in progress and, crucially, that it exists. The following are the logical forms associated to the the sentences *Leo sta uscendo* ('Leo is going out') and *la bomba sta esplodendo* ('the bomb is exploding'):

(44) a. $\exists d[going\_out(Leo,d) \wedge prog(d,i_r) \wedge \Diamond \exists e \exists q[absent(Leo,q) \wedge e = \bigvee\{d,q\}]]$

   b. $\exists d[exploding(the\_bomb,d) \wedge prog(d,i_r)]$

With achievement verbs, the attainment of the resulting state is in the scope of a modal operator: nothing in principle suggests that it will be attained, but since its causing event *has* to obtain, its consequence is
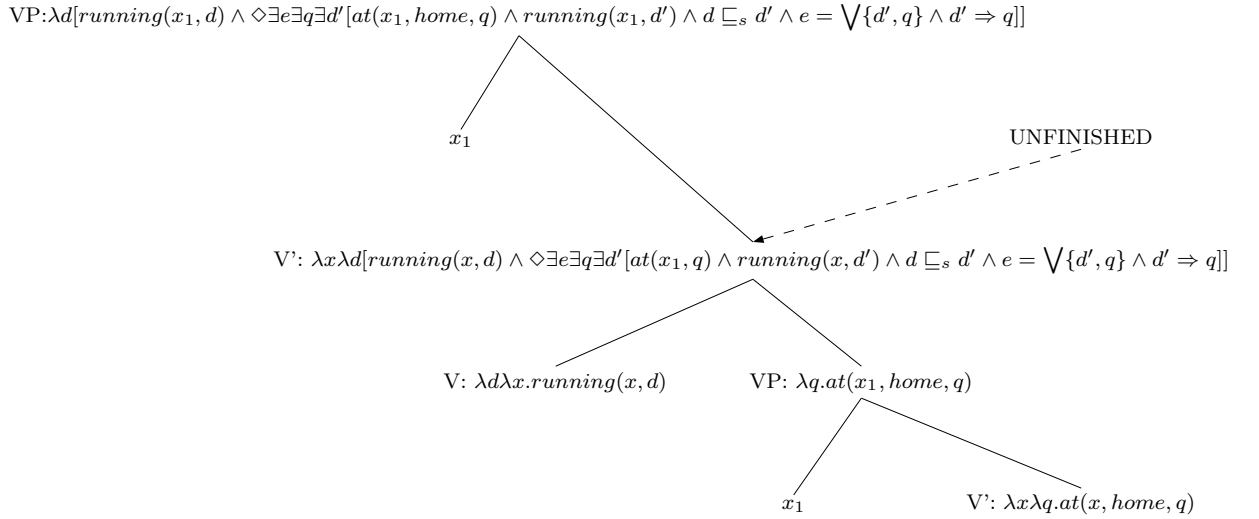
$$\text{VP:}\lambda d[running(x_1, d) \wedge \Diamond\exists e\exists q\exists d'[at(x_1, home, q) \wedge running(x_1, d') \wedge d \sqsubseteq_s d' \wedge e = \bigvee\{d', q\} \wedge d' \Rightarrow q]]$$

x_1

UNFINISHED

$$\text{V':} \lambda x\lambda d[running(x, d) \wedge \Diamond\exists e\exists q\exists d'[at(x_1, q) \wedge running(x, d') \wedge d \sqsubseteq_s d' \wedge e = \bigvee\{d', q\} \wedge d' \Rightarrow q]]$$

V: $\lambda d\lambda x.running(x, d)$ VP: $\lambda q.at(x_1, home, q)$

x_1 V': $\lambda x\lambda q.at(x, home, q)$

Figure 3. Relevant part of the derivation of *correre a casa* thorough the UNFIN-ISHED operator.

also extremely likely to occur. This is even clearer when punctuals are considered: since they have no resulting state and since, in spite of the application of the progressive operator, their unique atomic change is existentially predicated, we get the following inference, whose validity is confirmed by Italian speakers:

(45) La casa stava esplodendo → la casa è esplosa
    The house was exploding → the house exploded

Trying to capture the exact semantics and contextual use of the imminential progressive is definitely outside the scope of the present paper. Suffice it to say that the kind of semantics we would like to propose makes crucial reference to the notion of *preparatory phase of the resulting state*. This is not a unique case in the semantics of Italian. In the next section, we will see that also *in*-adverbials embody such a notion in their semantic interpretation (through the function *res* in (54)). If this is the case, we expect imminential uses of achievements, for which the notion of *preparatory phase of the resulting state* makes sense. This explains why a sentence such as (46) can be interpreted as *I am about to leave*:

(46) Sto partendo
    Am leaving

    'I am leaving.'

The notion of resulting state for punctuals is, however, undefined (for they are atelic) and so is, *a fortiori*, the notion of *preparatory phase*

of the resulting state. This explains why puctuals with the progressive form are always interpreted according to the *momentaneous progressive reading*, rather than to the *extended progressive reading*, as we claimed in (2.1). [20]

---

[20] A further remark is in order here, concerning the possibility of a momentaneous reading with Italian achievements. Indeed, if the progressive of an achievement is interpreted momentaneously, thus implying (telic) completion of the event, this seems to yield a problem with respect to the well-known entailment "telic fulfillment -¿ perfectivity", due to the robust imperfective character of the progressive. By contrast, this problem does not arise with dynamic punctuals, since they are atelic from the start. We shall therefore discuss the issue only with respect to achievements. Consider:

(i) Rivolsi casualmente lo sguardo verso la banca proprio quando il rapinatore stava uscendo.
  'I turned by chance the eyes towards the bank right when the robber was getting out'.

In fact, this tendency is even stronger in the case of the bare Imperfect, as in:

(ii) Rivolsi casualmente lo sguardo verso la banca proprio quando usciva il rapinatore.
  'I turned by chance the eyes towards the bank right when the robber was getting out [= got out.IMPERFECT]'.

although in the appropriate contexts the extended (imminential) reading may emerge even with the bare Imperfect, despite the pervasiveness of the pragmatic constraints admittedly favoring the alternative momentaneous reading with this type of predicates:

(iii) Quando il 7 Cavalleria finalmente arrivó, era troppo tardi, L'eroe ormai si spegneva, congedandosi virilmente dai suoi compagni.
  'When the 7 Cavalry finally arrived, it was too late. The hero was dying [died.IMPERFECT], taking leave of his comrades'.

The crucial point for us is the interpretation of achievements with the momentaneous reading. To make our point clear, we shall focus on the bare Imperfect, which exhibits the strongest inclination towards this interpretation (obviously disregarding other aspectual values, such as habituality, that the Imperfect may take on in the appropriate contexts). The difference between bare and periphrastic Imperfect with achievements seems ultimately to be of a pragmatic rather than semantic nature. Even the bare Imperfect may convey the progressive reading in the appropriate contexts, as in (iii). What then about sentences like (i-ii) , which preserve the progressive meaning in its momentaneous variant? We would like to propose that, although the momentaneous interpretation strongly suggests that the event reached its obvious conclusion, this is to be regarded as a pragmatic implicature rather than a semantic entailment. In these cases telicity is not directly asserted, but rather implied by the intrinsic non-durativity of the event. This should not be regarded as particularly surprising, for the semantics of the progressive often meets pragmatic constraints of some sort. Consider for instance a sentence such as *Right at that point, the plane was taking off*, which for obvious reasons may escape the usual condition available to most progressive events, consisting in allowing for a sudden interruption of the state of affairs. Quite understandably, an event like taking off requires some time in order to be interrupted, and most importantly cannot always be interrupted.

4.2. Temporal Adverbials

4.2.1. in/for *Adverbials*
4.2.1.1. in-*adverbials.* Let's have a look at two semantic representations of the time-span adverbial *in an hour* provided in the framework of lattice-based event semantics, namely those of Hinrichs (1985) (in turn derived from Dowty (1979)) and Krifka (1989):

(47) in an hour: $\lambda S \lambda e_1^s \lambda x^i . \exists l [hour'(l) \wedge e_1^s \preceq l \wedge S(e_1^s)(x^i) \wedge \forall e_2^s [e_2^s \preceq e_1^s \wedge S(e_2^s)(x^1) \rightarrow e_1^s = e_2^s]])$

(48) in an hour: $\lambda P \lambda e . [P(e) \wedge \exists t [CONV(t) \wedge h'(t) = 1 \wedge \tau(e) \subseteq_T t]]$

A common point of the above translations is an *inclusion* relation between the duration of the interval picked up by *in* and the event time ($e_1^s \preceq l$ in (47) and $\tau(e) \subseteq_T t$ in (48)). The rationale for using such a constraint, rather than the more intuitive constraint of equality, is twofold. In Krifka's system it is justified by the fact that time-span adverbials are upward-entailing operators; i.e. if I performed an action *in x time*, it has to be true that I also performed it *in x+n time*. Thus the following assertion will not necessarily be contradictory:

(49) Ann drank a bottle of wine in one hour; in fact she did it in 53 minutes.

Hinrichs, on the other hand, borrowing arguments from Dowty (1979), justifies the use of an inclusion relation on the basis of the fact that *in*-adverbials can also be used with momentaneous events, for which, in his system, no interval specification should be possible:

(50) John closed the door in an hour

Gricean reasons are then advocated in order to capture the fact that the interval has to be as short as possible, i.e. that the event should reasonably take place during the final subinterval denoted by the *in*-adverbials, and so on.

We think that Dowty/Hinrichs's rationale for using an inclusion relation is on the wrong track, the reason being that when one utters a sentence containing a momentaneous verb like

(51) The soldier left in two hours

it is not true that one is giving an "inaccurate" characterization of the interval at which the *leaving* takes place. On the contrary, I am trying to measure, by some contextual parameter, the process which prepared the soldier's leaving, in such a way that if he left in two hours, it is

simply false that he left in three hours or he left in one hour. Trying to capture the compatibility of *in*-adverbials with achievements by means of the temporal inclusion relation, hides the most fundamental aspect of the *in*-adverbials' meaning, i.e. the fact that they always measure a process (whether lexicalized or not) which leads up to a state.

As for Krifka's rationale for having an inclusion relation, we admit that sentence (49) can be uttered without contradiction, but we also think that *vagueness* should be resorted to, rather than *pragmatics*, to account for its non contradictory meaning. In other words, we think that temporal characterizations such as *in an hour*, when appearing in unmarked contexts, have to be interpreted vaguely, i.e. as making reference to a human perception of time, where there is no such a big difference between one hour and 59.59 or 53 minutes. In any case, we shall account for achievements appearing with *in*-adverbials in a way radically differing from Dowty-Hinrichs' treatment. Consequently, if the reader were not satisfied by the suggestion that the alleged upward entailing property of *in*-adverbials is a matter of vagueness, s/he can substitute '=' with '$\sqsubseteq$' in formula (55), without incurring in the "informational weakening" of Dowty-Hinrichs' treatment.

The second point concerning (47) and (48), is the way in which they rule out processes with *in*-adverbials. Both treatments rely on the fact that the event modified by these adverbials has to be atomic (through pragmatics rules in Krifka, directly in the semantics of the *in*-adverbial in Hinrichs). However, they do not explicitly state that processes are, in their systems, non-atomic, which implies that *in*-adverbials should be considered compatible with processes, provided they denote an interval small enough to contain only a single 'bit of a process'. For instance (52) (an example from Krifka (1989), although the asterisk is ours) should be acceptable, but this seems to us rather dubious, at least under a non-inchoative reading:

(52) * Ann drank wine in 0.43 seconds

In our system, *in*-adverbials measure the length of the process which leads up to the final state. For instance we interpret the sentence:

(53) Leo ran home in ten minutes

as: the duration of the process leading up to the final state of Leo's being at home (i.e. Leo's running) is ten minutes. In order to implement such an idea we must first of all introduce a partial function returning the resulting state of a telic event, undefined otherwise. Such a function (*res*) could be defined as :

(54) $res(e) = \iota q^{-}[q^{-} \sqsubset_s e]$

That is, *res(e)* will return the unique atomic state which is part of the input event e, if e has a unique proper part which is an atomic state, undefined otherwise. Such a function will be undefined with processes and e-punctuals (as they have no state at all), with states (as the uniqueness requirement is not satisfied) and with s-punctuals (as they have no proper subparts). Equipped with the *res* function, the semantics of *in*-adverbials is rather simple (remember that s^+ is a variable over non atomic situations):

(55) $in(e, i)$ *iff* $\exists s^+[s^+ \Rightarrow res(e) \wedge \tau(s^+) = i]$

If e is a state or a process, *in*-modification will always turn out to be uninterpretable, as $res(e)$ is undefined. This explains the ill-formedness of (56a) and (56b) under a non inchoative reading (and obviously, it also explains the ungrammaticality of (52), for *drink wine* is always a process, with no resulting state):

(56) a. * Lia walked in ten minutes

      b. * Lia was sick in three minutes

By contast, if s is an accomplishment, the function $res(s)$ will return its resulting state; and since accomplishments lexically specify the process which causes their resulting state, *in*-adverbials will measure the length of the preparatory process. Thus the following inference is captured[21]:

(57) Leo has eaten a cake in ten minutes $\rightarrow$ Leo has eaten for ten minutes

   Note that (55) also axplains the behaviour of achievements modified by *in*-adverbials. We noted in section 2.2 (example 10) that the preparatory process measured by *in*-adverbials in those examples heavily depends on our world knowledge. Take for instance a sentence such as:

(58) They left in twenty minutes

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[21] Actually, such an inference is defeaseble, as the speaker can have in mind a bigger process, than the one literally ending up into the described resulting state. For instance someone could legitimately say:

  (i) Leo ha mangiato la   mela in 60 minuti.
      Leo has eaten   the apple in 60 minutes

      'Leo ate the apple in 60 minutes.'

including the time of carefully peeling the apple, not just the eating time. Such a possibility is admitted in the kind of semantics we are proposing, even though the lexical availability of the preparatory process strongly discourages such uses in unmarked contexts.

If the subject of (58) is understood as a group of travellers, we would identify the preparatory phase which lasted twenty minutes with the process of packing the luggage, loading it onto the car and so on. However, if the subject of (58) is understood as a platoon of soldiers, things are different: the twenty minutes long preparatory process would involve other actions, such as awakening the soldiers, distributing the rifles, loading the military stuff onto the trucks and so on. In both cases, there is a complete dependence of the preparatory phase on contextual factors, a dependence which forces us to avoid any reference to the preparatory process in the semantics of achievements (*contra* Pustejovsky (1988)). Moreover, even with respect to the same contexts, different speakers might identify the preparatory process with different sequences of actions. For instance, both sentences in (59) can be true at the same time, depending on whether the speaker has in mind a sequence of quarreling events involving Leo and Lia or Lia's final talk to Leo:

(59) a. Lia ha lasciato Leo in una settimana.
         Lia has left   Leo in one week

         'Lia left Leo in one week.'

      b. Lia ha lasciato Leo in venti   minuti.
         Lia has left   Leo in twenty minutes

         'Lia left Leo in twenty minutes.'

This indeterminacy is fully predicted by our system. The sentences in (59) are true only if the duration of the process preparing Leo's remaining alone lasted either a week or twenty minutes. Crucially, however, such a process is not lexically specified, for the initial change of an achievement such as *lasciare* is not a process, but a mere atomic change. Thus the *in*-adverbials in (59) measure some *contextually* determined preparatory process of the state of *remaining alone*. Since such a process needs not be unique (for there is a great deal of indeterminacy among speakers in identifying what counts as a preparatory process) the fact that (59a) and (59b) can be simultaneously true is accounted for.

  Obviously, since no resulting state is admitted with punctuals, they will always be ungrammatical with *in*-adverbials. Thus, the following data are explained:

(60) a. # Leo sbaglió in dieci minuti. /=e-punctual/
            Leo failed   in ten   minutes

         'Leo failed in ten minutes.'

    b. # Leo si   stupí   in quattro minuti. /=s-punctual
        Leo SI-Clit amazed in four   minutes

    'Leo became amazed in four minutes.'

The reason why the diacritic '#' has been used, rather than '*' is that, in Italian, there is a homophonous preposition *in* designating a prospective use. Informally, this other use of *in* may be stated as: "in(e, i) is true if and only if e takes place i time after the reference time". In this case, no notion of preparatory phase is involved; punctuals behave as any other actional class under this particular reading of *in*-adverbials. Thus, crucially, (60a) is intepreted, by the speakers who accept it, as "Leo failed after ten minutes" or "it took Leo 10 minutes to fail", rather than "the process which caused Leo's failure lasted ten minutes".

4.2.1.2. For-*adverbials*   Intuitively, if John ate for three hours, it is true that for every interval included in three hours there is an event of an eating type, in which such an interval is included. Thus, we impose the following conditions on the interpretation of *for* (reminiscent of those proposed in Dowty (1979), Hinrichs (1985), Moltmann (1991)):

(61) (prov.)$for(s, i)$ *iff* $\forall i'[i' \sqsubset_t i \rightarrow \exists s'[s' \sqsubset_s s \wedge i' \sqsubseteq_t \tau(s')]]$

The truth conditions in (61) state that if a situation s occurs *for* an interval i, then for every subinterval i' of i there is a part of s such that its temporal trace is equal or bigger than i'. Under such a definition, *for*-adverbials are downward monotone, i.e. they allow the following inference

(62) I hammered for ten minutes $\rightarrow$ I hammered for five minutes.

    More interestingly, in spite of being downward monotone, they do not run into the problem of minimal parts. The problem could be formulated as follows: if my walking is composed of a set of atomic events which are again walkings, but which have no walking as a part, it should be impossible to draw the inference that, for instance, if I walked for ten minutes I also walked for 0.5 seconds. Indeed, if there is no walking defined at that interval, it makes no sense to speak about the duration of a walking event. Thus we would end up with the following exception to (62):

(63) I walked for ten minutes $\nrightarrow$ I walked for 0.5 seconds

In our opinion, however, language does not behave in this way and the semantics of *for*-adverbials should ignore whether there is a situation corresponding *exactly* to the interval under consideration. This is basically the reason why in (61) we imposed the subpart relation ($\sqsubseteq_t$)

rather than equality between i' and $\tau(s')$. An inference like (63) would then be justified, since there is a part of the event of walking for ten minutes whose temporal trace *includes* an interval of 0.5 seconds.

With this interpretation of *for*-adverbials, we are able to justify why they are compatible with states and processes. However, we fail to predict their incompatibility with achievements and their 'unfinished' reading with accomplishments (cf. section 4.2.1). In order to remedy this, we impose, as in the case of the progressive, the homogeneity condition over the modified event:

(64) $for(s,i)$ *iff* $hom(s) \wedge \forall i'[i' \sqsubset_t i \rightarrow \exists s'[s' \sqsubset_s s \wedge i' \sqsubseteq_t \tau(s')]]$

Now, only states and processes are allowed, while the derivation for achievements and accomplishments crashes, due to the *hom* predicate. As with the progressive, the derivation can be rescued by the application of the UNFINISHED operator, which makes only the eventive part available, by embedding the resulting state within a defeasible context. Thus, in the case of an accomplishment modified by a *for*-adverbial, such as the one in (65a), we obtain the logical form in (65b):

(65) a. Leo ha mangiato la   torta per dieci minuti.
          Leo has eaten   the cake for ten   minutes

          'Leo ate the cake for ten minutes.'

      b. $\exists d \exists i[eating(leo,d) \wedge for(i,d) \wedge ten\_minutes(i) \wedge \Diamond \exists e \exists d' \exists q[consumed(the\_cake,q) \wedge$
          $d \sqsubseteq_s d' \wedge eating(leo,d') \wedge e = \bigvee\{d,q\} \wedge d \Rightarrow q]]$

In this way, we justify the already mentioned fact that:

(66) Leo ha mangiato la torta per dieci minuti $\nrightarrow$ Leo ha mangiato la torta.
      Leo ha mangiato la torta per dieci minuti $\rightarrow$ Leo ha mangiato per dieci minuti.

Concerning the relationship of the remaining actional classes (punctuals and achievements) with the UNFINISHED operator, there are two possibilities. Either this operator cannot apply at all, as in the case of punctual verbs (which lack a state joined to the atomic change), or it can apply, as in the case of achievements. However, even in the latter case, the conditions on *for* adverbials interpretation are not satisfied. Punctuals have no parts by definition; achievements, after coercion, can only make one atomic change available to *for*-modification, so that our furmula, again, fails to apply. This explain the ungrammaticality of the sentences in (67), at least under a standard durational reading:

(67) a. # Leo è uscito   per dieci minuti. /=achievement/
         Leo is gone out for ten   minutes

     'Leo went out for ten minutes.'

    b. * Ha commesso uno sbaglio per dieci minuti   /=punctual/
         Has made   a   mistake for ten   minutes

     'He made a mistake for ten minutes.'

    The parallelism between achievements and punctuals is broken when the *for*-adverbial is used to measure the resulting state, as in (67a), which is acceptable under the reading *Leo went out and was absent for ten minutes*. Given the treatment we gave of telic verbs, two options are conceivable: (a) there is an operator (analogous to TELIC and UNFINISHED) that shifts the actionality of telic verbs, tranforming them into states; (b) there is a second entry for *per/for* which is able to only modify the resulting state, without changing the actionality of the event. Hypothesis (a) cannot work, since achievements with a *for*-adverbial over the resulting state behave as achievements, not as states. For instance, they are compatible with the progressive:

(68) Sto uscendo   per una decina di minuti.
    Am going out for a   ten   minutes.

    'I am going out for ten minutes.'

As to hypothesis (b), the following arguments can be provided in its support:

Cross-linguistic evidence. As noted by Moens and Steedmann (1988), while languages such as Italian and English have a unique preposition to express the meaning associated to both standard *for*-adverbials (let's call them *for*$_1$-adverbials) and *for*-adverbials over resulting states (*for*$_2$-adverbials), other languages, such as Spanish, French and German, distinguish these two uses by means of different prepositions:

  (69) a. Il est sorti pour trois minutes

       b. Il á marché pendant deux heures

  (70) a. Salió para dos minutos

       b. Caminó durante dos horas

  (71) a. Johann verliess für einige Minuten das Zimmer

       b. Johan ging zwei Stunden lang.

Syntactic evidence. In Italian for_2-adverbials behave in a different manner w.r.t. for_1-adverbials. For instance, while for_1-adverbials can naturally appear in a preverbal position, for_2-adverbials are usually ungrammatical in that position:

(72) a. Per due ore   ha   corso, poi   è andato a   riposarsi.
For two hours has run,   then is gone   to rest

'He ran for two hours, then he rested.'

b. * Per due anni   è partito, poi   è tornato   e
For two years is left,   then is come back and

si   è messo   a lavorare.
SI-Clit is started to work

'For two years he left, then came back and started to work.'

Moreover, for_2-adverbials show a clear tendency to appear after the constituent instantiating the resulting state, if present. For instance (73a) is more readily interpreted as a case of for_1 modification, while (73b) is acceptable under both readings:

(73) a. E' corso per 10 minuti   a casa.
Is run   for 10 minutes at home

'He ran for ten minutes home.'

b. E' corso a casa   per 10 minuti.
Is run   at home for ten minutes

'He ran home for ten minutes.'

Providing an explanation for these facts is far beyond the scope of this work. Suffices it to say that there are syntactic tests by which for_1 and for_2 can be distinguished.

We consider these pieces of evidence to be a sufficient prove that a lexical ambiguity analysis is superior to a type coercion analysis. We will avoid, however, to introduce another predicate with an autonomous interpretation, along the lines of *for* in (64) , but will rely on different semantic traslations of the words *per/for*:

(74) a. for_1 translates as $\lambda I \lambda P \lambda s. [P(s) \wedge for(s,i) \wedge I(i)]$

b. for_2 translates as $\lambda I \lambda P \lambda s. [P(s) \wedge REV(P) \wedge \exists s'[s \sqsubset_s s' \wedge P(s') \wedge for(s',i) \wedge I(i)]]$

In prose, (74b) states that a for_2-adverbial takes a reversible predicate and measures the length of a situation which includes it and for

which the same predicate holds. Since the definition of for_2 is based on the semantic definition of for, the predicate has to be homogeneus. Moreover, as we will see shortly, the predicate REV is only defined for predicates of state, so that both s and s' have to be states[22].

Let us now consider the predicate REV, which plays a crucial role in ruling out sentences such as (**??**). We propose the following definition (where q is a variable over states):

(75) $REV(S) \textit{iff } \forall q[S(q) \rightarrow \Diamond \exists i[\tau(q) \prec i \wedge \neg \exists q'[S(q') \wedge \tau(q') = i]]]$

In prose: a predicate S is reversible if and only if it is true of a certain state and there could be an interval in its future such that the same predicate would not be true for any of the states holding in that interval. For instance the predicate $\lambda s.dead(john, s)$ does not satisfy this condition by virtue of the fact that one part of the definitory conditions of the predicate *dead* is the clause according to which, once one is dead, one is dead forever. Thus, all we need to account for, as for the ungrammaticality of (76a), is a meaning postulate like the one in (76b):

(76)   a.   * Leo é   morto per due anni
             Leo is died   for   two years

         'Leo died for two years.'

   b. $\forall x \forall s[dead(x, s) \Box \rightarrow \forall i[\tau(s) \prec i \rightarrow \exists s'[dead(x, s') \wedge \tau(s') = i]]]$

As the reader can easily prove, $REV(\lambda s.dead(john, s))$ and the meaning postulate in (76b) generate a contradiction, hence the ungrammaticality of (76a)[23]. Concerning the use of the modal operator of possibility in (75), its introduction emphasizes the fact that, for a predicate to be

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[22] Obviously, together with the above semantic translation of for_2, we are making here some syntactic assumptions, namely the one according to which for_2-adverbials can only be adjoined to an inner VP projection. This seems to be justified by the impossibility for them to appear in a non topicalized sentence initial position (72b) and by their preferential attachment to the right of the state denoting constituent, if any (cf. the contrast in (73)). The full derivation of a sentence such as *uscire per dieci minuti* ('to go out for ten minutes') is provided in Dini (2000).

[23] Pustejovsky (1988) seems to assume that such a reversibility condition is due to pragmatic matters, as the following example should prove:

  (i) My SPARC died for two days

The same thesis is assumed in Egg (1995a) (1995), where the failure of *for*-adverbials over non reversible resulting states is explained in term of informativeness. It is indeed not informative to specify a part of the duration of a never ending state. Such hypothesis must, however, face the problem that no pragmatic condition can

reversible, it is enough to have a *possible* world were it stops being true. An actual state can be true forever in the actual word, and still the associated predicate may be reversible. This modal characterization of reversibility is required to capture the perfect grammaticality of sentences such as:

(77) Leo è partito per sempre.
Leo is left for ever

'Leo left forever.'

Without the possibility operator in (75), (77) should count as a contradiction: (75) would say that the state of being absent must have a conclusion, but the *for₂*-adverbial in (77) states the contrary. In our formulation, this contradiction does not arise. What the reversibility condition states is that there could be a world where Leo comes back, even if such a world does not coincide with the actual one. Conversely, the impossibility of:

(78) * Leo ha mangiato la mela per sempre
Leo has eaten the apple for ever

'Leo ate the apple forever.'

---

rescue a sentences such as (ii), as we should expect if the problem with (ii) were only of a pragmatic nature:

(ii) * Mary won the race for three months

Moreover, the same uninformativeness is present in sentences containing stative verbs such as

(iii) Once you are dead you are dead at least for three months

with the difference that when uttering (iii), one asserts something fairly odd, whereas when uttering (ii) one utters something wrong. Under Eggs' account, there is no room for such a difference, for both (ii) and (iii) should be ruled out by virtue of the same pragmatic principle.

Our explanation of the grammaticality of (i) relies on lexical ambiguity: the state resulting from a machine "dying" and from a man dying is simply of a different type (say $dead_1$ and $dead_2$), with different meaning postulates.

The same fact can be observed with the verb *win*:

((iv)) a. * Mary won the race for two month

b. Mary won a car for two month

Here, again, pragmatics seems to play no role: the event described in (iv.a) can have, as a pragmatic resulting state (or *aftermath* in Eggs' terminology), the possession of a car, as in (iv.b). However, the contrast between the two sentences is striking. This proves that it is not pragmatics that is at stake here, but lexical semantics: whereas the resulting state of the verb *win* used with an eventive direct object is irreversible (*being the winner of a certain competition*, i.e. a state which persists all life long and beyond), the resulting state of the same verb, when it subcategorizes for an object or an amount, is reversible (*possession*, i.e. a state which can be alienated).

is accounted for by assuming the fact that "once something is consumed, it is consumed for ever" as a necessary condition for the predicate *being_consumed* to apply. There is simply no world where a consumed onject stops being consumed. Hence, the impossibility of *for₂*-adverbials.

4.3. Reducing the Ambiguity to Underspecification

As the reader must have noted, many of the punctual verbs we presented through the preceding sections display some actional ambiguity. Verbs such as *toccare*, *vedere*, *rispondere* are ambiguous between a punctual and a stative reading, depending on the syntactic-semantic context. For instance, the verb *toccare* denotes a punctual event in (79a) and a state in (79b)

(79) a. Se tocchi il   fuoco ti   scotti.
          If touch the fire   yourself burnt

          'If you touch the fire, you will burn yourself.'

      b. L'armadio tocca   la   scrivania
         The closet touches the desk

          'The closet touches the desk.'

Other verbs are even more idiosyncratic: for instance *ricevere* denotes an achievement when used in the standard sense of 'getting possession of', while it denotes a punctual when its direct object refers to an event. Thus, while *ricevere un premio* is an achievement VP, *ricevere un ceffone* passes all the tests for punctuality.

These cases are, in our opinion, genuine cases of lexical ambiguity. Indeed, at the best of our knowledge, there is no semantic criteria to sort out exactly the class of verbs which partecipate in such alternations. Suppose, however, that we could find an alternation involving punctual verbs in an almost systematic way. We should then consider whether our semantics is adequate to handle it in a proper way. By *proper way* we mean a treatment which avoids the use of non-monotonic devices, such as rules of lexical redundancy. The mere stipulation that there is a device in the grammar converting a verb of type A into a verb of type B is no more than a surrender to the impossibility of finding an explanations for *why* there is such an alternation.

Actually, such a nearly systematic alternation does exist. Indeed, most *e*-punctual verbs have a homophonous form, denoting a process constituted by the repeated occurence of the event designated by the e-punctual predicate. For instance: *saltare,* ('jump') *starnutire* ('sneeze'),

tossire ('cough'), *sparare* ('shot'), *battere* ('beat'), *bussare* ('knock'), *singhiozzare* ('hiccup') , *urlare, gridare* ('shout'), *pugnalare* ('stab') etc. The double nature of these verbal predicates is proved by the fact that they can occur with adverbials presenting a contrasting meaning. For instance:

(80) a. Improvvisamente sparó.
         Suddenly   shot

      'Suddenly s/he shot.'

      b. Sparó per cinque minuti   di fila.
         Shot   for five   minutes uninterruptedly

      'S/He shot for five minutes uninterruptedly.'

Before trying to sketch out our treatment of this alternations, we should first counter the objection that the process reading in (80b) is obtained by some coercion operator, possibly of the kind we introduced to handle telic events with the progressive form. This is indeed a possibility, because *for*-adverbials may force an iterative reading of achievements and accomplishments through a mechanism of event quantification of the kind explored in Moltmann (1991), or through an iteration operator such as the one introduced by Krifka (1989). For instance, an achievement such as *partire* can be forced in (81) to denote a sequence of leaving events:

(81) Per molti anni sono partito alle   7,30.
     For many years am   left   at the 7,30

     'For several years I left at 7,30.'

However, we think that this is not the case in (80b). If the iterative reading were generated as a coercion induced by the *for*-adverbial, we should expect e-punctual predicates with the perfective form without *for*-adverbials to be unambiguosly interpreted as single events. This, however, is contradicted by the data. A sentence such as (82) is ambiguous between a reading such that I performed a single shooting event and one such that I was involved in a sequence of shootings:

(82) Oggi   ho   sparato.
     Today have shot

     'Today I shot.'

We conclude, therefore, that what we are facing here is a genuine case of ambiguity.

One of the classical approaches in lexical semantics (Pustejovsky 995a 1995a, Pustejovsky 995b 1995) and lexicalist theories of the grammar (Kathol 1994, Dini and Busa 1994) tends to reduce as far as possible lexical ambiguity to lexical underspecification. This reduction is welcome both from a computational and from a cognitive point of view, as proven by Pustejovsky 995b (1996). Now, if our theory of events is on the right track, we should be able to derive the double nature of e-punctual verbs: (i) without postulating any lexical ambiguity; (ii) without resorting to lexical rules (Stanley 1967, Jackendoff 1975, Bresnan 1982), which constitute a spurious device in the grammar's organization. This is achieved via underspecification. Section 3 has shown that the only constraint distinguishing *e*-punctuals from processes is a condition on the cardinality of the events set:

(83) a. $\forall e[proc(e) \leftrightarrow \exists X[e = \bigvee X \wedge X \subseteq D \wedge |X| > 1]$

   b. $\forall e[e\text{-}punt(e) \leftrightarrow \exists X[e = \bigvee X \wedge X \subseteq D \wedge |X| = 1]$

It is immediately clear that, by omitting such a specification, we obtain an actional class which is by definition ambiguous between process and e-punctuals:

(84) $\lambda e \exists X[e = \bigvee X \wedge X \subseteq D]$

This is the skeleton of the lexical entry of a verb such as *sparare*. When it appears in the scope of a *for*-adverbial, the cardinality of the set X is forced to be bigger than one (by the condition that events modified by *for*-adverbials have to be non atomic), thus behaving as a standard process. When it appears in the scope of an adverbial marking punctuality, such as *all'improvviso* ('suddenly'), the single-event reading is forced. Finally, if none of these factors intervenes, we mantain the underspecified reading: there is a set of atomic events of, e.g., shooting, whose cardinality remains unspecified.

5.   Conclusions

Abstracting from formal details, we think that the major conclusion of our research is that *actionality* can be properly defined as *the way in which events are composed out of smaller events*. We have proven that, in order for this definition to be effective, only a small set of assumptions concerning the domain of event semantics has to be made. As a side effect of this assumption, we derived the existence of two actional classes which have never received much attention in the relevant literature: 'eventive punctuals' and 'stative punctuals'.

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