Types of degrees and types of event structures

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In this paper, we investigate how certain types of predicates should be connected with certain types of degree scales, and how this can affect the events they describe. The distribution and interpretation of various degree adverbials will serve us as a guideline in this perspective. They suggest that two main types of degree scales should be distinguished: (i) quantity scales, which are characterized by the semantic equivalence of *Yannig ate the cake partially* and *Yannig ate part of the cake*; quantity scales only appear with verbs possessing an incremental theme (cf. Dowty 1991); (ii) intensity scales, which are characterized by degree modifiers (e.g., *extremely*, *perfectly*) receiving an intensive interpretation; intensity scales typically occur with verbs morphologically related to an adjective (*to dry*). More generally, we capitalize on a typology of degree structures to explain how degrees play a central role with respect to event structure.

1. Introduction

1.1 Objective of the paper

The goal of this paper is to propose a treatment of the degree structures associated with various linguistic expressions, and thus to shed light on some related aspectual phenomena. Although degrees can be ascribed to different types of objects within a linguistic ontology, either concrete (e.g., material objects, events) or abstract (propositions, propositional attitudes, speech acts), we will be mostly concerned with the former here. We will focus on the treatment of degree modifiers such as *completely* (in *Yannig ate a cookie completely* or *The table is completely wooden*), and their relationship with event structure, considering that the nature of the scales over which they range notably determines telicity.

1.2 Main theoretical concepts and issues

So far, gradable adjectives like *long* have been the main topic of interest with respect to a formal theory of scalar structures (cf. Kennedy 1999, 2001, Paradis 1997, Kennedy et al. 1999). Degrees are indeed convenient to account for the meaning of expressions such as *long*, *two meters long, longer than a boat*, *extremely long*, etc.

   Like many other authors, we take degrees to be arguments of gradable predicates (see Kennedy 1999, 2001 for a review of the different technical strategies available). The idea is that an adjective like *long* takes at least two arguments, an argument x for the entity which is said to be long, and an argument d for the degree of length which is attributed to x.

   One of the central issues at stake is whether only certain linguistic expressions have a degree argument (see e.g., Piñón 2000; Kennedy et al. 1999), or if all do (Ballweg and Frosch 1979). We assume that most predicates can receive a degree argument, either for

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inherent lexical reasons, or by virtue of their semantic and/or syntactic context. We take degree arguments to range over a discrete set (e.g., {0,1}) or an interval (e.g., [0,1]). Only certain sets of degrees can give rise to scalar readings (e.g., they can be modified by *completely* if they contain more than two degrees); in contrast, intervals of degrees can always do so.

1.3 Degrees and aspect

For clarity's sake, we will first examine stative and telic predicates[1]. We claim that both types of predicates can possess a degree argument, whose value is made explicit by degree modifiers such as *completely*, cf. for instance *Yannig cooked a chicken completely*.

Introducing degree arguments for verbal predicates will yield in particular a new analysis of telicity. The 'localist' analysis of telicity (cf. Jackendoff 1996, Verkuyl 1993) amounts to treating changes -of-state as changes of location, regardless of the type of telicity involved. Localists treat in this manner the following classes of telic verbs:

1. Verbs with totally affected arguments like *leave*;
2. Directed motion verbs like *drive to Birmingham*;
3. Path-argument verbs like *walk the trail*;
4. Verbs with incrementally affected arguments like *eat*;
5. Verbs expressing gradual changes of state like *cook*.

In our opinion, some of the crucial characteristics of these aspectual classes are obscured by the existing localist proposals, which treat them on a par. We will propose a degree analysis which makes it possible to understand both the unity of these cases of telicity, as well as their specific differences.

On top of telicity, we will also pay attention to the relationship between degrees and atomicity. Atomicity should be understood as in Dowty (1986). That is, atomic telic events are based on a holistic, 'one step' change-of-state, and reject *finish* and *completely*.[2] They involve only two degrees, i.e. a minimal degree and a maximal one, cf. (1). On the contrary, non-atomic telic events are based on a complex change-of-state, possessing intermediary degrees between the minimal and the maximal degree, and combine with *finish* and

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[1] By *predicate* we understand a specific, disambiguated use of a verbal predicate–i.e., within a particular sentence and discourse context –rather than a purely lexical, out-of-context predicate. This term will be contrasted with that of *predication*, which refers to the combination of a predicate and its arguments.

[2] However, proportional degree modifiers (e.g., *completely*) seem to offer more reliable tests for atomicity than *finish* (the 'traditional' test inherited from Vendler 1957). *Finish* does not consistently reject atomic events, even if their development does not admit any intermediary degrees (cf. the acceptable *He finished registering at the University*, although there are only two degrees of registration; Caudal 2000a). Note also that the English (present) perfect progressive is another good test for atomicity, since it rejects atomic telic predications (Caudal 1999, 2000a):
    (i)   #Yannig has been leaving.   (OK if iterative, * otherwise)   (atomic)
    (ii)   Yannig has been eating his pancake.   (non-atomic)

completely, cf. (2). We consider that atomic telic events involve a one-step change-of-state, while remaining capable of forming complex degree structures (i.e., scales) with collection-denoting argument noun phrases, cf. (3).

(1)   #Yannig left completely.[3]   (*finish)   atomic
(2)   Yannig ate his pancake completely.   ([OK]*finish*) non-atomic
(3)   The tourists left completely.   ([OK]*finish*) non-atomic

So, as said above, we assume that both telic and stative predicates can receive a degree argument. In the next section, we will see what the linguistic data tell us about the types of degree scales that are associated with various stative and telic predicates.

2. Degrees and their empirical manifestations

2.1 Some foundational elements for a treatment of scalarity

As observed in Kennedy et al. (1999), degree scales can be closed or open. Intuitively, the range of degrees lexically associated with an adjective like *wealthy* is not bounded (there is no limit to wealth), and therefore forms an open scale. On the contrary, a predicate like *destroy* has a maximal degree. Once a building is completely destroyed, no further destruction of it is possible. The degree scale associated with *destroy* is therefore closed.

These intuitive distinctions are empirically corroborated by certain distributional facts. Thus, adjectives are endowed with closed scalar structures when they combine with adverbs such as *completely*, and reject *very* or *extremely*, cf. (4); conversely, they are endowed with open scales when they exhibit the opposite syntactic behavior, cf. (5).

(4)   a.   The building is completely/*very/*extremely destroyed.   (closed scale)
      b.   The door is completely/*very/*extremely wooden.   (closed scale)
(5)   a.   Yannig is very/extremely/*completely wealthy.   (open scale)
      b.   Yannig is very/extremely/*completely intelligent.   (open scale)

Similar tests can be proposed for verb phrases in general, by replacing *very / extremely* with *a lot*:

(6)   a.   Yannig ate his pancake [OK]completely/*a lot.   (closed scale)
(7)   b.   The gap widened *completely/[OK]a lot.   (open scale)

Besides scale closure, we introduce the notion of *restricted accessibility* (following Caudal 2000a,b, 2002, where it is also called *zoning*). The degree scale associated with some predicates is such that it is not possible to access certain zones on the scale, cf. the excluded low degrees in (8):

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[3]   We use the following conventions. '*' marks unacceptability, and '??' a weaker form of unacceptability. Finally, the sign '#' indicates that the sentence is acceptable but cannot be given the interpretation under consideration.

(8)   ??The bomber slightly destroyed / annihilated the building.

Restricted accessibility should not be confused with the notion of standard degree,[4] that is, with the fact that some gradable predicates have a 'normal', default degree value:

(9)   The glass is full. = The glass is completely full.   (standard degree)
             ≠ The glass is half-full.   (non-standard accessible degree)
(10)   This pull-over is damp. = This pull-over is damp enough.   (standard degree)
             ≠ This pull-over is entirely damp.   (non-standard accessible degree)

2.2 Types of degrees and adjectival predications

Crucially, proportional degree modifiers can receive several types of interpretation. The 'quantity' interpretation (Caudal 2000a,b) is characterized by the inference pattern given in (11)-(12):

(11)   The high wall of the sitting room is half painted.
             → Half the high wall of the sitting room is painted.
(12)   The gatehouse on the High Street is half-wooden.
             → Half the gatehouse on the High Street is wooden.

From *the high wall of the sitting room is half painted* we can deduce that *half the high wall of the sitting room is painted*. Such predicates will be noted [+quantity]. We call 'quantity argument' any theme or patient argument whose reference can be measured by verb phrase adverbials, following the inference pattern exemplified above. The notion is broader than that of incremental theme, which is restricted to [+quantity] changes-of-state.

In contrast, scales of degrees involving an 'intensity' interpretation do not allow for the same kind of inference pattern, as shown in (13)-(14):

(13)   The hostel-guy was half drunk, and served us welcome drinks.
             -/→ Half the hostel-guy was drunk.
(14)   The man was half awake, as if under the effects of some sort of drug.
             -/→ Half the man was awake.

Predicates involving this kind of degrees will be called [+intensity].

2.3 Degrees and VP reference: events

It has been observed for a fairly long time already (see e.g., Kennedy et al. 1999, Caudal 2000a,b) that degree modifiers interact with the internal structure of events. We take such verb phrase modifiers to be event descriptor modifiers. Thus, *completely* and *partially*

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contribute to the internal structure of the event described in (15), whose development is measured or graded by the modifier at stake.

(15)   Yannig ate his pancake completely / partially.   (non-atomic telic event)

As a consequence, certain types of non-stative predications are also incompatible with certain degree modifiers, cf. (16)-(18). Being a closed-scale degree modifier, *completely* rules out dynamic predications which are atelic and deprived of a closed scale, or those which lack a complex degree structure (cf. the dynamic atelic event description in (16) and the atomic telic descriptions in (17)-(18), as opposed to (15)):

(16)   *Yannig walked completely.   (atelic dynamic predication)
(17)   *Yannig ran completely to the store.   (atomic telic predication)
(18)   #Yannig left completely.   (atomic telic predication)

In contrast, modifiers associated with open scales such as *a lot* accept atelic dynamic predications (19), but reject all types of telic predications (20)-(22) (cf. Doetjes 1997):

(19)   Yannig walked a lot.
(20)   #Yannig ran to the store a lot.
(21)   #Yannig left a lot.
(22)   *Yannig ate his pancake a lot.

In short, scale structure and event structure are related: whenever they bear on non-stative predications, degree modifiers can either require them to be telic or to be atelic, depending on whether these modifiers require open or closed scales. Modifiers can therefore be used for purposes of aspectual classification among non-stative predications.

In contrast to the data discussed so far, certain predications do not involve events or objects that can be measured by (at least certain) degree modifiers—i.e., they offer either an inappropriate scale or are not lexically scalar. Whenever degree modifiers bear on such predications, the scalar interpretation they receive does not involve a concrete, lexically-encoded degree scale, but one that is associated with an abstract object of discourse. In sentences such as (23)-(24), the function of *half* is not to measure a lexically encoded variable, but to grade the relevance of a given propositional content to describe a situation:

(23) He **half-ran**, **half-stumbled** down the obsidian corridors of his home, relishing even
       the dim green light that permeated the place.   (web corpus)
(24) Vanessa moaned then and **half-fainted** on the couch.   (web corpus)

Degree modifiers can also grade commitment for speech acts, as the French example in (25) suggests; we leave the study of such cases to future research.

(25) a.   A: _ Elle est superbe !   ('She's superb!')
      b.   B: _ Complètement! / Tout à fait!   ('Completely! /Absolutely!')

3. Degree modifiers and aspect

3.1 Application to (telic) change-of-state predications

As suggested in §2.3, degree modifiers can be used to classify change-of-state predications, and not just stative predications: [+quantity],[−intensity] telic predications are identified in (26), [+quantity], [+intensity] telic predications in (27) and [−quantity], [+intensity] telic predications in (28).

(26) a. ??Yannig ate his pancake perfectly/a lot.   ([−intensity] scale)
     b. Yannig ate his pancake completely/halfway.
         → Yannig ate half his/his entire pancake.   ([+quantity] closed scale)
(27) a. Yannig dried his shirt perfectly/to the perfection.   ([+intensity] closed scale)
     b. Yannig dried his shirt completely/halfway.
         → Yannig dried half his/his entire shirt.   ([+quantity] closed scale)
(28) a. Yannig convinced Mona completely/perfectly.   ([+intensity] closed scale)
     b. Yannig convinced Mona completely/halfway.
         -/→*Yannig convinced one half of / the entire Mona.   ([−quantity] scale)

[−quantity], [−intensity] telic predications can be characterized by the same method: (29)-(30) describe atomic telic events since they involve a non-gradual change-of-state.

(29)   *Yannig completely killed the calf.
         -/→ ??Yannig killed the entire calf.   ([−quantity]   scale)
(30)   Yannig killed the calf #perfectly/*a lot.   ([−intensity]   scale)

A complete classification of telic predications in terms of degree structures emerges from these tests (cf. Table 1). Each type of telicity involves a specific type of degree structure (cf. Table 2), depending on whether it is simple (e.g., the set {0,1}) or complex (e.g. the interval [0,1]), and depending on whether it is [+quantity] or/and [+intensity].

Table 1: Types of telic situations and [+/-quantity]/[+/-intensity] scale

Type of degree structure	Type of telic predication	Examples
[−quantity],[−intensity]	Atomic	*Yannig killed Bill*
[+quantity],[−intensity]	Non-atomic incremental	*Yannig ate an apple*
[+quantity],[+intensity]	Non-atomic incremental & scalar	*Yannig washed the shirt*
[−quantity],[+intensity]	Non-atomic scalar	*Yannig convinced Bill*

Table 2: Scalar structures and types of situations

Type of telicity	Associated degree structure
Class 1: *Yannig left*	Discrete set ({0,1}⊂ℕ)
Class 2: *Yannig drove to Birmingham*	Discrete set ({0,1}⊂ℕ)
Class 3: *Yannig walked the trail*	[+quantity] scale ([0,1]⊂ℝ$^+$)
Class 4: *Yannig ate his pancake*	[+quantity] scale ([0,1]⊂ℝ$^+$)
Class 5: *Yannig cooked the chicken*	[+intensity] scale ([0,1]⊂ℝ$^+$)

Note that contrary to a widespread opinion (cf. Tenny 1994), *X drive to Y* is an atomic telic predication, since it rejects both *finish* and *completely*. Like all atomic telic predications, it is associated with the simplest possible degree structure, i.e., the set {0,1}.

This classification indicates that telicity is sensitive to degree structures; but this is not the only parameter of event structure which is related to scalarity. As already shown in §1.3, [–quantity], [–intensity] telic predications describe atomic telic events, cf. (31a); so there is also a connection between atomicity and degree structure. Furthermore, verbs which are lexically [–quantity] can possess a complex [+quantity] degree structure (i.e., comprising more than two degrees) and describe a non-atomic event when they receive a quantity argument with a mereologically complex denotation, cf. (31b).

(31) a. # This tourist has completely left. ([–quantity],[–intensity])
   b. The tourists have completely left. ([+quantity],[–intensity])

3.2 Event structure and degree structure: telicity, atomicity and scales

The data discussed above show that event structure is related to scalarity through atomicity and telicity, which are respectively related to the complexity and closure of degree structures. The latter fact has already been largely commented on in the literature (cf. e.g., Caudal 2000a, Kennedy et al. 1999): telic predications seem to require a closed scale, i.e., a scale possessing a specified maximal degree.[5] Yet, as we will see below, this is a necessary but not a sufficient property of telic predications: there must also exist a mapping between the degrees of the scale and the internal structure of the event described (indeed, otherwise, stative predications associated with closed scales would also turn out to be telic).

Interestingly, in the case of (at least some) atelic predications, degree adverbials can bear upon an implicit quantity argument, thus rendering the predication telic:

(32) a. Yannig ran (for a long time).
   b. Yannig ran a lot.   (a quantity argument is required by 'a lot')
    (meaning: "Yannig ran a long distance/for a long time")

A lot apparently requires an open scale as its input, and yields a closed one as its output (cf. the telic predication *Yannig ran a lot in (*for) two hours*). Its function is similar to that of temporal modifiers such as *for*, which require an atelic event as their input, and yield one which is temporally bounded.

In addition to this, it seems that implicit quantity arguments are ruled out with atelic predications possessing an overt, strong internal argument, cf. (33), whereas they are licensed with verbs receiving a syntactically weak internal argument, cf. (34):

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[5] Indeed, verbs that can be lexically characterized as [+quantity][–intensity], i.e., verbs with so-called incremental themes, are apparently all telic. Of course this is true *modulo* the impact of noun phrase quantification on aspect, cf. e.g., Krifka (1992, 1998) and Verkuyl (1993, 1999).

(33)   The peasant pushed the cart ??a lot.
(34)   Yannig listened to the radio a lot.

We should therefore carefully distinguish atelic predications without any lexical degree argument (i.e., lacking a degree scale), from those that can receive one (and require one with a degree modifier). Finally, a third class of atelic predications should be isolated, namely those associated with [+intensity] scales (cf. *widen*). We will come back to these issues when we propose a typology of scales.

3.3 Aspectual interest of the notion of restricted accessibility

Besides complexity and closure of degree structures, we take the notion of restricted accessibility (already evoked in §2.1) to determine some interesting aspectual constraints (cf. Caudal 2000a,b). The degree scale associated with certain predicates is such that it is impossible to access certain zones on the scale. When applied to a telic predication, restricted accessibility implies that the change-of-state is restricted to a subpart of the associated degree scale (which grades the event's degree of development). For instance, in the case of *destroy*, the lower end (i.e., the lowest degrees) of the degree scale is not accessible:

(35)   NATO destroyed Belgrade completely / #NATO barely destroyed Belgrade.

Restricted accessibility makes it possible to identify some aspectual phenomena which have gone unnoticed so far. If, in the case of *destroy*, the lowest degrees of the associated scale are inaccessible (e.g., *barely* is out), in the case of *annihilate*, the associated scale is even more restricted: the only possible degree is the maximal degree, although *annihilate* predications are not atomic (cf. *The bomb completely annihilated the building*). So there seems to exist more or less restricted brands of degree structures, the simplest or poorest one being associated with atomic telic predications.[6]

To put it in an aspectual perspective, annihilating-events are almost atomic telic events, insofar as they admit a severely restricted range of degrees, while destroying-events are not so close to atomicity, since they exclude only the lowest degrees (i.e., any degree below *partially*), thus retaining a fairly large range of accessible degrees. And indeed, while *destroy* is fully compatible with the perfect progressive, cf. (36), *annihilate* does not accept it so readily, cf. (37)–a clear sign of its vicinity with verbs capable of describing atomic telic events (since they reject the perfect progressive, cf. note 2).

(36)   Obasanjo's arrogance and his belief that he knows it all, **has been destroying** the
           very basis of our federalism.   (Web corpus)

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[6]   The semantics of *annihilate* suggests that one should not understand restricted accessibility in
      terms of 'gaps' on scales. Indeed, if the scale associated with this verb comprised only degrees 0
      and 1 (with 'gaps' between them), then this would be tantamount to saying that *annihilate* is an
      atomic telic predicate. But it is not one, since it combines with *completely*. Note also that
      annihilate admits an 'almost completed' reading with *almost*, unlike atomic telic predicates.
      Almost precisely selects the 'threshold' of the first or last accessible zone on a scale.

(37)   The Dominion is less organized and more erratic. They'**ve been annihilating** nearby worlds (#this world) and disrupting the entire quadrant.   (Web corpus)

4. Degrees at the syntax/semantics interface

Now that the foundations for a detailed account of scalar structures are laid, we want to propose some elements concerning their role at the syntax/semantics interface, before moving on to a more thorough semantic account.

4.1 Event structure and the syntax/semantics interface: event templates

We interpret telic predicates as changes -of-state, therefore crucially involving states. Thus, *the shirt is dry* should so to speak be embedded within the meaning of *the shirt dried*, and *the cake is eaten* should be embedded within the meaning of *John ate the cake.* To meet these requirements, we assume a compositional syntax/semantics interface in the spirit of Levin and Rappaport's (1999) 'event templates'. We use three types of event templates:

(38) a.   [<State> X] = « "state/property" is attributed to X »
Temp late for states (*The table is wooden, The apple is eaten*)

   b.   [BECOME [<State> X]] = « patient X gradually acquires a property/result state »
Template for degree achievements (*The gap widened)* and for accomplishments described by inaccusative verbs (*The shirt dried*)

   c.   [Y CAUSE [BECOME [<State> X]]] = « Agent Y causes patient X to gradually acquire a property/result state »
Template for accomplishments (*John ate an apple*)

4.2 Assumptions concerning degree structures and event templates

Moreover, we make the following assumptions:

(i)   Some state templates [<Stative> X] are associated with quantity arguments;

(ii) Change-of-state templates introduce a mapping between a scale of degrees and the internal structure of an event variable. We assume that the above *BECOME* predicate is responsible for this, since it expresses a change-of-state, and possibly a gradual one. Starting from a stative predicate (e.g. *to be dry*), *BECOME* constructs a change-of-state predicate (e.g. *to dry*) which measures an event along a degree d.

In section 5 below, we develop further our analysis, in terms of a mapping from degrees to events, as illustrated on Figure 1. It departs substantially from Krifka (1992, 1998), notably because it does not introduce a mapping between objects and events, but also because it assumes a different definition of telicity, as we will see.

Figure 1: Mapping between degrees and events

$$d_1 < d_2 < ... < ... < d_{max}$$
$$e_1 < e_2 < ... < ... < e_{max} = e$$

5. A semantics for degrees, events and objects

Before putting forth a formal treatment of the relationship between event and degree arguments, that is, of the aspectual effects of degree modifiers (cf. §5.3-§5.6), we need to expose (§5.1-§5.2) the properties which degrees, objects and events have in our model.

5.1 Degree structures: an ontology and a typology

We take degrees to be elements of either $\mathbb{N}$, the set of natural integers, or $\mathbb{R}^+$, the set of positive real numbers. We assume that many predicates are associated with a set of degrees–possibly a scale, if that set is sufficiently complex.

When a predicate P is associated with a set of degrees, we note it S_p. S_P is part of the domain of degrees, U_D.[7] We take the minimal element of S_P to be the constant $d_{min} = 0$. S_p is closed if it has a specified maximal element, noted d_{max}; it is said to be open otherwise.

The simplest degree structure is that associated with atomic telic predications like *The tourist has left*: it is reduced to the discrete set $\{0,1\} \subset \mathbb{N}$. This simple structure excludes degree modifiers like *completely* (**The tourist left completely*): indeed, *completely* can apply only if the degree structure associated with the predicate contains an element d different from 0 (the minimal degree) and d_{max} (the maximal degree). However, definite plural arguments can ascribe complex [+quantity] degree structures to atomic telic predications, namely a set $\{0,...d_{max}\} \subset \mathbb{N}$, where d_{max} is the cardinality of the set denoted by the definite plural noun phrase. This makes *completely* acceptable, as in *The tourists left completely* (cf. §1.3 and §3.1).[8]

The degree structure associated with a predicate is often richer than $\{0,1\}$. Many closed scale predications have an associated scale that corresponds to an interval of $\mathbb{R}^+$, of the form $[0, d_{max}]$, with $0 < d_{max}$. This is the case of non-atomic telic predicates (e.g. *cook the chicken*, *eat an apple*), and of some stative predicates associated with a closed scale (e.g., *be wooden*, *cover*).

Interestingly, non-atomic telic predicates combined with definite plural argument noun phrases and proportional degree modifiers can receive two distinct kinds of scales, depending on whether the degree modifier receives a 'narrow scope' or a 'wide scope' interpretation. Thus,

(39)   Yannig partially ate his thirty pancakes

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[7] U_D inherits from $\mathbb{N}$ or $\mathbb{R}^+$ the order relations $<$ and $\leq$, as well as addition and multiplication.
[8]   Weak indefinites do not license similar readings, cf. ??(*Thirty*) *tourists have completely left.*

can receive two distinct interpretations: one for which the scale is $[0,1] \subset \mathbb{R}^+$ (this is the 'narrow scope' reading of *partially*, which bears on each individual pancake: Yannig partially ate each pancake), and one for which the scale is $\{0,...,30\} \subset \mathbb{N}$ (this is the 'wide scope' reading; *partially* bears on the whole collection; e.g., Yannig ate twenty pancakes).

This, however, does not happen when the argument position at stake is filled by a bare plural noun phrase. Thus, (40) can only mean that Yannig ate completely each individual apple, not that he ate an entire set of apples. Likewise, in (41), *completely* can only be interpreted with respect to individual fields—i.e., it only has a 'narrow scope' reading.

(40)   #Yannig ate apples completely.
(41)   #A thick blanket of snow completely covered fields as far as one could see.

This is due to the fact bare noun phrases do not possess any fixed quantificational information (i.e., they do not have a fixed cardinality; cf. Verkuyl 1993).[9] Therefore, no maximal degree is specified for the quantity argument, thus blocking proportional degree modifiers.

But the most delicate part of this lexical semantic typology of scales concerns activity predicates (i.e., predicates describing dynamic, atelic events even without bare noun phrase arguments). These predicates fall into at least three broad classes with respect to scalarity:

  i)   Intransitive activity verbs capable of receiving an implicit patient/theme argument; when associated with an open [+quantity] scale, the addition of *a lot* renders the scale closed (cf. §3.2):

(42)   The German tourist ate. (open [+quantity] scale on $\mathbb{R}^+$: no fixed maximal degree) [meaning 'ate some edible substance']

(43)   The German tourist ate a lot.   (closed scale: $[0, d_{max}] \subset \mathbb{R}^+$)

(44)   A: Are you coming? We're going to the cafeteria!
            B: No thanks, ??I've completely eaten.   (closed scale: $\{0,1\} \subset \mathbb{N}$)

 ii)   Transitive activity verbs receiving a syntactically weak internal argument; we take such atelic, dynamic predicates to be lexically deprived of degree structure:[10]

(45)   *The peasant pushed this cart completely.   (no lexical degree argument)
(46)   *The peasant dragged this cart completely.   (no lexical degree argument)

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[9]   In fact, the correct generalization should extend to semantically weak noun phrases in general, whose quantificational information seems to remain inaccessible to proportional degree modifiers, cf. the absence of 'wide scope' reading for *completely* in #*Yannig ate thirty apples completely.*
[10] They can only become scalar by means of some meaning-shift operation; cf. *half-ran* in (23).

iii)   Open [+intensity] activity predicates ('degree achievement' verbs, cf. Kennedy et al. 1999); they receive scales lacking a fixed maximal degree, cf. (47)-(48):

(47)   The gap widened for two days / #in two days.   (open [+intensity] scale on $\mathbb{R}^+$)

(48)   *The gap widened completely.

As argued for instance in Kennedy and Mc Nally (2002), the latter kind of predicates do not have a terminus; they describe an open-ended change-of-state. And they are atelic because their scales lack a specified maximal degree that would correspond to the endpoint of that change-of-state.

It appears then that degree structures are not a purely lexical category, but are construed at the sentence level, on the basis of lexical information combined with syntactic and semantic information. The corresponding procedure can be summarized as follows:

(i)   Lexical semantics determines what kind of scale is available (or not) for a given interpretation of a predicate (e.g., whether it is [+/–quantity] or [+/–intensity], whether it is *a priori* open or closed, whether it has a standard value and restricted accessible zones, etc.).

(ii)   The syntax/semantics interface interacts with this information; e.g., degree modifiers and determiners can restructure or introduce[11] scales (for instance, *a lot* can turn an open scale into a closed one, or enforce the presence of an implicit quantity argument; similarly, collective argument noun phrases can introduce a complex [+quantity] scale).

(iii) Semantics provides additional information about the structure of the available scale(s) (for instance, the value of d_{max}), by means of certain axioms (e.g., QUANTITY in (56)).

(iv)   The value of the degree d is constrained or specified by combining the semantics of degree modifiers (if any) with the scale thus construed.

5.2 Part structures for objects and events

Degrees are not the only entities in our ontology. We assume for instance that it also comprises material objects and events. They are modeled using part-structures, in the spirit of Simons (1987) and Krifka (1992, 1998). The crucial fact for us is that there is a part relationship among objects, and a part relationship among events.

A part structure $P = \langle U_P, <_P, \leq_P, \otimes_P, \oplus_P \rangle$ is defined over a domain of entities, U_P. The relation of mereological part, $<_P$, is taken as primitive. The relations of improper mereological part, overlap and sum are then defined:

(49)   Definitions:

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[11] We do not propose here any semantic mechanism capable of adding a degree argument to a predicate that would initially not possess one, but see Piñón (2000) for an instance of such a mechanism.

a. *y* is an improper mereological part of *x* ('y $\leq_P$ x') if *y* is identical to *x* or if *y* is a mereological part of *x*:

$\forall x \, \forall y \, [\, y \leq_P x \leftrightarrow \, [\, [y = x] \vee y <_P x \,] \,] \,]$

b. *y* and *x* overlap ('y $\otimes_P$ x') if they have a common improper mereological part *z*:

$\forall x \, \forall y \, [x \otimes_P y \leftrightarrow \exists z \, [\, z \leq_P y \wedge z \leq_P x \,] \,]$

c. x $\oplus_P$ y, the mereological sum of *x* and *y*, is the individual *s* such that for any individual *z*, *s* and *z* overlap if and only if *z* and *x* overlap or *z* and *y* overlap:

$\forall x \, \forall y \, \forall s \, [s = x \oplus_P y \, \leftrightarrow \forall z \, [\, z \otimes_P s \leftrightarrow [z \otimes_P x \, \vee \, z \otimes_P y \,] \,] \,]$

These relations are then characterized by four axioms (cf. Simons 1987):

(50) Axioms:

a. $\forall x \, \forall y \, [y <_P x \rightarrow \neg x <_P y \,]$ Asymmetry

b. $\forall x \, \forall y \, \forall z \, [z <_P y \wedge y <_P x \rightarrow z <_P x]$ Transitivity

c. $\forall x \, \forall y \, [y <_P x \rightarrow \exists z \, [z <_P x \wedge \neg z \otimes_P y] \,]$ Weak complementation

d. $\forall x \, \forall y \, [\, \exists!z \, [z = x \oplus_P y] \,]$ Existence and uniqueness of mereological sums

Besides the domain of degrees U_D, our model comprises three other domains of entities, namely U_O, the domain of objects, U_E the domain of events, U_T the domain of times. Each of these domains is associated with a part-structure of the type defined above. We have notably $<_E, \leq_E, \otimes_E$, and $\oplus_E$ for events, and $<_O, \leq_O, \otimes_O$, and $\oplus_O$ for objects.[12]

Now that the technical foundations of our theory are laid, let us now move to the treatment of the interaction of degrees, objects and events.

5.3 The semantics of proportional degree modifiers

Proportional degree modifiers like *partially*, *halfway* and *completely* can combine with a gradable predicate *P* only if the scale associated with *P* is closed and if it is not reduced to just two elements, 0 and d_{max}. These degree modifiers then constrain or specify the value of the degree argument as indicated in (51).

(51) a. *partially*, *completely* and *half(way)* can apply only if the scale is not reduced to $\{0, d_{max}\}$; then:

b. *partially* specifies that the value of the degree argument of P is a degree d such that $0 < d < d_{max}$

c. *completely* specifies that the value of the degree argument of P is d_{max}

d. *halfway* specifies that the value of the degree argument of P is $d_{max}/2$

We characterize [+quantity] verbs, and then changes-of-state (telic change-of-state verbs, in fact) in the following section.

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[12] Throughout the paper, we use *d, d'…* to denote degrees, and *e, e'…* to denote events or states. Likewise, *x, x', y, y'…* generally denote objects, except in this section, §5.2, where they are used in a universal fashion.

5.4 The semantics for [+quantity] verbs

In what follows, we use a Parsons-style 'subatomic' semantics (cf. Parsons 1990) in order to represent the semantics of complex sentences. We assume the following kind of neo-davidsonian decomposition for [+quantity] stative predications, such as *The snow covered the field*:

(52) $\exists x \exists y \exists e \exists d$ [Verbal-Predicate(d,e)$\wedge$Quantity(d,y)$\wedge$Role-1(x,e)$\wedge$Role-2(y,e)$\wedge$
       Semantic-Type-1(x)$\wedge$ Semantic-Type-2(y)] [13]

Verbal-Predicate(d,e) stands for a stative verbal predicate describing a state *e* with degree *d*. *Role-1(x,e)* and *Role-2(y,e)* are classic semantic roles, such as agent and patient (of course, if the predication is intransitive, rather than transitive, only one role will be present in the decomposition). *Semantic-Type-1/2(x/y)* represents the semantic contributions of the verbal predicate's arguments, for instance, *The_snow(x)* if the agent denoting noun phrase is *The snow*. *Quantity(d,y)* is a semantic role indicating that argument *y* offers a [+quantity] scale: it maps the reference of argument *y* onto the degree *d* associated with the overall formula at stake (see rule (56) below). Finally, since it is irrelevant here, information about tense is ignored. To illustrate the above analysis, the sentence *The snow covered the field* is represented as follows:

(53) $\exists x \exists y \exists e \exists d$ [Cover(d,e)$\wedge$Quantity(d,y)$\wedge$Agent(x,e)$\wedge$Patient(y,e)$\wedge$The_snow(x)$\wedge$
       The_field(y)]

For telic [+quantity] transitive predications such as *John ate an apple*, we assume in (55) a richer decomposition: on top of the ingredients already present in (52), the verbal predicate *Verbal-Predicate(d,e)* must satisfy a second-order predicate *Become*, which maps degrees onto parts of the event described, and vice versa (cf. §5.6 below). In addition, the *e* variable now denotes a telic event (instead of a state).

(54) $\exists x \exists y \exists e \exists d$ [Verbal-Predicate(d,e)$\wedge$Become(Verbal-Predicate)$\wedge$Quantity(d,y)$\wedge$
       Agent(e,x)$\wedge$Patient(e,y)$\wedge$Semantic-Type-1(x)$\wedge$ Semantic-Type-2(y)]

Thus, the sentence *John ate an apple* is represented as:

(55) $\exists x \exists y \exists e \exists d$ [eat(d,e)$\wedge$Become(eat)$\wedge$Quantity(d,y)$\wedge$Agent(e,x)$\wedge$Patient(e,y)$\wedge$
       John(x)$\wedge$ an_apple(y)]

Note that in this case, patient argument *y* acts as a 'event delimiting argument' (in the sense of Tenny 1994) with respect to the verbal predicate.

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[13]   This decomposition is related to Parsons' (1990) decomposition of the semantics of transitive verbs, i.e., *Verbal-Predicate(e)ÙTheta-role-1(x)ÙTheta-role-2(y) ÙSemantic-Type-1(x)ÙSemantic-Type-2(y)*. However, Parsons' verbal predicate does not receive any degree argument *d* on top of an event argument *e*, unlike in the present account. We do not give here the complete set of compositional rules making it possible to derive such formulas, because they are rather trivial; but see e.g., Krifka (1992:36 sqq.) for such rules.

The following axiom then characterizes [+quantity], stative and telic predicates. It establishes a morphism from degrees to quantities.[14] The axiom concerns only predicates that have an associated degree scale, with a specified maximal degree, and degrees intermediary between 0 and d_{max}.

(56)   QUANTITY:

$$\forall d \, \forall y \, [\, Quantity(d,y) \wedge 0 < d \leq d_{max}$$
$$\rightarrow \exists! \, y° \, [\, [y° = Max \, [\, y' \mid y' \leq_O y \wedge Quantity(d_{max}, y') \,] \,] \wedge d \, / \, d_{max} = Prop \, (y°, y)]$$

The left part of the axiom's consequent says that if the degree associated with the quantity role *Quantity(d, y)* is between 0 and d_{max}, then there is a unique, greatest part $y°$ of y such that *Quantity(d_{max}, y°)* (*Max* acting as a maximizing function).[15] Thus, if an apple is half eaten, then there is a unique, greatest part of the apple that is completely eaten. Likewise, if a table is half wooden, then there is a unique, greatest part of the table that is completely wooden.

The right part of the axiom's consequent, *d / d_{max} = Prop (y°, y)*, means that $y°$ is in the same proportion to y as d is in proportion to d_{max}. Thus, if an apple is half eaten, then half the apple is eaten.

It is worth mentioning that the above axiom is trivially valid for atomic predicates, insofar as they are associated with a scale reduced to {0,1}. In that case, we have $d = d_{max}$ and $y° = y$ in (56) – atomic predicates apply to entities 'as a whole'. It is clear that this holistic and binary nature of atomic predicates explains why they are incompatible with intermediary degree adverbials. But somewhat surprisingly, even 'maximal degree' adverbs such as *completely* or *entirely* are incompatible with atomic predicates (cf. (31a) and (51). We believe that these adverb *imply* the existence of intermediary degrees between 0 and d_{max}=1. Indeed, degree adverbs seem to involve an implicational scale (in the sense of scalar implicatures) – maximal degree adverbials somehow imply lesser degree adverbials; having completely eaten an apple implies having partially eaten an apple. In other words, the validity of a certain proposition associated with the maximal degree d_{max} implies the validity of similar propositions associated with lesser, intermediary degrees – i.e., less informative propositions. But of course, such implications are ruled out in the case of atomic predicates, and therefore, these predicates reject maximal degree adverbs.

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[14] Naumann (1996) noted that Krifka's (1992) homomorphisms between objects and events need not apply directly to the denotation of some patient noun phrase, but rather to some facet of its denotation–cf. *peel the apple*, which does not involve the whole apple but merely its skin. In (56), y is therefore built from the relevant facet or dimension of the quantity argument at stake.

[15] For the sake of simplicity, we ignore issues related to so-called event and object uniqueness. Indeed, Krifka (1998) uses homomorphisms like the following, where $\boldsymbol{q_O}$ shows 'uniqueness of objects', and $\boldsymbol{q_E}$ shows 'uniqueness of events':

$\forall y \, \forall e \, [\, \theta_O(y,e) \wedge e' \leq_E e \rightarrow \exists! y' \, [y' \leq_O y \wedge \theta_O(y',e')] \,]$

$\forall y \, \forall e \, [\, \theta_E(y,e) \wedge y' \leq_O y \rightarrow \exists! e' \, [e' \leq_E e \wedge \theta_E(y',e')] \,]$

These notions are relevant to the treatment of predications such as *read the novel*, where several parts of the same novel can be read several times in a telic reading event.

It should also be noted that the notion of atomicity is a lexical semantic issue, by and large; it amounts to the possibility or impossibility of a distributive/incremental reading of the verb with respect to a certain argument noun phrase. Thus, *rent the car* is atomic, while *paint the car* is not. This is reflected in the content of the *Semantic-Type-1/2* predicates in e.g., (52)-(54): *rent* requires an object of e.g., the *vehicle* type, whereas *paint* requires its object to be of the *material_surface* type. Only in the latter case is the predicate non-atomic. See Caudal (1999) for a detailed discussion of these phenomena and a treatment within a formal lexical semantic framework.

Finally, we should stress that the part-of relation on objects is to be applied differently when the quantity argument is a definite plural. In that case, indeed, it can be understood in a manner similar to Link's (1998) *i-part* operator ('individual-part'), which returns a subset of a collection of individual entities. This reading arises if the degree expression involved has 'wide scope', i.e., if *Yannig ate his pancakes partially* means that Yannig ate part of the set of pancakes, and not that he ate part of each pancake—this would be the 'narrow scope' reading of the degree expression. In the latter case, the part-of relation on objects is to be understood as Link's (1998) *q-part* operator ('quantity of matter-part'), which returns a subpart of an individual entity. This also accounts for examples such as *The tourists left partially*: the agent noun phrase acts as a quantity argument, with an associated scale $\{0..d_{max}\}\subset\mathbb{N}$, d_{max} being the cardinality of the set of tourists.

5.5 Changes-of-state

We see changes-of-state as events developing along a degree scale. Non-atomic telic events are endowed with complex changes-of-state: they go through different intermediary degrees of development. On the contrary, atomic telic events are endowed with simple changes-of-states, reduced to two degrees: 0 and 1. We capture the notion of change-of-state in axiom (57), which makes sure that if a verbal predicate *P* describes an event *e* with degree *d*, every initial part *e'* of *e* is associated with a unique lesser degree *d'* (cf. (57a)), and vice versa (cf. (57b)). A part is said to be initial if it satisfies the *INI* predicate, cf. (58):[16]

(57)   BECOME :
        $\forall P \; [\, \text{Become}\,(P) \leftrightarrow \text{MAP-ED}(P) \wedge \text{MAP-DE}(P)\,]$
        a. $\forall P \; [\text{MAP-ED}(P) \leftrightarrow$
                $\forall e \; \forall e' \; \forall d \; [\, P(d,e) \wedge \text{INI}(e',e) \wedge 0 < d \rightarrow \exists !d' \; [0 < d' \leq d \wedge P(d',e')]]]$
        b. $\forall P \; [\text{MAP-DE}(P) \leftrightarrow$
                $\forall e \; \forall d \; \forall d' \; [\, P(d,e) \wedge 0 < d' \leq d \rightarrow \exists !e' \; [\text{INI}(e',e) \wedge P(d',e')]]]$

(58) $\forall e \; \forall e' \; [\, \text{INI}(e',e) \leftrightarrow e' \leq_E e \wedge \neg \exists e'' [e'' <_E e \wedge e'' \ll e'\,]\,]$

Note that the relation « expresses strict temporal precedence; *e'' « e'* is true if the temporal trace of *e''* strictly precedes that of *e'* (a fact which implies $\neg e'' \otimes_E e'$).

This definition guarantees that the order on degrees matches the temporal ordering of the initial subparts of a change-of-state event e. It also implies that:

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[16] We do not pay attention here to event connectedness–see Piñón (2000) for details about that issue.

(59)   a. $\forall P$ [Become (P) $\rightarrow$ [P(d,e) $\wedge$ P(d',e) $\wedge$ 0<d $\rightarrow$ d'=d]]
        b. $\forall P$ [Become (P) $\rightarrow$ [P(d,e) $\wedge$ P(d,e') $\wedge$ 0<d $\rightarrow$ e'=e]]

The proof is basically the same for (59a) and (59b), so we'll restrict ourselves to (59b). Suppose $P(d,e) \wedge P(d,e')$. Then, given $P(d,e) \wedge 0<d\leq d$, we can apply (57b) and deduce that $\exists!e'$ [$INI(e',e) \wedge P(d,e')$]. But e satisfies this very same clause, since it is true that $INI(e,e) \wedge P(d,e)$. This implies that $e'=e$.

   To illustrate how axiom (57) functions, let us consider the treatment of (60), assuming decomposition (61).

(60)   Yannig cooked the chicken.
(61) $\exists x \exists y \exists e \exists d$ [cook(d,e)$\wedge$Become(cook)$\wedge$Agent(e,x)$\wedge$Patient(e,y)$\wedge$Yannig(x)$\wedge$
       the_chicken(y)]

Become(*cook*) says that there is a strict mapping between degrees and initial parts of the event e described. As the event unfolds and mereologically 'grows', the corresponding degree steadily increases. In addition, lexical information indicates that *cook* has an associated [+intensity] closed scale, $[0,1]\subset\mathbb{R}^+$, and that, by default, the degree in (61) is $d = d_{max} = 1$.[17]

5.6 Event structures, degree scales and telicity

As noted in §2.3 and §3.2, the tests for identifying degree structures apply straightforwardly to telic predications. Proportional degree modifiers reject atomic telic predications, cf. (62)-(63), whereas they combine felicitously with non-atomic telic predications, cf. (64)-(66):

(62)   #Yannig half/completely left.   (Class 1)
(63)   #Yannig half/completely ran into the kitchen.   (Class 2)
(64)   Yannig walked the trail halfway/completely.   (Class 3)
(65)   Yannig ate his pancake halfway/completely.   (Class 4)
(66)   Yannig deep-froze the chicken halfway/completely.   (Class 5)

These observations indicate that there is a strong relationship between degree structures, telicity, and modes of change-of-state (cf. Caudal 2000a, Kennedy and Levin 2000). We express it through the following characterization of telicity:

(67)   TELICITY: A predication is telic if and only if (i) it has an associated set of degrees, with (ii) a specified maximal degree, and (iii) its verbal predicate satisfies axiom BECOME (57), i.e., it describes a change-of-state.

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[17] Note that no Quantity role appears in (61); this corresponds to the fact that *cook* does not have any quantity argument under this interpretation.

This characterization captures in a new way the notion of a 'set terminal point', generally seen as defining of telicity since Vendler (1967):[18] the set terminal point of an event described by a telic predication is reached when the specified maximal degree is reached too; then the event cannot develop any further. Indeed, (67) implies (68):

(68)   A telic predication (noted by means of a predicate *P*) cannot describe an event *e'* which would include an event *e* associated with the specified maximal degree:
$$\forall e\, [\, P(d_{max}, e) \rightarrow \neg\, [\exists d' \exists e'\, [P(d', e') \wedge INI(e, e') \wedge e <_E e']\,]\,]\,]$$

Proof : let us assume that such an event *e'* exists. There are two possibilities:

(i) $d' = d_{max}$; in that case, applying (59b), we can deduce that *e'=e*, in contradiction with the hypothesis that $e <_E e'$;

(ii) $d' < d_{max}$; then, given $P(d', e') \wedge INI(e, e')$, we can apply (57a) and deduce that there exists a unique degree *d"* such that $0 < d" \leq d'$ (hence $d" < d_{max}$) and $P(d", e)$, in contradiction with the initial assumption that $P(d_{max}, e)$, since (59a) makes it clear that a predicate applies to an event to a unique degree.

This characterization applies, for instance, to a telic predication like *Yannig dried the shirt*: there cannot exist two (distinct) telic events *e* and *e'* of drying the same shirt, such that *INI(e, e')*.

Now, there is also an atelic reading of *dry*, for which it could be true that the shirt becomes dry before the event ends (cf. *Yannig dried the shirt for a whole day, although it was already dry after only two hours*). How are we to treat it? If we considered the scale of the atelic *dry* to be open, then we would loose the insight that there is a maximal degree of dryness. Let us therefore assume that, under such a reading, the scale associated with *dry* is closed. However, by hypothesis, the drying events described can keep on developing beyond whatever subevent is associated with the maximal degree of dryness: there are at least two drying events *e* and *e'* such that *INI(e', e)*, $P(e, d_{max})$ and $P(e', d_{max})$. Thus, given (67), the predicate is not telic.

In addition to *dry*, *cook* and *bake* also admit telic and atelic readings with the same set of participants, in so far as the degree of 'cookedness'/'bakedness' of some edible thing can exceed its 'normal' maximal degree—in which case it is too cooked/baked; it becomes, e.g., burnt. Under this 'too much' reading, *cook* and *bake* are atelic (cf. *Yannig cooked the chicken for three hours, and he burnt it*). These are cases in which a normally closed scale becomes

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[18] Krifka (1992, 1998) argues that telicity obtains, notably, through the conjunction of what he calls 'mapping to objects' (an homomorphism between objects and events) and quantization of the (patient) object predicate. He defines quantization as follows: a predicate is quantized if, when it applies to objects *x* and *x'*, *x'* cannot be a part of *x*. Now, telicity being a weaker property than quantization, every quantized predicate is also telic (cf. Krifka 1992: 36). In our case, quantization cannot be directly invoked because we do not map events onto objects. Moreover, following certain authors that have raised objections against quantization (e.g., Verkuyl 1993, Naumann 1996), we do not believe that telicity should be expressed in such terms.

open. They could be handled either by postulating two different scales for *cook / bake*, or by creating a special subtype of optionally closed scales.

6. Comparison with some existing approaches

Before concluding, we would like to compare our approach with other theories, i.e., that of Kennedy *et alii* on the one hand, and that of Krifka and Verkuyl on the other hand.

6.1 Comparison with Kennedy et al. (1999)

Our work differs from Kennedy et al. (1999) in two main respects. First, we do not use negative degrees. We believe that antonymy is not lexically, but contextually determined; in our view, introducing negative degrees is thus going one step too far in the lexical semantics of degree modifiers. For instance, *cold* can be either opposed to *warm* or *hot*, depending on whether we are talking about people or substances, and, crucially, these adjectives do not possess identical scalar properties. (Another, related difference is that Kennedy *et al.* model degrees as intervals, whereas we identify them with numbers.)

Second, we have introduced the notion of restricted accessibility, which does not have any equivalent in Kennedy et al. (1999). The degree scale associated with some predications is such that it is impossible to access any arbitrary zone on the scale. For instance, **Yannig slightly destroyed the chair* is out: the low degree specified by *slightly* is inaccessible on the scale associated with *destroy*.

6.2 Comparison with Krifka (1992, 1998) and Verkuyl (1993, 1999)

The present account differs from Krifka's and Verkuyl's in the following respects.

First, it does not characterize telicity in terms of a relationship between events and objects, but in terms of a relationship between events and degrees and the notion of scale closure. It is neither a purely mereological approach (like Krifka's) nor a purely quantificational one (like Verkuyl's). This makes it possible to avoid some of the shortcomings inherent to a definition of telicity in terms of quantization, by resorting to quantificational mechanisms, while retaining some of the insights of a mereological approach.

Second, our degree-based approach is capable of capturing a number of (dis)similarities between classes of verbs, which have been overlooked in Krifka's and Verkuyl's works:

- A partial analogy exists between [+quantity] stative verbs and [+quantity] telic verbs: while both satisfy axiom QUANTITY (56), only the latter involve a change-of-state mapping between degrees and events (i.e. satisfy *Become* (57));

- A partial analogy exists between [+intensity] stative verbs and [+intensity] telic or activity verbs: while they all fail to satisfy axiom QUANTITY, only the latter involve the *Become* change-of-state mapping between degrees and events;

- All types of stative verbs are analogous, insofar as they lack the *Become* change-of-state mapping between degrees and events;

- All types of change-of-state verbs ([+intensity] activity verbs / telic verbs) are analogous, insofar as they involve the *Become* mapping between degrees and events.

Table 3 gives a synthetic overview of these results.

Table 3: Aspectual classes of verbs and mappings

	Example	Quantity	Become
[+quantity] stative predications	*The table was completely wooden.*	+	–
[+intensity] stative predications	*The shirt was completely dry.*	–	–
[+intensity] activity predications	*The gap widened.*	–	+
[–quantity],[–intensity] activity predications	*The peasants pushed the cart.*	–	–
[–quantity],[–intensity] atomic telic predications	*Yannig left.*	–	+
[+quantity] telic predications	*Yannig his pancake partially.*	+	+
[+intensity] telic predications	*The shirt dried completely.*	–	+

7. Conclusion

In this paper, we have proposed a treatment of adverbial modification by degree expressions like *halfway* and *completely*. In order to do so, we have introduced a degree argument within the semantics of many verbal predicates, including stative predicates.

We have shown that the scales underlying telic and atelic change-of-state predicates are strongly correlated with their aspectual properties, and we have put forward a conception of (a)telicity and event structure which is broader than the one assumed in most existing formal theories of aspect.

We have defined telicity by conjoining a mapping between degrees and events (expressed by the *Become* predicate) with a theory of degree structures. Our conception of telicity extends to cases such as *cook the chicken* or *dry the shirt*, without resorting to any special 'path-argument'.[19] The addition of a quantity argument with verbs such as *eat* causes the same scale to be mapped onto the mereological and quantificational structure of an argument noun phrase, thus capturing Dowty's (1991) notion of incremental theme.[20]

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[19] Unlike Krifka (1998), and 'localist' approaches generally (e.g., Tenny 1994), which assume that [+intensity] telic verbs are associated with a special path argument corresponding to the different degrees of cookedness involved in the cooking event, and playing a role similar to that of so-called incremental theme arguments.

[20] As it stands, the present account is unable to address cases where more than one argument noun phrase have an impact on aspect calculus, e.g., when the agent and the patient simultaneously act as [+quantity] arguments. It thus seems to fall under some of the criticisms addressed by Verkuyl (1999:47) to Krifka (1992). However, we believe that predications always possess at most one [+quantity] argument, but that this argument needs not be a patient or a theme argument.

Indeed, following Caudal (1999), we have identified [+quantity] predicates as predicates relating a degree scale with the mereological and quantificational structure of some specific noun phrase argument (which we call a quantity argument). This has revealed deep analogies between various types of stative and telic predicates.

Concerning scale structures, we have noted that degree modifiers act as scale modifiers. We have hypothesized in §3.2 that *a lot* affects the scale associated with certain intransitive verbs, cf. (32b) *Yannig ran a lot:* these modifiers transform an initially open scale into a closed one. Similarly, adding certain degree modifiers to an open scale, atelic predicate turns it into a telic predicate, with a specified maximal degree, cf. (69)-(70):

(69)   *The gap widened in two weeks.   (atelic; open scale)
(70)   The gap widened considerably in two weeks.   (telic; closed scale)

From a more general point of view, our proposal bridges the gap between quantificational approaches to aspect such as Verkuyl's and mereological approaches such as Krifka's, leaving room for both types of mechanisms in the realm of aspect calculus.

7. References

Ballweg, Joachim, Helmut Frosch (1979): „Comparison and Gradual Change." – In: R.Baüerle et al. (eds.), *Semantics from different points of view*, Springer, Berlin, 75–89.

Caudal, Patrick. (2000a): *La polysémie aspectuelle – contraste français/anglais*. – PhD thesis, University of Paris 7.

–   (2000b): „Types of telicity, types of paths and types of changes of state." – Paper presented at the *Path and Event Structure* Workshop, ESSLI'2000, Birmingham.

–   (2002): „Degree Scales and Aspect." – Paper presented at *Chronos'5*, Groningen, the Netherlands. To appear in *Cahiers Chronos*, Rodopi, Amsterdam/Paris/New York.

–   (1999), „Computational lexical semantics, incrementality and the so-called punctuality of events", – In: *Proceedings of ACL'99*, University of Maryland, MD, 497-504.

Doetjes, Jenny (1997): *Quantifiers and selection* – PhD thesis, Rijkuniversiteit Leiden.

Dowty, David (1979): *Word Meaning and Montague Grammar.* – Kluwer, Dordrecht, 1991.

–   (1991): „Thematic Proto-Roles and Argument Selection." – In: *Languages* 67.3, 547–-619

Hay, Jennifer, Christopher Kennedy, Beth Levin (1999), "Scalar Structure Underlies Telicity in Degree Achievements." – In: *Proceedings of SALT 9*, 127-144.

Jackendoff, Ray. (1996): „The Proper Treatment of Measuring Out, Telicity and Perhaps Event Quantification in English." – In: *Natural Language and Linguistic Theory* 14, 305–-354.

Kennedy, Christopher. (1999): „Gradable Adjectives Denote Measure Functions, Not Partial Functions." – In: *Studies in the Linguistic Sciences*, 29.1.

–   (2001): „Polar Opposition and the Ontology of Degrees." – In: *Linguistics and Philosophy* 24: 33–70.

Kennedy, Christopher, Louise McNally (1999): „Degree modification and the scalar structure of gradable adjectives." – In: *Actes de TALN'99*, Cargèse, France.

–   (2002): „Scale Structure and the Semantic Typology of Gradable Predicates." – Submitted to *Language.*

Kennedy, Christopher, Beth Levin (2000): „Telicity Corresponds to Degree of Change." – Paper presented at Michigan State University.

Krifka, Manfred. (1992): „Thematic Relations as Links between Nominal Reference and Temporal Constitution." – In: Sag, I., Szabolsci, A. (eds.), *Lexical Matters*. CSLI, Stanford, CA.

– (1998): „The Origins of Telicity." – In: S. Rothstein (ed.), *Events and Grammar*, Kluwer, Dordrecht, 197–235.

Levin, Beth, Malka Rappaport Hovav (1999): „Two Structures for Compositionally Derived Events." – In: *Proceedings of SALT 9*, 199–233.

Link, Godehart (1998): *Algebraic Semantics in Language and Philosophy* – CSLI, Stanford, CA.

Naumann, Ralf (1996): *Aspectual Composition and Dynamic Logic* – PhD thesis, Heinrich Heine Universität, Düsseldorf.

Paradis, Carita (1997): *Degree modifiers of adjectives in spoken British English*. – Lund University Press, Lund.

Parsons, Terence (1990): *Events in the Semantics of English. A Study of Subatomic Semantics* - Current Studies in Linguistics Series, vol. 19 – MIT Press, Cambridge, MA.

Piñón, Christopher (2000): „Happening gradually." – To appear in *Proceedings of BLS'26*, U. Berkeley, CA.

Simons, Peter. (1987): *Parts. A Study in Ontology*. – Oxford University Press, Oxford.

Tenny, Carol (1994): *Aspectual Roles and the Syntax-Semantics Interface*.– Kluwer, Dordrecht.

Vendler, Zeno (1957): „Verbs and Times" – In: *The Philosophical Review* 66: 143–160.

Verkuyl, Henk (1993): *A theory of aspectuality*. – Cambridge University Press, Cambridge.

– (1999): *Aspectual Issues – Studies on time and quantity*, CSLI, Stanford, CA.