5 The role of granularity in event semantics

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In the past decade, the role of scales in the semantics of gradable adjectives became more pronounced, and an increasingly wider range of phenomena involving vagueness came to be analysed in a scalar semantics. In the present article, I will argue that the adoption of a scalar semantics, and in particular, the introduction of a granularity parameter in event semantics, can be advantageous in the analysis of a number of phenomena. After a review of scalar semantics and the analysis of scalar vagueness by granularity functions, I will briefly describe three issues in event semantics where granularity functions can be expedient: the minimal parts problem of activities, the progressive form of achievements and a pragmatic phenomenon I will call commensurability.

1 Scales and granularity functions

One of the most established analyses of gradable adjectives like *hot* is couched within a scalar approach, wherein a gradable adjective determines a scale and maps entities to degrees on this scale.[1] Thus, *hot* maps entities to the degree of heat they have. Formally, a scale is a linearly ordered set of degrees with a dimension (such as temperature, weight, etc.).

A distinction is made between so called *relative gradable adjectives* (like *large*) and *absolute gradable adjectives* (like *open*), which will be of some importance to us in the discussion of the temporal scale below. In the case of relative gradable adjectives, there is a contextually determined standard of comparison that needs to be reached for the positive form of the adjective to be true of an entity: trivially, for example, a large mouse is smaller than a small elephant. In contrast, in the case of absolute gradable adjectives, this standard is generally either the maximal or the minimal element of the scale (as captured by the "interpretive economy" of Kennedy 2007). This helps in accounting for some entailment differences between

[1]The exact compositional implementation to adopt is of no concern to us at present. Depending on one's analysis, a gradable adjective can be of type $\langle e,d\rangle$ or $\langle d,\langle e,t\rangle\rangle$, where d is the type of degrees. We will also not be concerned with the question of adopting an interval-based or a point-based analysis. Kennedy (2001) and Schwarzchild and Wilkinson (2002), for instance, argue for an interval-based semantics, but I will here assume the more common point-based analysis for simplicity, while noting that nothing hinges on this choice in relation to the issues discussed in this paper.

relative and absolute gradable adjectives, and in particular, that the negated form of an absolute, but not a relative adjective entails the positive form of its opposite (see, e.g., Kennedy 2007).

Introducing scales into the formal machinery is advantageous because a number of their characteristics are useful in accounting for various phenomena. For instance, if the scale has a maximal element, then, as mentioned above, this will by default constitute the standard to be reached, rather than a contextually determined degree. Also, Hay et al. (1999) noted that the telicity of so called degree achievements depends on the boundedness of the scale defined by the base adjective. Finally, Beavers (2008) argued that whether a scale is binary or multi-valued determines if the predicate will function as a gradable predicate or not. I will argue that the granularity level of a scale can play an analogously important role in some phenomena.

Sauerland and Stateva (2007) propose to handle a form of vagueness (what they call scalar vagueness) through granularity functions, which are contextual parameters of interpretation. A granularity function γ maps each point of a scale to an interval containing it, and satisfies the following restrictions (where S is the scale over which the granularity function γ is defined):

(1) a. $\forall s \in S : s \in \gamma(s)$
b. $\forall s \in S : \gamma(s)$ is convex
c. $\forall s, s\prime \in S : \max(\gamma(s)) - \min(\gamma(s)) = \max(\gamma(s\prime)) - \min(\gamma(s\prime))$

(1a) says that the set to which a granularity function γ maps a point has to include the point as element. (1b) states that the range of γ includes convex sets, i.e., intervals. (1c) requires the images of all points by γ to be of the same size (i.e., a granularity function defines a unit on the scale).

In addition, Sauerland and Stateva (2007) define a *finer than* relation over granularity functions, which is a partial order satisfying the following criterion for all scales S and granularity functions: γ is *finer than* $\gamma\prime$ if and only if

(2) $\forall s \in S : \max(\gamma(s)) - \min(\gamma(s)) < \max(\gamma\prime(s)) - \min(\gamma\prime(s))$

In other words, a granularity function γ over scale S is finer than $\gamma\prime$ over S if and only if the size of its units is smaller than the size of the units of $\gamma\prime$.

An example we can find in Sauerland and Stateva (2007) is the following: On the scale of distance, they define three granularity functions, a fine, an average and a coarse granularity, which map the expression *5 meters* to the following intervals:

$\text{gran}_{\text{fine}}(5\text{m}) = [4.95\text{m}, \ldots, 5.05\text{m}]$
$\text{gran}_{\text{mid}}(5\text{m}) = [4.75\text{m}, \ldots, 5.25\text{m}]$
$\text{gran}_{\text{coarse}}(5\text{m}) = [4.5\text{m}, \ldots, 5.5\text{m}]$

As can be seen, the unit of the fine granularity function is the smallest, and the image of a particular point is properly included in the image thereof by the coarser granularity functions. In anticipation of our discussion of the role of granularity in event semantics, let us introduce the concept of a minimal interval:

Definition 27 *We will call the interval size defined by* $\max(\gamma(s)) - \min(\gamma(s))$, *or equivalently,* $|\gamma(s)|$, *the* minimally distinguishable interval *(mdi, for short) by granularity function* γ*, where* s *is an arbitrary point of the scale on which* γ *is defined.*

A final point to be noted in connection with the granularity functions of Sauerland and Stateva (2007) is that apparently, they assume a *finite* set of granularity functions. They thereby cut short the potential problem of higher level vagueness, involving which granularity function(s) to choose, as it is usually not possible to determine how big intervals a scale is structured into in a particular situation. Taking the interpretation of 5 meters, Sauerland and Stateva (2007) assume that the finest granularity divides the scale into 10cm-intervals, while the next finest one into 50cm ones, when obviously, in most scenarios, speakers would not be able to decide whether they assume, for instance, 5cm or 10cm intervals. The number of granularity functions can be increased, but this would not alter the fact that the units of granularity have a precise size, which is rather counterintuitive.

This is thus a serious shortcoming of this analysis of scalar vagueness: it assumes precise minimal units while there is as equal imprecision in this as in the degree to which a gradable property can be said to hold of an entity (say, whether a rod can be said to be 5 meters long). Consequently, this analysis assumes that although some points are not distinguishable at a given granularity (those that map to the same interval by that granularity function), some nearby points belonging to different intervals are. With the granularity parameter set to "mid" in the 5 meter example, for instance, a 4.74m-long rod would not qualify as 5 meters long, while a 4.75m one would. However, another well-known theory of vagueness, that of supervaluations, also suffers from an analogous problem, and apart from introducing continuous distribution into semantic analysis, there appears to be little hope of overcoming this obstacle. I shall therefore adopt the granularity functions of Sauerland and Stateva (2007) and assume a finite set of these, while acknowledging the limitations of this assumption.

2 The temporal scale

Time is straightforwardly a scale, being a set of linearly ordered points. Its scalar aspect is enforced by gradable adjectives and adverbials like *late* and *early*. Time adverbials like *for* α *time* can then be thought of as measure phrases, denoting the intervals of $\alpha\prime$ size.

However, in having *no upper or lower bound*, the time scale is quite special. (Indeed, apart from the mathematical domain, it might be the case that only scales associated with time and space are like this). As noted above, having a minimal or maximal element, as well as having an upper or lower bound are features of a scale that are relevant and have various consequences. For instance, open scales associated with adjectives are always associated with a standard of comparison, while in the case of closed scales, the standard is generally their maximal/minimal element; additionally, Hay et al. (1999) argue that boundedness of a scale associated with an adjective will render its corresponding degree achievement telic.

Although some of the scales associated with adjectives and studied at length in the literature are open, and some of them are unbounded in one direction, none of them is unbounded in *both* directions. There are a number of consequences which follow from this feature of time scale. Firstly, we can explain why it is customary to divide the time scale into *closed subscales*, such as days or years based on different measure phrases measuring out degrees: In absence of a stable reference point, it would be difficult to make sense of the "degrees" of the scale, since they cannot be measured from a zero point.

Second, it is also easy to see that with an unbounded scale, what can be expressed meaningfully is *i)* the size of the intervals denoted by measure phrases (which I here mean to include the temporal extent of events, not just simple measure phrases like *for an hour*), *ii)* the relative positions of degrees on the scale (which is needed for the interpretation of *later than*, as well as *before / after*) and *iii)* distance from a given reference point (corresponding to the "measuring-from-a-reference point" divergent interpretation of adjectives in Kennedy 2001: p. 65).

Accordingly, it is expected that the precedence relation, reference points and the sizes of intervals will play the most important role in phenomena related to the temporal scale. In what follows, however, I would like to inspect, instead, the role that *granularity* plays in the semantics of time and events.

There is of course an obvious way in which granularity plays a role in temporal and event semantics, namely, in the way it does in the case of vague predicates in general. Thus, we can employ the Simplicity of Expressions, Simplicity of Representations principle of Krifka (2007) to temporal expressions, according to which, a conceptually simpler numeric or quantity interpretation tends to have a simpler realization in language than a more complex one, and a simple expression will tend to receive an approximate interpretation, while a complex expression a precise interpretation. This, of course, holds in the temporal domain, as well: an expression like *at six A.M.* is conceptually simpler and displays greater vagueness than an expression like *at 5:58 A.M.*.

As such, temporal expressions such as *at 6 A.M.* exhibit the same scalar vagueness that Sauerland and Stateva (2007) discussed and handled with granularity functions: *Jane arrived at six A.M.* can be true if Jane, in fact, arrived at 5:58. In line with Krifka's observation, the account of scalar vagueness through granularity functions also predicts that an expression like *at 5:58* will be true by default at a smaller interval than an expression like *at six*. The reason for this is that in evaluating a scalar expression, the coarsest granularity is chosen such that it is the shortest (or simplest) expression that denotes the interval to which it is mapped. Since *at 5:58* and *at six A.M.* are mapped to the same intervals by several granularity functions up to one which distinguishes, say, minute-long intervals, the expression *at 5:58* will introduce this latter granularity, and will thus denote an interval of about one or two minutes minutes in length. By contrast, for the same reason, *at six A.M.* can even, under some circumstances, denote an interval of half an hour, ranging from 5:45 to 6:15.

However, the foregoing discussion only shows that the temporal domain is no different in terms of scalar vagueness than any other domain discussed in the literature. I propose, however, that granularity functions can be of more pronounced importance in event semantics, over and above the vagueness exhibited by temporal expressions. It is expected that in the semantics of events, the scale assumed is the temporal scale, although scales relating to space and spatial extension could also play an important role. However, the focus will be on the role granularity plays in certain phenomena, rather than the well-known, strictly scalar characteristics.

3 The role of granularity in the semantics of events

3.1 The question of minimal parts

Activities, one of the four great Vendlerian verbal categories, are traditionally assumed to be *homogeneous* (see, e.g., Dowty 1979; Verkuyl 1989; Rothstein 2004), that is, if a homogeneous predicate is true of an eventuality, then it is also true of its parts. Thus, if *X Ved for* α *time* is true, then *X Ved* is true at all times during that interval. However, it is a long-standing view since Dowty (1979) that activities are homogeneous only to *minimal parts*:

> "Thus a cumulative predicate such as *run*, although intuitively homogeneous, has non-homogeneous minimal parts: there are parts of running events which are just too small to count as events of running."
>
> (Rothstein 2004: p. 11)

In fact, this is held to be a distinguishing point between activities and states, states being homogeneous down to instants, while activities only "down to small parts" (Rothstein 2004: p. 11). It is not a trivial question, as, for instance, the semantics of measure adverbials like *for α time* can depend on this:

> "As different activities may involve minimal subintervals of different sizes to be performed, we need to assume that the universal quantification in the translation of durational *for* is implicitly restricted to subintervals of the appropriate size."
>
> (Zucchi and White 2001: p. 232)

Thus, as mentioned in the quotation by Zucchi and White, *for*-adverbials are normally assumed to involve universal quantification over an interval, but – because of the minimal parts issue of activities – quantification is restricted to a contextually given set of relevant subintervals, as in Dowty (1979); Moltmann (1991).

However, it is worthwhile delving into the question of whether there is indeed enough ground to distinguish states and activities in terms of minimal parts. The main reason activities are assumed to have minimal parts is that it is counterintuitive to think of, say, a running event taking place for a few milliseconds, and there would not be enough evidence in that small stretch of time to establish that the event in fact falls under the predicate run (this is more pronounced in the traditional example of waltzing).

The crucial point, I suggest, is that it would be counterintuitive to assume that a *maximal* event of a few milliseconds in duration could be categorized as a running event, but once there is a maximal running event, all of its parts can be categorized as running events, as well, including instants. Indeed, Rothstein (2004: p. 186) observes that while semelfactives like *jump* have natural atoms, the atoms of activities like *run* have no such clear and straightforward delimitation, and can overlap, in contrast to atoms of semelfactives. Thus, the atoms or minimal parts of activities appear more to be an artefact rather than an ontological necessity. I therefore suggest that the minimal parts criterion only applies to *maximal activities*: to be categorized as falling under an activity predicate *A*, an eventuality has to be of either a minimal length (this length being dependent on the predicate), or has to be a proper part of an activity of type *A*.

On the other hand, it is true to say that when talking about activities, speakers do not normally consider subevents thereof with an extremely small duration. Without sacrificing the above hypothesis that infinitely small parts of an activity can fall under the same predicate, we can account for the intuition of minimal parts with the help of the granularity functions introduced above.

If we assume a granularity parameter of the time scale, we can assume that each event type introduces a default granularity function (akin to expressions like *at six A.M.* discussed above, but in a more complicated and roundabout way), which in turn defines the minimally distinguishable unit of time (the mdi). Parts of an event can then only be at least as long in length as the mdi *at that particular level of granularity*. In this way, the minimal parts problem disappears: an eventuality of a great magnitude will not have as its parts events whose size can be measured in, say, nanoseconds, except in very special cases involving switching to a finer granularity, which is generally indicated explicitly or apparent from the context (this might happen, for instance, in a physics study). Thus, if there is a switch in the granularity parameter, an event will have more or less parts (depending on the direction of the switch: from coarser to finer or vice versa). Importantly, the granularity parameter of Sauerland and Stateva (2007) is essential to enable an eventuality to have a different number of parts under different circumstances. In this way, an activity like *run* would not have parts smaller in length than, say, a second.

The question, however, remains to be settled how exactly an event defines the default granularity function to be assumed in its evaluation. This depends to a great extent on our decision concerning the number of granularity functions associated to a scale. As mentioned above, Sauerland and Stateva (2007) appear to assume (though do not address the issue explicitly) that there is a finite, and even limited number of granularity functions under consideration in each case. Though we have mentioned above the difficulties inherent in such a decision, we will for the present adopt this view, as it simplifies the question of which granularity function a given event introduces by default.[2] We could say that there is granularity function γ_{everyday} which is used in the evaluation of all "normal", "everyday" events like *running into the house*, *pushing the cart*, etc. Coarser or finer granularity functions would be used in scientific scenarios, but essentially, granularity functions under discussion differ by an order of magnitude from each other. We could thus distinguish, among others, the following types of granularity functions which can be introduced by events:

$$\gamma_{\text{microphysics}} < \gamma_{\text{microbiology}} < \gamma_{\text{electronics}} < \gamma_{\text{everyday}} \\ < \gamma_{\text{geography}} < \gamma_{\text{geology}} < \gamma_{\text{astrophysics}}$$

Such levels of granularity have been, in fact, argued to play a role in the semantics of states, as well, by Varasdi (2010), who showed that a given eventuality

[2] If there were a by far greater, not to mention infinite number of granularity functions, this question would be much more complex. We would, for instance, have to give an algorithm which would pair minimally distinguishable intervals with the mean length of eventualities falling under a given predicate, but this would only be a partial and rather rough solution to the problem. For one thing, this would mean that an eventuality would introduce different granularity functions under different descriptions, which is not very intuitive.

might be a state at one granularity, but an activity at another. For our purposes, such a limited number of granularity functions might prove to be too few, and can perhaps entail that eventualities which intuitively differ in this respect have minimal parts of the same size (or more precisely, have a same lower bound on the size of their parts). On the other hand, as we will see below in the discussion of the commensurability principle in section 3.3, the choice of a limited number of granularity functions can actually prove useful in some other respect. For the present, therefore, I will stay with this conception and leave the study and precision of this issue for further research.

3.2 Achievements

There are two main issues related to achievements and punctual events I will discuss. Firstly, I shall examine the two-faced nature of non-durative events, and argue that for a truth-conditional analysis, the interpretation had best make use of the granularity parameter as described in Sauerland and Stateva (2007). Next, I will discuss the progressive form of achievements and propose a semantic analysis based on the notion of a minimally distinguishable interval introduced above.

Achievements and punctual events in general display a two-faced behaviour: they generally appear to be instantaneous, but in some contexts, they do appear to have duration. This point was, for instance, argued by Verkuyl (1989), who went as far as suggesting on this basis that achievements and accomplishments do not, in fact, differ essentially, contrary to what is commonly held. Without taking sides in this question at present, let us inspect this two-faced issue, and consider the following pair of examples from Kearns (1991: p. 60):

(3) a. Just as Mary read the note, the meeting ended.
b. #Just as Mary read the paper, the meeting ended.

Kearns argues that the first part of (3a) appears to describe a momentary event, and not the end of an extended one, as shown by the unacceptability of (3b). She goes on to add that there are no truly durationless events, and this momentariness is “partly a matter of »grain size«”, which is a “problem [. . .] for truth-conditional semantics” (p. 61).

However, if we assume a granularity parameter of interpretation and the notion of a minimally distinguishable interval, the problem can be tackled within truth-conditional semantics: at a suitably fine granularity, achievements have duration (and thus have an internal structure, which – at least in most of the cases – is analogous to that of accomplishments, as argued for by Verkuyl), while at a coarser granularity, their length is smaller than the minimally distinguishable interval, and is consequently mapped to the zero-sized interval, i.e., an instant. The inclusion of a granularity parameter of interpretation and the assumption that the minimally distinguishable interval functions as a dividing line make it possible to tackle the problem of an event being able to have both an extended and an instantaneous temporal trace.

Turning to the progressive form of achievements, we should note that *a)* there is a difference between achievements proper and truly punctual events, in that only the former may (under normal circumstances) appear in the progressive, and that *b)* there is a well-known immediacy component of progressive achievements (see, e.g., Kearns 1991; Rothstein 2004), meaning that a progressive achievement is roughly similar in meaning to a construction with *about to*.

One of the standard ways to analyse achievements in the progressive is to assume some form of coercion (cf., e.g., Moens and Steedman 1988; Rothstein 2004) and say that the progressive coerces the non-durative achievement into an extended activity or an accomplishment. Such analyses, however, have difficulty in accounting for the constraint of immediacy, that is, that a progressive achievement signals that its (potentially unrealised culmination) is close. Moreover, we could also raise the question Rothstein (2004) does, namely, exactly how long before arriving at the station the progressive *Mary is arriving at the station* can be true.

While it might not be possible to give an answer to the latter question, as the location of the point where a progressive achievement becomes true is essentially vague, we can nevertheless make some approximation. The hypothesis I will propose is the following: an achievement that can appear in the progressive (with a meaning component of the culmination being imminent) is the culmination of a greater event, which I will call a *cover event*. The cover event defines a default granularity function to be used in its evaluation, which in turn defines the minimally distinguishable interval (mdi) at that granularity. I suggest that the progressive form of the relevant achievement is true at the final mdi of the cover event. Figure 1 illustrates how the interval at which a progressive achievement like *arrive at the station* is true is determined.

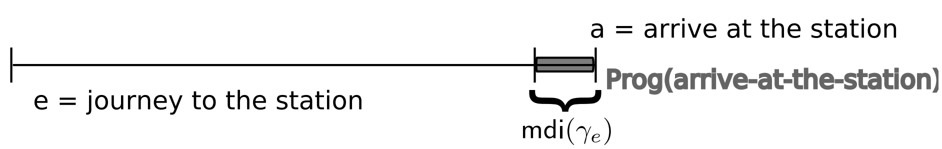

Figure 1: *Illustration of the computation of the interval at which a progressive achievement like* arriving at the station *is true. The cover event is the journey, whose final* mdi *is the interval at which the progressive achievement is true.*

Naturally, the hypothesis in its present form is too strong: it predicts that there is a well-defined point at which a progressive achievement becomes true, while our intuition is that the location of this starting point is underdetermined. There are a number of ways to overcome this problem, which, however, I shall leave for further research. For instance, if we choose to assume a great, perhaps infinite number of granularity functions over a scale, we can adopt and adapt the suggestion of Kennedy (2007) (who aimed to account for the vagueness of gradable adjectives while assuming a precise degree of standard) and say that there is a precise point where a progressive achievement becomes true, but due to epistemic uncertainty about it, judgements of speakers vary in these cases. Another option we could take is to say that the starting point of the relevant interval may be anywhere $\gamma(\mathsf{mdi}(\gamma))$ before the culmination, that is, we could put to use granularity functions for their original purpose, and account for this scalar vagueness thereby.

Barring the too exact characterisation of the interval in question, this analysis of progressive achievements interestingly predicts that the homomorphism between the event and its incremental argument (see Krifka 1998) plays an important role in the computation of the progressive form of achievements. When speakers evaluate a progressive achievement, they are not in the position to determine the culmination point (not to mention the case where the culmination is not, in fact, realised), and thus cannot count backwards from it to determine the interval at which the progressive is true. Thus, they can make use of the incremental argument of the cover event and determine the final mdi based on the change observed in the incremental argument. Accordingly, it is not surprising that an achievement like *die* is much less definite intuitively in the question of when the progressive can be said to become true: there is no incremental argument, save the deterioration of the patient's health we can rely on, but the latter is much less easy to gauge than, say, a distance covered.

A final point to be examined concerns different types of achievements or momentaneous events, which behave differently with respect to the progressive. Although the original Vendlerian category of achievements appears to be homogeneous with respect to the temporal extent of these eventualities, several authors have argued for the need to set apart achievements proper or culminations from punctual events or happenings (see, e.g., Bach 1986; Moens and Steedman 1988; Dini and Bertinetto 1995). One of the several reasons for this is that, as opposed to achievements like *reach*, punctual events such as *recognize* cannot appear in the progressive. With our reference to the final minimal interval of a cover event in the semantics of the progressive of achievements, we are able to explain why truly punctual events fail to appear in this construction. Since they have no preparatory phase (see, e.g., Kearns 1991; Dini and Bertinetto 1995), there is no cover event that they form a final part of, at which point the analysis described above cannot proceed further.

Thus, to summarise, with our granularity-based analysis of the two-faced nature of punctual events and of progressive achievements, we can:

- make it possible for an eventuality to be durationless in one context and durative in another while staying within truth-conditional semantics,
- show how achievements are, indeed, like accomplishments as argued by Verkuyl (1989) (at a fine granularity, at which they are durative, they are structurally like accomplishments), while showing that they differ from accomplishments, as argued by Piñón (1997); Rothstein (2004), among others (at the default granularity, they are instantaneous, and consequently, the semantic analysis of their progressive form differs from that of accomplishments),
- explain why a progressive achievement implies that the culmination (if reached) is imminent,
- capture the difference that achievements and punctual events show with respect to the progressive (punctual events having no cover event, the progressive cannot apply to them).

3.3 Commensurability

Consider the following pairs of sentences:

(4) a. When Susan walked in, Peter left. (Partee 1973)
b. When the Earth cooled, ...

Although Partee's (1973) pronominal account of tense will be able to relate the times of the two clauses in sentence (4a), it cannot explain why speakers will consider this true even if the time of Susan walking in and Peter leaving do not coincide exactly (or do not overlap). There is an amount of time-lag tolerated, the size of which is dependent on the granularity functions generally used with walking-ins and leavings. In (4b), the hearer will assume a much coarser granularity function over the time scale than in the case of (4a), and will tolerate a greater time-lag. This phenomenon can be explained if we assume that this time-lag is subject to the following constraint:[3]

Principle 1 Commensurability of granularity: *During the evaluation of a sentence, do not change the granularity parameter of a scale without explicit indication thereof.*

[3]It remains to be checked how granularity can change in discourse. For the time being, I will concentrate on stand-alone sentences.

Since the first part of the sentence in (4b) introduces a much coarser granularity than the one in (4a), the pause tolerated will also be evaluated at this coarser granularity, and the minimally distinguishable interval (and consequently, the tolerated length of the pause) thereof will thus be much greater.

In the discussion of minimal parts in Section 3.1, we have already argued that events introduce a default granularity function to be used in their evaluation (which can, naturally, be overridden in a specific context). The present analysis shows the advantage of assuming a finite, limited number of granularity functions for a scale: for two events to be commensurable, they only need to introduce the same default granularity. On the other hand, assuming even an infinite number of granularity functions would still make it possible to have a reasonable constraint on commensurability: a relation over the set of granularity functions could be defined to relate granularity functions that are "close" enough to count as commensurable. And, in fact, as we will see, such a relation is necessary in any case, to define commensurability of granularity functions over different scales.

With the requirement on commensurable granularity in place we can also explain the oddity of speaking of events for the interpretation of which generally (very) different granularity functions are used, as shown by the oddity of sentence (5a). This is a general phenomenon, not restricted to the temporal scale, as shown by the humorous nature of the quotation from Douglas Adams in (5b).

(5) a. #Pierre studied geography for two years in Paris, then he moved to New York, graduated from NYU, and then drank a cup of coffee.
b. ☺Space is big. [. . .] I mean, you may think it's a long way down the road to the chemist's, but that's just peanuts to space. (Douglas Adams)

This requirement, moreover, does not even appear to be restricted to granularity functions of a single scale, but seems to apply to granularity functions of *different* scales, as well. Compare the following sentences:

(6) It took me 30 minutes 57 seconds and 2 ms to reach N48.86611 E2.35528.

(7) It took me half an hour to reach N48.86611 E2.35528.

(8) It took me 30 minutes 57 seconds and 2 ms to reach the middle of the field.

(6) is quite well-behaved with respect to the Simplicity of Expressions and Simplicity of Representations account of Krifka (2007): both *30 minutes 57 seconds and 2 ms* and *N48.86611 E2.35528* are complex expressions and are evaluated with respect to a fine granularity. (7), on the other hand, is surprising, because *N48.86611 E2.35528* is evaluated with respect to a coarser granularity than in (6), which essentially forces an *imprecise* interpretation of a *precise* number word. This

can only be due to the coarser granularity function introduced on the temporal scale by the first vague expression in the sentence, which then seems to carry over to the granularity function assumed for the interpretation of the spatial coordinates.

It could be reasonable to suppose that in a sentence, the coarsest (rather than the first) granularity is the one determining the overall granularity, considering that the sentence *I reached N48.86611 E2.35528 in half an hour* receives exactly the same interpretation as (7). However, the picture is slightly more complicated, as the granularity in (8) is determined by the finer-grained expression, rather than *the middle of the field*. Perhaps some expressions, such as *the middle of the field*, are *underspecified* for the granularity function to be used, and do not force a coarse or a fine interpretation, and will only be evaluated at a coarse granularity unless specified otherwise.

The important conclusion to be drawn from the above data is that there appears to be a general requirement that granularity functions within a sentence be commensurate: that is, if we apply a fine/coarse granularity function in one domain (say, in the temporal domain in example (7)), then we should likewise apply a fine/coarse granularity in all other domains (in (7), the spatial domain). For this, we need to define a commensurability relation $\Bumpeq$, which relates all granularity functions (even those defined over different scales) which are of the same magnitude.

Definition 28 Commensurability relation*:* $\Bumpeq\ \subseteq G \times G$*, where G is the set of* all *granularity functions.* $\Bumpeq$ *is reflexive, transitive and symmetric.*[4] *Two granularity functions,* γ_1 *and* γ_2 *are* commensurable *iff* $\gamma_1 \Bumpeq \gamma_2$*.*

How exactly the commensurability of two granularity functions is established remains at present an open question.[5] However, with the help of this relation, we can extend our former principle of commensurability to apply to granularity functions of different scales:

Principle 2 Extended commensurability of granularity: *During the evaluation of a sentence, the granularity parameters of all scales should be commensurable, unless there is explicit indication to the contrary.*

Such a requirement is intuitive and might be cognitively motivated, as these granularity functions play an important role in being able to describe and categorise

[4] Thus, $\Bumpeq$ is an equivalence relation. However, if we decide on assuming a much greater, perhaps even an infinite number of granularity functions over a scale, then $\Bumpeq$ should not be transitive, and would have to be defined instead as a tolerance relation.

[5] One option could perhaps be to employ a case-based approach and gradually learn from attested examples which granularities can co-occur.

the world.[6] Of course, this principle of commensurability of granularity is not exceptionless, and constitutes a more general, but on occasion violable constraint. Thus, this constraint might lend itself readily to a formalisation within the framework of bi-directional optimality theory in the long run (cf. the account of Krifka 2007).

4 Conclusions

In the present article, I argued that the account of scalar vagueness with the help of granularity functions developed in Sauerland and Stateva (2007) on the basis of Krifka (2007) can be adopted in the domain of events to assist the analysis of various phenomena. An important assumption lies behind all of these suggestions, which is that events introduce a default granularity function over the temporal scale which is used in their evaluation. In all of the analyses proposed in this article therefore, it is necessary to have explicit reference to the granularity parameter.

The issue of the minimal parts of activities was discussed and a solution suggested, which involved a new conception of parts: namely, an event can have different parts at different granularities. This, I proposed, could answer to the qualms about the unbounded homogeneity of activities while not requiring activities to have a lower bound on their parts. I also addressed the question of point-like events and achievements, focussing on their two-faced behaviour with respect to durativity and on the problematic issue of achievements in the progressive. I put forth an analysis thereof based on the minimally distinguishable interval at a given granularity. This analysis, I claimed, can address several well-known issues about progressive achievements, such as, notably, their meaning component of the imminency of the culmination. Finally, I argued for a general pragmatic principle of commensurability not restricted to the semantics of events, which constrains the granularity functions used in the evaluation of different expressions in a sentence. I proposed that such a principle can account, among others, for the oddity of some sentences involving expressions "of different magnitude", as well as the fine or coarse interpretations of some expressions. The latter issue uncovered a need to explore how the definitive granularity parameter is in fact established: whether the finest or the first granularity function is to be used, or perhaps some other, more complex algorithm determines the granularity parameter.

During the discussion of these phenomena, I have also drawn attention to some shortcomings of the analysis based on granularity functions. Most importantly, there

[6] Drawing on Wittgenstein's words, "Let us imagine a white surface with irregular black spots. We now say: Whatever kind of picture these make I can always get as near as I like to its description, if I cover the surface with a sufficiently fine square network and now say of every square that it is white or black." (Wittgenstein 1922: 6.341).

are various problems with, as well as advantages of assuming both an infinite, and a finite number of granularity functions for a given scale. For the present purposes, I decided that a finite and even limited number of granularity functions will be appropriate, but all of the analyses in this paper can be adapted to an infinite number of granularity functions.

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