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Elements for a linguistic ontology in the verbal domain

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Abstract. In this paper, we propose to put together the intuition developed in the descriptive work by Cusic on plurality in the verbal domain and the formal tools developed by Landman on groups. Cusic's hierarchy is used to say something both on the accessibility of the members of a plurality, and on the iteration of pluralisation to produce predefined new units. The notion of structured unit such as a group introduces a breaking point in the transitive relation that is part of the definition of the partial order imposed on the denotation of a predicate. Looking inside a group means to jump out of the semilattice to which the group belongs, and to land into another semilattice generated by a set of elements that are units (or collections thereof) of a different layer and are associated with a different sub-sortal. Discourse accessibility of the elements in the landing structure is not warranted.

Keywords. plurality, event domain, granularity for events, Ontology and Natural Language Semantics

1. Introduction

In the literature on formal semantics, the meaning of nouns is traditionally represented through predicates.[1] The possibility of identifying the various entities in the extension and the division present in the domain are tacitly assumed, as if the philosophical notion of SORTAL had been imported in linguistics. More recently, concerns of lexical semantics have found their way in generative approaches to syntax and semantics, and the nature and structure of the lexicon has come under closer scrutiny. One of the consequences of discussing the hypothesis that morphology operations are done in syntax and not in the lexicon, as in the Minimalist framework, has been the intense discussion about the nature of content words, the information associated with roots, and the information carried by functional projections in the syntactic tree representations.[2] It appears that roots cannot be made correspond to sortals, because discretude information is absent.

Some of the concerns about nouns, and their domain of individuals and substances, have been debated also with respect to verbs and their domain of eventualities. The parallelism in the discussions about the two domains is not strict, however, neither in the timing of the debates nor in the solutions adopted. For a start, there clearly is no agreement on how to represent the meanings of verbs, although predicates are a frequent solu-

[1]Thanks to the reviewers of FOIS'12 for their comments.

[2]Among others, see [13] for the distributed morphology approach, and [3] and references therein for proposals against a lexicalist approach to denotational effects in the nominal domain.

tion for verbs like for nouns. A solution widespread in early work but still used by some modern authors, is to use n-ary relations, like predicates in first order predicate logic, to represent the meaning of verbs with n syntactic arguments. Davidson [6] has proposed reifying events and has argued that verbs denote relations between events and their arguments, so that, for instance, a predicate corresponding to a transitive verb, taken to denote a two-place relation in a first order logic translation, becomes a three-place ($n + 1$-ary) relation. In the neo-Davidsonian tradition, verbs denote properties of events and all the participants in the situation are added by conjunction. Next, the identifiability of events is by far less uncontroversial than for individuals in the nominal domain. Plurality and divisivity are two notions that are not distinct for all authors.

This paper is about the linguistic ontology that is needed for properly modelling the functioning of natural language and the information it can convey. As a consequence, it is not geared toward a realist ontology, although human perception of reality may have something to do with widespread lexical choices such as using mass nouns for talking about substances like water, and count nouns for individuals like dogs and books. More specifically, we are going to discuss issues related to the hypothesis that the notion of group as defined by Link and Landman [23,16] has a counterpart for events. More generally, we are concerned with the type of units that one has to accept for describing plurality facts in the verbal domain. As it will be recalled shortly, approximately at the same time, i.e. at the beginning of the eighties, and presumably unaware of each other's work, Link [23] and Cusic [5] have proposed analyses of plurality in natural language. Link's proposal is about the nominal domain, is concerned with the domain of one sortal at the time, and is formalised through the notion of Boolean join semilattice. Cusic's proposal is about the verbal domain, is interested in plotting the dependencies between the units, possibly across sortals, and is not formalised.

There are reasons to doubt the assumption that events can be freely divided into subevents that can always be reanalysed as events—i.e. entities that are made referentially accessible in the discourse—by operating directly on the temporal interval. Suppose that basic predicates are predicates that are semantically interpreted as sets of atoms, adopt Landman's [18] proposal of taking basic predicates as lexical items that assign thematic roles, and add to it the requirement that each of them be associated to a sortal. If the unity of participants is the main criterion for the identification of single events, then this criterion is equally satisfied by both sentences in (1) from Italian, and one is left with no explanation for why the expression *tree times* can count jumps in (1a) but not small jumps in (1b). Only collections of small jumps can be counted in (1b).[3]

(1) a. Ha saltato tre volte
s/he jumped three times
b. Ha saltellato tre volte
s/he made several little hops three times

We may want to say that the two sentences describe three events, that something in the essence of these events is the same in both cases, but that there is also something different, in particular with respect to their internal constituency. In the (1b) case, the three events are internally plural.

[3] Verbs like *saltellare* are analysed as diminutive pluractional forms by Tovena [29], as explained below.

Linguists need to unpack the information packed into the philosophical notion of SORTAL, and distinguish between a form of characterisation concerning the essence, and information concerning discretude/division. This distinction does not prevent one from assuming that there may be default pairings of essence and division in several cases. In this paper we endeavour to show that a multilayered conception of units for discretude is required, and their hierarchical organisation is preferred over free recursion. We leave for another occasion the more linguistic oriented discussion of where in the representation should such information be expressed. In section 2, we provide some background information on the linguistic discussions about the mass vs. count distinction and the notion of group as a possible sort/unit for plural forms in the nominal domain, and we point at counterparts for the verbal domain. We draw attention to the work by Cusic [5], who introduces a hierarchy of units that structures recursive application of a form of pluralization. Then, we argue that the notion of sortal as used in philosophy should be split if one wants to satisfy the needs of linguists. On the one hand, we have a sub-sortal, that characterises the essence of an entity, introduced in section 3, on the other we have different possibilities of discretisation, detailed in section 4. Events are the most commonly acknowledged unit, albeit a problematic one. We then provide empirical support for the other two units proposed by Cusic, namely phases and occasions. The overall picture is that the notion of group corresponds to a change in unit and possibly also a change in sub-sortal, depending on the level of complexity (level in the hierarchy) at which it takes place.

As a caveat, before we start, let us make it clear that linguistic ontology is the ontology that is needed to support a proper theorisation about linguistic data. It may be taken to reflect/be compatible with, at least in part, a conceptualisation of reality psychologically plausible and philosophically sound, yet it is independent and does not come with commitments on reality and on mind organisation.

2. Linguistic background

The issue of plurality in the nominal domain was treated by Link [23], together with the issue of the structure of the denotation of count and mass nouns, by enriching the linguistic ontology, i.e. extending the concept of individual to cover plural as well as singular entities. The denotation of a noun is structured as a mereology, where 'a⊕b' is the individual sum of a and b and can freely shift from a singular to a plural individual status. The denotation of a singular noun corresponding to a unary predicate P is a set of entities. The star operator applies to P to generate all the individual sums of the entities in the extension of P. *P has the same cumulative referential property as mass predicates. Distributivity is seen as a feature VPs have if it is passed on to them by the constituents and the way they are combined. Thus, a plural individual interpreted as a collection of entities in an argument position, makes it possible to interpret the verb distributively and build a plurality of events.

In the verbal domain, at about the same time and presumably aware of Link's work and reciprocally, Mourelatos [25] and Bach [2] have proposed to classify lexical aspect

classes by extending the nominal mass vs. count distinction to the verbal domain.[4] Their work can be read as providing motivation for a classification of sortals for the event domain, whereby the Vendlerian states and activities fall on the mass side and achievements and accomplishments on the count side.[5] Bach mentions the property of *antisubdivisivity*, according to which no part of an event with this property can be an event of the same kind. This is not to say that a process can always be divided into parts that are also processes of the same kind, just that (telic) events, i.e. Vendlerian accomplishments and achievements, never can. In other words, this is a characterisation of (non) downward homogeneity. A second property is *additivity*, according to which if one sums two or more processes of the same kind, one will have a process of the same kind and this is not the case with (telic) events. This is a form of upward homogeneity. The former property captures a form of count–uncount distinction; the latter captures a form of mass and plural similarity.

A new proposal for enriching the ontology was independently put forth by Cusic [5], in his thesis on plurality in the verbal domain. Recall that PLURACTIONAL MARKERS [7,26,5] encode inherent verbal number morphology.[6] Cusic sees pluralisation in the verb domain as an operation that admits a reduced number of iterations, and organises its input and output in a hierarchical arrangement of bounded units in three levels of structure depicted in Figure 1, namely PHASES, EVENTS and OCCASIONS, but does not provide a formal relation defining a partial order among items of these three levels.

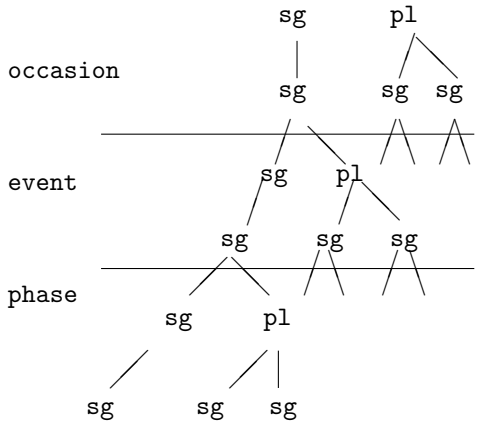

Figure 1. Cusic's hierarchy of event plurality

Three specifications to the definitions of the various units and of plurality are provided. First, every unit of the superior level is composed of at least one unit of the level

[4] As pointed out by a reviewer, Goodman's [11] classification of predicates for cumulativity and divisivity, 'dissectivity' in his terms, is a relevant precursor. See Langedoen and Magloire [21] for a recent discussion of his work.

[5] Once one accepts that a linguist needs to tease apart components of the notion of sortal, as we are going to argue shortly, the four classes can be viewed as a way to classify subkinds of essences.

[6] PLURACTIONALITY is the term used to refer to the phenomenon whereby number is grammaticised as a morphological category inherent to the verb. This is a distinct phenomenon from number agreement, as demonstrated by Frajzyngier [10] and Durie [8]. Nowadays, the term is extended to plurality of eventualities no matter how it is produced.

right below it, so that every event is composed of at least one phase and every occasion is composed of at least one event. Second, every unit of a lower level belongs to at most one unit of the immediately superior level, so that every phase belongs to at most one event and every event belongs to at most one occasion. Third, 'plural' at any level of the structure indicates more than one unit of the same nature and of that level. Pluralisation can but need not induce a change of level, and change of level can but need not be associated with plurality, as indicated by the intermediary layer of labels in each level in Figure 1.

Cusic calls pluralities created at the lowest level as EVENT-INTERNAL, and gathers under the term of EVENT-EXTERNAL the pluralities of the other two levels. He identifies several parameters to characterise spaces of variation among languages. The distributive parameter offers a view of verbal plurality as a form of distributivity, insofar as the source of the multitude of occurrences of one event type is identified in multiple temporal and spatial extensions, and with number in associated noun phrases. The formulation of this parameter is intended to apply to external plurality in general, but also to internal plurality in his view, through time distribution. This position is endorsed by Lasersohn [22] in his formalisation, but the data discussed in section 4.2 provide evidence against it. Lasersohn applies Link's sum formation operation to Cusic's occasions, events, and phases. His characterisation of the effect of a pluractional marker is recalled in (2). The distributive key is provided by a non-overlap condition that works together with a function f that is either a temporal or spatio-temporal trace, or a thematic role assigned by the verb V.[7]

(2) $\text{V-PA(X)} \Leftrightarrow \forall\, e\ e' \in X[P(e) \& \neg f(e) \circ f(e')] \,\&\, \text{card(X)} \geq n$
PA=pluractional affix, X is a variable that denotes sets of events
card=the cardinality function

In prose, X is a plural event characterised by the pluractional verb V-PA iff all the subevents e and e' characterised by P and supposed to be different, are disjoint with respect either their temporal or spatiotemporal trace or the values that are assigned to a thematic role, and the cardinality of the plural event is greater or equal to a contextually defined value *n* which is necessarily greater than 1. The way *n* is defined is presumably left to world knowledge. Indeed, the main purpose of the non-overlap condition that Lasersohn imposes on the range of the trace/space/thematic role function f is to ensure discontinuity along a dimension, since this warrants boundedness, a basic ingredient in plurality. It is then posited that V and P that occur on the two sides of the equation in (2) are instantiated by the same verb base in event-external plurality, whereas they are required to differ in event–internal plurality.

Landman [18] has studied plurality in argument positions in a neo-Davidsonian approach to events. The assumption informing his work is that collective predication is singular predication, and plural noun phrases like *the boys* are interpreted collectively through an implicit group-operator similar to Link's. Apparently unaware of Cusic's work, Landman [20] looks at the issue of grouping together events (instances of event properties) in a way that could be made compatible with Cusic's layered proposal. He claims that counting can be done only on singularities, i.e. atoms, and introduces the

[7] [31] have shown that Lasersohn's characterisation does not cover event-internal plurality such as with verbs like *saltellare* in (1b), precisely because multiplicity has an event-internal source.

term of GRIDDING to refer to intensional individuals that can be used for counting pluralities. Indefinite time expressions like *three times* induce such a gridding operation on pluralities of events by shifting them to intensional entities that can be counted. Building on [24] and [16,17], Landman introduces three sorts of atoms: individual atoms (IND), group atoms (GROUP) and group of group atoms (G-GROUP). The operation of group formation is viewed as iterative. This means that the sorts are potentially much more than just three. The hierarchy that is built is different from Cusic's in at least two respects. First, atoms are always events for Landman, but Cusic does not talk about atoms. Second, two levels higher up (or more) are envisaged by Landman, whereas Cusic assumes occasions above events and phases below, as a fourth layer called discourse is never properly discussed in his thesis. A similarity between the two proposals is the derivative status of the layer above events. Cusic argues that occasions are not introduced autonomously, but result from the need of counting groups due to scoping relations among scope-taking temporal expressions.

In order to make work together the notion of unit as atoms from Landman and the notion of layer from Cusic, we have to be also able to verify that the matter gathered together in a plurality of units of one layer is of the same nature, and this for all units and layers. For this, we need to modify the philosophical notion of sortal. We turn to this next.

3. Splitting the notion of sortal

The notion of sortal is widely accepted as a philosophically relevant one, although it is less clear and more criticized than is generally recognised. Grandy [12] notices that "There is variation, in whether 'sortal' is applied to linguistic items, e.g., predicates or words, abstract entities, e.g., universals or properties, or psychological entities, e.g., concepts. There is also variation, mostly unnoticed, in how 'sortal' is defined. Much of the disagreement is probably masked by the fact that there is agreement on some examples, so 'tiger' (or the associated concept or universal) is a sortal and 'water' is not."

In linguistic terms, *tiger* is a count noun and *water* is a mass one. This classification is undoubtedly useful, but it is equally undoubted that it is not well defined. The intuitive link between the structure of the domain of denotation of common nouns and the types of determiners they can combine with, does not seem to provide independent ground for definitions, because the distinction between countable and mass nouns is often linked or even made to depend on differences observed among determiners and vice–versa. For instance, only mass nouns combine with *much* and only countable nouns combine with *each*, see [14] for a recent appraisal. Furthermore, this bipartition remain silent on cases that are particularly relevant for the present discussion, such as collective nouns like *cattle* and *furniture*. It is in our interest to introduce a way to talk of the characterising force of common nouns (and verbs) separately from the fact that they apply to entities that are standardly conceived as discrete or to entities that are standardly conceived as substances with no intrinsic division associated to them.

For the purpose of the present work, we need to conceive a sortal as a notion/piece of information for identifying the essence of a substance, an entity and a class of such entities. We will call it SUB-SORTAL, in order to reduce the risks of misunderstanding linked with the redefinition of a known term, and for lack of a better term. This notion is

close to what a root can be taken to refer to in linguistics. But 'root' is a term that is morphological loaded, and selecting it would introduce further risks of misunderstanding.

Crucially, the notion of sub-sortal does not (and is not meant to) help defining set membership by itself, contrary to what is typical for a property expressed by a predicate in a formal metalanguage, and this because it does not have/express conditions on discretude. A sub-sortal is one of the ingredients for defining membership, not a full condition on its own. Therefore, it is part of a semantic analysis of natural language, but it is not autonomously associated with an extension. It is one of the ingredients making up the characterising potential of a word, it has a form of descriptive content but provides no discretising instruction.

4. Units

In this section, we look at ways in which information about the division of the domain partially characterised by a sub-sortal, can get expressed. We assume that verbs denote properties of events. Events are instances of these properties and are the basic units.

4.1. Events

Plurality of events and issues of event structure in event semantics are treated within a single mereological structure. In principle, all bits/entities are events, can be subevents and super events, to whom the trace function can associate an interval of time. In practice, we suggest, recursion is not free.

We adopt Carlson's [4] definition of event as 'a spatially and temporally bounded, ephemeral constituent of the world that has but a single occurrence', with the distinguo that we remain agnostic on the issue of whether events are in the world itself, but we are inclined to believe that what is important for understanding the functioning of language is that they definitely are in our conceptualisation of the world. Next, events are ordered in a mereological structure (Bach [1], Krifka [15]), but the adoption of different layers from Cusic means that not all parts of an event are events. Link's [23] distinction between the ordering relations between individual parts i-part and between portions of stuff m-part becomes relevant.

Plurality in argument position is one of the sources for event plurality, in particular in the case of once-only events such as events of creation or destruction, e.g. *build a house, eat an apple*. A common strategy is to carve out a singular event through the discretude and singularity of its participants. In this way, singular events are events whose thematic roles map them exclusively to singular individuals. Different views have been expressed in the literature on the question of whether in general singular events should be represented as mereological atoms. For instance, Krifka [15] does not commit himself on the existence of atomic events. In his characterisation of accomplishments with an incremental theme, he needs to say that the event in which Daniel reads a certain book has proper parts in which Daniel reads part of the book. He takes plural marking in argument position to be an alteration of the event description that betrays the fact that the event described by such a predicate is quantised and telic. On the contrary, Landman [19] assumes that all singular events are atoms, because distributivity and plurality are the same thing in his analysis. Example (1b) forces us to admit that singular participants

are not the ultimate warrant for a singular event, and that a singular event may have some structure inside it that is analysed at a subatomic level.

4.2. Counting: events vs. phases

In this and the next sections, we review empirical data that provide evidence for a layer below and a layer above events. The relevance of each level of Cusic's hierarchy is defended by Tovena [29] who emphasises two major differences between nominal and verbal domains. First, the hierarchy is entered at the level of events, therefore there is a standard level which is not the bottom in the verbal domain, and second, the units *phases* and pluralities thereof do not have the same (referential) properties as the elements of other levels. As it will be shown below, differences between the layers justify the idea that it is not a mere case of recursion in the application of groupification. We start with phases, the lowest layer. Not all languages possess a way of marking explicitly the presence of multi phases. Several Romance languages do, with different degrees of productivity. In Italian, this option corresponds to a word formation process that derives verbs from verbs or nouns.

We gather old and new evidence for the linguistic existence to phases by reviewing empirical data on which to ground the distinction from events. As we will see, the issue of identification plays a crucial role.

First, the unity of the events described by event-internal pluractional verbs is confirmed by the fact that the type of plurality in question undergoes restrictions with respect to thematic relations that are not shared by pluralities of events and occasions. Internally plural events require argument identity across phases, and plural patients cannot be grouped. Consider the Italian verb *tagliare* (cut) and its pluractional form *tagliuzzare* (give many small cuts). In (3a), one or two cuts per apple won't do even if there are many apples, hence many cuts in total. Hence, even if one assumes that a plurality of events is the reflect of the plurality of patients, in event-internal plurality distribution must go down to the individual patients. Each event of *tagliuzzare* one apple must be made up of a plurality of cuts to the same apple, and such a requirement of plurality through and through is not affected by the overt expression of a singular patient, cf. (3b). On the contrary, such a reading is possible for the verb in its simplex form, cf. (3c). Note also that in verbs like English *nibble*, which diachronically is a morphological constructed form but synchronically is now perceived as a simple verb, can be used to describe an event of a single little biting, at least by some speaker, whereas the corresponding French form *mordiller* is always perceived as morphologically complex and applicable only to a multi phase event.

(3) a. Luisa ha tagliuzzato le mele
Luisa chopped the apples

b. Luisa ha tagliuzzato una mela
Luisa chopped one apple

c. Luisa ha tagliato una mela
Luisa cut one apple

On the contrary, the same or different carts may be involved in (4), which describes an event-external plurality.[8]

(4) a. Oggi Luisa ha spinto un carrello dal parcheggio al magazzino venti volte
today Luisa pushed a cart from the car park to the deposit twenty times
b. Luisa ha spinto un carrello dal parcheggio al magazzino per tutto il giorno
Luisa pushed a cart from the car park to the deposit for the whole day

Second, internal plurality does not predicate plurality at the discourse referent level. Phases are parts described all by the same predicate and endowed with some form of atomicity that makes it possible for us to appreciate their multiplicity, but does not warrant their identification, (5). Thus, they cannot be counted.

(5) Daniele ha mordicchiato la matita due volte
Daniele nibbled the pencil two times
(two events of nibbling, not two little-bitings making up one nibbling)

Furthermore, phases cannot be specified with manner information, only events can (6).

(6) Daniele ha mordicchiato la matita due volte, ogni volta molto lentamente.
Daniele nibbled the pencil two times, very slowly
(not two little slow bitings making up one nibbling)

Third, infinitival nominalisations, which have eventive readings, cannot refer to phases. Only counting events is possible in this case too, (7).

(7) Il suo mordicchiare la matita due volte durante il colloquio di assunzione è stato male interpretato dalla commissione
His giving several little bites to the pencil twice during the job interview was badly interpreted by the committee (two events of giving little bites)

Fourth, duration of events can be compared, not duration or number of phases. Only the whole event's length is compared in (8), cf. the lack of congruence in the short dialogue in (9).

(8) Daniele ha mordicchiato la matita più di Maria
Daniele nibbled the pencil more (= longer, $\neq$ more times) than Maria

(9) A. Luisa ha mordicchiato più di Daniele
Luisa nibbled more than Daniele
B. # No, perch lui è più veloce
no, because he is faster

[8] As correctly noted by a reviewer, (4b) allows both a slow motion single event reading and a normal speed multi event one. Only the second reading is relevant for the issue of argument identity under discussion.

Fifth, phases cannot be too wide apart and yet constitute one and the same event, they require a temporal proximity which is not accounted, for instance, by the formalisation in (2). This is what Cusic characterises by connectedness, one of the parameters of his classification of pluractionality.

Finally, there is a clear difference between processive readings of semelfactive verbs, e.g. *cough* and *knock*, and plurality of phases. Semelfactive verbs in Italian are verb forms that admit both semel, i.e. bounded single event, and processive, i.e. activity-like, readings. The verbs that can combine with pluractional marking, e.g. pairs like simple *tossire* (cough) and pluractional *tossicchiare*, no longer admit a semelfactive interpretation when marked as pluractional, see the impossibility of making explicit the 'single event' use (10). They become marginal, or have only inchoative reading, with a time adverbial indicating a point in time, see the contrast in (11).

(10) a. #Daniele ha tossicchiato (un colpo di tosse)
Daniel coughed a single cough
b. #Daniele ha sputacchiato (un singolo sputo)
Daniel spluttered a single spit

(11) a. Daniele ha tossito alle due in punto
Daniel coughed at two o'clock sharp (=semelfactive reading)
b. #Daniele ha tossicchiato alle due in punto
Daniel coughed (slightly and repeatedly) at two o'clock (sharp)

What can be concluded from this collection of points, and all these examples that illustrate them, is that speakers who choose to describe a situation via an event-internal pluractional verb, have a clear perception of an event constituted by a multitude of phases, but they present the plurality in such a way that the internal structure is not accessible. No individual phrase can be singled out, whether through direct reference, through localisation in time or through counting or measuring. In other words, it is necessary to distinguish between the case where an event is seen as complex entity whose components can be reanalysed as events, from the case where such a reanalysis is not supported. The term of phase applies to the components present in this latter case and in this sense it is meant to encode an ontological difference. We need the notion of sub-sortal to impose the constraint of similarity in nature that is intrinsic in the form of pluralisation we are concerned with, and to avoid ascribing full identity to the members of the plurality.

A phase is a conceptual unit and does not correspond directly to a taxonomic word applying to a countable period or as an event unfolding at a subinterval. Therefore, it cannot be used in the same technical meaning, for instance, to say that there were three phases of running when what is meant is that someone ran three times. Similarly, it is not a classifier for languages that do not have them, since a crucial function of classifiers is to make discourse accessible the discretisation of the nominal domain.

We take events as basic units for reference, not as the bottom unit in the ontology. This means that we cannot refer directly to the parts of a single event *e* as parts of such an event, and in this sense *e* is atom like. We have seen that it is often assumed that one may recategorize the parts of *e* and refers to them as subevents that are viewed as events, and in this sense *e* is not said to be atomic, rather to be a basic unit. This section has shown that phases are subevents viewed as parts of an event with no possible recategorization. In [29] is was shown that a definition of phase in temporal terms is

problematic and that grounding them on the participant that is used to measure out the event is a more promising option. Indeed, the progression of the event described by the simple verb phrase can be traced by following the degree of affectedness of the theme, cf. (3c), i.e. there is a homomorphism between the structure of the event and the structure of the theme as defined by Krifka [15], but the homomorphism is no longer there in the pluractional verb, cf. (3b).

4.3. Occasions and the interface for overtly marked number opposition

In this section, we discuss evidence supporting the hypothesis that there is a level of grouping above events. As a starting point, recall that Cusic's understanding that languages exploit the same linguistic devices to get a plurality of events and of occasions, is behind his reorganising the system from a three levels hierarchy to the bipartition between event internal vs. event external pluralities. Cusic supports his claim with English data on the interpretation of adverbials, taken to show that the main opposition is between singularity and plurality at the level of event, and that plurality at the level of occasions is obtained when a second adverbial can provide a second key for distribution. For instance, (12a) says that there are several events and by default we infer that there is one occasion. One reading of sentence (12b) says that there is one event that is repeated at several occasions. Data on temporal adverbial modification are used also by Landman [18,20] to support his idea of gridding. He argues that the grouping effect cannot be reduced to a scoping effect.

(12) a. The boy shouted again and again
b. Again and again the boy shouted on Tuesday

Next, in the following we discuss two sets of data that provide positive evidence for the layer of occasions. First, the French data in (13) are from Tovena [30]. Sentence (13a) is ambiguous between a reading where two ringing events make up a plural event mapped onto one occasion, for instance if Daniel went to the door once and pressed the button twice, and a reading where ringing events are distributed over two occasions, for instance if Daniel went twice to the door and rang the bell an unspecified number of times/ringings. Beside the non specialised expression *fois* (time), that can be used for counting events or occasions, French has a specialised device for counting events via the occasions they belong to, and not counting events directly. Sentence (13b) only exhibits the latter reading, whereby ringing events are distributed over two distinct occasions. The expression *reprise* is used specifically for occasions, thereby providing support to their existence as primitive.

(13) a. Daniel a sonné deux fois
Daniel rang the bell two times
b. Daniel a sonné à deux reprises
Daniel rang the bell (on) two (different) times

The two expressions can be combined, see (14) which is interpreted as saying that at two different occasions, there were three ringings by Daniel. A similar double combination is possible in English with semelfactive *knock*, a piece of data that shows that this type of verb denotes only event-external pluralities, cf. (15).

(14) Daniel a sonné trois fois à deux reprises
Daniel rang the bell three times twice

(15) Daniel knocked three times twice

The noun *fois* behave differently from *reprise*. As can be seen in (13), *reprise* occurs in a PP, while *fois* does not, similarly to English *time* [20]. Second, they behave differently in definite quantificational phrases. According to Rothstein and Landman [28,20], definite and quantificational time adverbials count main clause events indirectly through matching. The contrast in (16) indicates that indirect matching is not a possibility for *reprise*.

(16) a. Daniel a sonné chaque fois
Daniel rang the bell every time
b. # Daniel a sonné a chaque reprise
Daniel rang the bell each of those times

Second, we have recalled above that Cusic locates the main verbal number opposition between phases and the rest. However, there are languages that seem to convey number opposition at the interface between event and occasion as the main piece of information. This could be the case in Emerillon, a language of the Tupi-Guarani family. In a recent paper, Rose [27] associates different forms of verb reduplication with different layers of Cusic's hierarchy. More precisely, monosyllabic reduplication of verb forms is said to result in interpretations as event-internal plurality, and disyllabic reduplication to result in interpretations as event-external plurality. However, the possible cooccurrence of monosyllabic reduplication with a distributivity marker does not fit in Rose's analysis, which predicts a multi-phase single event in this case too, and she needs to invoke ongoing diachronic change for a pattern that is otherwise presented as typical of the languages of the Tupi-Guarani family. These data are reanalysed by Tovena [30], who points out that in all the examples, monosyllabic reduplication matches with strictly contiguous or simultaneous situations, whereas disyllabic reduplication matches with lack of temporal contiguity. In other words, disyllabic reduplication is likely to mark plurality at the level of occasions, and monosyllabic reduplication covers the remainder, i.e. events and phases.

Standard Arabic provides another interesting case of potential misalignment with respect to Cusic's event-based bipartition. The relevant interpretative variation is observed with respect to some of the verbs of the so-called second form, forms obtained through gemination of the second consonant of the root. Verbs of this second form group work as intensive[9] pluractionals but they also might distribute over a collective patient. For instance, the verb *jarraḥa*, which means to inflict many wounds on a single entity, might distribute over a collective patient and be interpreted as 'wound many' with intensive meaning but no clear specification that each one element of the collectivity gets many wounds, adapting from [9]. This interpretation is possible when the entity realising the theme admits plural interpretation.[10] This behaviour has been accounted by [30] by making the same assumption adopted for Emerillon, that is that morphological marking via

[9]Intensive and diminutive are the two main varieties of event-internal pluractionals.

[10]The same effect, in reverse, can be observed when the English verb *massacre* is applied to a singular patient.

the second form in Arabic does not distinguish between event-internal vs. event-external plurality in the way Cusic has defined, but between plurality of phases and events vs. plurality of occasions. Indeed, the 'wound many' reading cannot apply to a situation where the wounding of the entities is sparse in time, where sparse in time means that distinct events are mapped onto distinct occasions. This impossibility is not expected if the reading is treated as a case of event-external plurality. The second form of verbs can only describe a connected sequence of events.

5. Conclusion

In the nominal domain, Link has introduced a difference in primitive when he has posited plural individuals, i.e. entities that are of semantic type *d* and are not atomic. One interesting feature of the notion of plural individuals is the (real or merely suggested) possibility of accessing the members of such pluralities. We assume that Cusic's hierarchy can be used to say something both on the accessibility of the members of a plurality, and on the iteration of pluralisation. In the view developed for verbs in this paper, a notion of unit such as a group introduces a breaking point in the transitive relation that is part of the definition of the partial order imposed on the denotation of a predicate. Looking inside a group means and requires more than to jump out of the semilattice in which the group is an atom, as claimed by Landman. It means landing into another semilattice generated by a set of elements that are units (or collections thereof) of a different layer and that are associated with a different sub-sortal. Such a landing is not freely warranted at discourse level. Only a subsequent overt referential expression, such a full noun phrase or a full verb phrase, can make the parts of the internal structure discourse accessible. The important conclusion that must be drawn is that adding an element to the ontology does not come with the commitment that the entities that fall under it can be directly talked about. Last, let's add that stative predicates denote in a domain with no links for changes of sub-sortal or of unit. The characterisation expressed by this type of predicates is cumulative and divisive, i.e. upward and downward homogeneous.

References

[1] Emmon Bach. The algebra of events. *Linguistics and Philosophy*, 9:5–16, 1986.
[2] Emmond Bach. On time, tense and aspect: an essay in English metaphysics. In Peter Cole, editor, *Radical Pragmatics*, pages 63–81. Academic Press, New York, 1981.
[3] Hagit Borer. *Structuring sense*, volume I. In name only. Oxford University Press, Oxford, 2005.
[4] Gregory Carlson. Thematic roles and the individuation of events. In Susan Rothstein, editor, *Events and Grammar*, pages 35–51. Kluwer, Dordrecht, 1998.
[5] David Cusic. *Verbal plurality and aspect*. PhD thesis, University of Stanford, 1981.
[6] Donald Davidson. The logical form of action sentences. In *Essays on Actions and Events*, pages 105–122. Clarendon, 1967/1980.
[7] Wolfgang Dressler. *Studien zur verbalen Pluralität*. Österreichische Akademie der Wissenschaft, Phil-Hist, Wien, 1968.
[8] Mark Durie. The grammaticization of number as a verbal category. In *Proceedings of the Twelfth Annual Meeting of the Berkeley Linguistics Society*, pages 355–370, 1986.
[9] Abdelkader Fassi Fehri. Verbal plurality, transitivity, and causativity. In Jacqueline Lecarme, editor, *Research in Afroasiatic Grammar II*, pages 151–185. Benjamins, Amsterdam, 2003.
[10] Zygmunt Frajzyngier. Ergativity, number, and agreement. In *Proceedings of the Eleventh Annual Meeting of the Berkeley Linguistics Society*, pages 96–106, 1985.

[11] Nelson Goodman, editor. *The Structure of Appearance*. Harvard University Press, Cambridge MA, USA, 1951.
[12] Richard Grandy. Sortals. In Edward N. Zalta, editor, *The Stanford Encyclopedia of Philosophy*. Stanford, 2007.
[13] Morris Halle and Alec Marantz. Distributed morphology and the pieces of inflection. In Kenneth Hale and Samuel Jay Keiser, editors, *The View from Building 20: Essays in Linguistics in Honor of Sylvain Bromberger*, pages 111–176. MIT Press, Cambridge MA, USA, 1993.
[14] Kathrin Koslicki. The semantics of mass-predicates. *Noûs*, 33, 1999.
[15] Manfred Krifka. The origins of telicity. In Susan Rothstein, editor, *Events and Grammar*, pages 197–235. Kluwer, Dordrecht, 1998.
[16] Fred Landman. Groups I. *Linguistics and Philosophy*, 12:559–605, 1989.
[17] Fred Landman. Groups II. *Linguistics and Philosophy*, 12:723–744, 1989.
[18] Fred Landman. Plurality. In Shalom Lappin, editor, *The handbook of Contemporary Semantic Theory*, pages 425–457. Blackwell, Oxford, 1996.
[19] Fred Landman. *Events and plurality*. Kluwer Academic Press, Dordrecht, 2000.
[20] Fred Landman. Indefinite *time*-phrase, *in situ*-scope, and dual-perspective intensionality. In Svetlana Vogeleer and Liliane Tasmowski, editors, *Non-definiteness and Plurality*. John Benjamins, Amsterdam, 2006.
[21] Terence Langedoen and Joël Magloire. The logic of reflexivity and reciprocity. In Andrew Barss, editor, *Anaphora: A Guidebook*, pages 237–263. Blackwell Publishing, Oxford, 2003.
[22] Peter Lasersohn. *Plurality, conjunction and events*. Kluwer Academic Press, Dordrecht, 1995.
[23] Godehard Link. The logical analysis of plural and mass terms: a lattice theoretical approach. In R. Bäuerle, C. Schwarze, and Arnim von Stechow, editors, *Meaning, Use and Interpretation of Language*, pages 302–323. de Gruyter, 1983.
[24] Godehart Link. Hydras. On the logic of relative constructions with multiple heads. In Fred Landman and Frank Veltman, editors, *Varieties of Formal Semantics*, pages 245–257. Foris Publications, 1984.
[25] Alexander Mourelatos. Events, processes and states. *Linguistics and Philosophy*, 2:415–434, 1978.
[26] Paul Newman. *The classification of Chadic within Afroasiatic*. Universitaire Pers., Leiden, 1980.
[27] Françoise Rose. Action répétitive et action répétée : aspect et pluralité verbale dans la réduplication en émérillon. *Faits de langues*, 29:125–143, 2007.
[28] Susan Rothstein. Adverbial quantification over events. *Natural Language Semantics*, 3:1–31, 1995.
[29] Lucia M. Tovena. Pluractionality and the unity of the event. In Maria Aloni and Katrin Schulz, editors, *Amsterdam Colloquium 2009*, pages 465–473. Springer, Heidelberg, 2010.
[30] Lucia M. Tovena. When small is many in the event domain. *Lexis*, 6:41–58, 2010.
[31] Lucia M. Tovena and Alain Kihm. Nibbling is not many bitings in French and Italian: A morphosemantic analysis of internal plurality. In *Proceedings of the 34th Annual Meeting of the Berkeley Linguistics Society*, 2008.