

Structuring Events

A Study in the Semantics of Lexical Aspect

Susan Rothstein

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Susan Rothstein

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Preface

This book grew out of two unanswered questions and one observation that I was left with when I was finishing writing *Predicates and their Subjects* (Rothstein 2001a). First, I knew that I had argued for a syntactic analysis of resultative predication, and for a mechanism for interpreting that structure, but that I had said nothing about what it meant, and, in any case, my theory of predication did not deal very elegantly with the question of intransitive resultatives such as *sing the baby asleep*. Secondly, while developing an analysis of progressives of *be* + AP in the last chapter of the book, I had begun by making the general assumption that achievements did not occur in the progressive – although there are, of course, exceptions. However, when I looked more closely at the data, I saw that there were so many exceptions that a general assertion that achievements did not occur in the progressive just could not be maintained. So what was going on with progressive achievements still had to be made clear. The observation, which I had written about but not explored in any depth, was that there existed homogeneous count nominals such as *fence*, *wall* and *lawn*. At the time, the summer of 1997, I had no idea that the three issues would come together in what would turn out to be a theory of lexical aspect.

I began thinking about progressive achievements in the fall of 1997, and gave a number of talks at which I began to develop the idea that the progressive operator applied to a VP headed by an achievement forces a type shift in the VP and results in an accomplishment into which the meaning of the achievement is incorporated. The fact that my work on aspect grew from there into this book is due to various circumstances and people who I want to thank here. Ewald Lang, Catherine Fabricius-Hansen and Claudia Maienborn invited me to speak on secondary predication at the Oslo Conference on Adjuncts which they organized in the fall of 1999, and this forced me to sit down and think about resultatives, and how resultatives can be analyzed as triggering a type-shifting operation from activities into derived accomplishments. My friend Paula Pranka-Neimitz, who had written her dissertation together with me at MIT, sat me down at her kitchen table one morning when I was visiting her in Germany in February 2000 (while her boys were entertaining my daughter) and asked me what I was working on, and by the time I had finished explaining

it to her, the parallelism between type-shifting from achievements to accomplishments and from activities to accomplishments had become clear. Then Fred Landman pointed out in the question period, when I presented the results on resultatives at the Tel Aviv Department colloquium in the spring of 2000, that the incremental structures I was using to try and constrain the distribution of resultative predicates were very similar to those I was using to restrict the distribution of progressive achievements. From there, the step to working on a theory of accomplishments and incrementality, and then onward to lexical classes, was obvious. It was not until later, when I came to think in detail about the relation between lexical classes and telicity, that I began to distinguish between singular and atomic events, and then the relevance of the comparison with the homogeneous count predicates allowed me to pull the whole thing together. This is also probably the place to acknowledge my intellectual debt to a number of published works which helped me enormously in understanding what lexical aspect is. Outstanding among these are David Dowty's book *Word Meaning and Montague Grammar* (1979), Manfred Krifka's papers on telicity (especially his 1992 and 1998 papers), Fred Landman's 1992 paper on the progressive, and Hans Kamp's two papers on the logic of events (1979a and b). The influence of these last two on this book is less obvious because in the end I deleted a long discussion of foundational issues from the last chapter, to be written up (I hope) and published separately. But the effect on my thinking was no less important because of that.

The book begins with a critical overview of Vendler classes and some of the most central concepts in theories of aspect, including quantization, cumulativity, stages, telicity and atelicity. Chapters 2 and 3 provide in-depth case studies of two constructions which make use of operations of lexical shift. Chapter 2 discusses progressive achievements, where the progressive applied to an achievement-headed VP shifts the VP from an achievement predicate to an accomplishment whose culmination is in the denotation of the achievement. Chapter 3 analyzes resultative predicates which can appear with activity verbs, and trigger a shift from an activity to an accomplishment reading. I argue that both constructions provide evidence that there are such things as "accomplishment structures," and chapter 4 provides an account of what an accomplishment is. I argue against Krifka's claim that what is special about an accomplishment is that it has an "incremental" or gradual relation with its theme, and I show that what characterizes an accomplishment is that it consists of an activity which is incrementally related to a gradual change of state, and give a precise characterization of what incrementality is. In chapter 5, I show how the theory of incrementality allows us to explain how the derived accomplishments analyzed in chapters 2 and 3 work. Chapters 6 and 7 analyze telicity. I show that while lexical aspect is a property of verbal heads, telicity and atelicity are properties of VPs. We see that a theory of telicity based on Krifka's notions of quantization and cumulativity does not work. Instead, I argue that the distinction between telic and atelic VPs is based on a distinction between atomic sets (sets where a unique criterion for individuating atoms is given) and singular

but non-atomic sets, which turn out to be homogeneous. Chapter 8 pulls together the issues in the book, presenting a general theory of lexical aspect, in which aspectual classes constrain the way in which events can be individuated.

Various parts of the book have been presented at conferences and seminars, and I would like to thank the audiences for very helpful comments (and in many cases the organizers for forcing me to give the talks). The progressive paper was presented at the seminar of the Formal Semantics Group at the Jerusalem Institute for Advanced Studies in the fall of 1997, the Tel Aviv Department colloquium in the spring of 1998, the 14th annual meeting of the Israel Association for Theoretical Linguistics held in Be'er Sheva in June of 1998, the Bergamo Conference on Tense and Aspect also in June 1998, and at the Workshop on Aspect at the University of Tübingen in the fall of 1998. I am particularly grateful to Andrea Bonomi for comments on the version presented at the Bergamo conference which made me think much more carefully about issues in the semantics of accomplishments. An earlier version of chapter 2 of this book, based on these talks, has been accepted for publication in a volume edited by Jim Higginbotham, Fabio Pianesi, and Alessandra Giorgi. The talk on which chapter 3 is based was originally presented at the Oslo Conference on Adjuncts in the fall of 1999, at the Tel Aviv Department Colloquium and at the 16th annual meeting of the Israel Association for Theoretical Linguistics at Tel Aviv in 2000. A very early version of chapter 3 appeared in E. Lang, C. Fabricius-Hansen, and C. Maienborn (eds.), *Papers from the Oslo Conference on Adjuncts* (ZAS Papers in Linguistics 17), and a revised version of this appears in the *Handbook on Adjuncts*, with the same editors (2003). Manfred Krifka's comments on versions of these papers were most helpful.

Parts of chapters 4 and 5, containing the theory of accomplishments, were presented in a workshop on predication at ZAS in Berlin and at the Paris conference on Tense and Aspect, both in the fall of 2000, at a colloquium at ZAS in February 2001, at an ISF-sponsored workshop on Aspect in Be'er Sheva in June of 2001, and at the Trondheim seminar on Predication in the fall of 2001. A very early version of part of chapter 4 appears as "What are Incremental Themes?" in G. Jaeger, A. Strigin, C. Wilder, and N. Zhang (eds.), *Papers on Predicative Constructions* (ZAS Papers in Linguistics 22). A paper related to some of this material will appear as "Derived Accomplishments and Lexical Aspect" in J. Guéron and J. Lacarme, *The Syntax of Time*, to be published by MIT Press. I presented much of this material at a course I taught at the LOT winter school in Leiden in January 2002. I spent the academic year 2001–2 on sabbatical as a guest of the Institute of Linguistics at Utrecht (UiL-OTS), and I thank my colleagues there for their hospitality. During that year, I presented what turned into chapter 8 at UiL-OTS, at the University of Paris VII, at the University of Groningen, and at the University of Stuttgart.

Various people commented on parts of the manuscript, and I would like to thank them. In particular, I'd like to thank Hana Filip for discussions and comments on chapters 1 and 4, and Hans Kamp for discussions of the material in chapters 6–8. While I was at Utrecht, I enjoyed conversations with Kriszta

Sendroi and Anna Mlynarczyk. At Bar-Ilan, I have learned much about aspect from my students, especially Pavel Braginsky, Anna Anikaev, Dafna Yitchaki, and Irena Shpinel, and from my colleagues Yael Greenberg and Gabi Danon, all of whom met early in the morning (too early) to discuss aspect. Anita Mittwoch, Sally McConnell-Ginet, my colleagues Joel Walters and Jonathan Fine, and my brother Joe Rothstein were all valiant in supplying judgements, usually via email. Fred Landman has discussed many of the issues in this book with me and commented on various drafts in various forms, and his insight and comments have been invaluable.

References to my daughter Dafna in the examples, and the surrounding discussion, should not just be taken as cuteness. Accompanying a child in the early years of her life when she is learning and acquiring all sorts of skills (such as walking, reading, and skipping) provides a unique opportunity to look in “slow-motion” at what an event actually does consist of and what kind of events normally fall in the denotations of common lexical predicates. Taking the time to look at what these events actually comprise turned out to have a considerable effect on how I began to think about what event individuation and event classification actually are. So in a very real way Dafna has accompanied this book since its inception, and although I have never really understood what it means to say that an academic book is “for” someone (after all, I wrote it because I wanted to), there is nonetheless a sense in which this book is for her, with love.

S. R.

Chapter 1

Verb Classes and Aspectual Classification

1.1 Introduction

This book is about lexical aspect. Aspect traditionally concerns itself with what Comrie (1976) calls “different ways of viewing the internal temporal constituency of a situation” (pp. 3, 5). The intuition behind this definition is that while tense relates the temporal location of a situation or “eventuality” to some other temporal reference point such as the time of utterance, aspect is concerned with the structural properties of the event itself. Within the study of aspect, linguists make a distinction between grammatical and lexical aspect. Some people take this to be a formal distinction between aspectual properties expressed by a grammatical category and/or characterized by a particular inflectional morphology (for example the French *imparfait* or the *passé simple*), and aspectual distinctions which are lexicalized or characterized by derivational morphology or which are not characterized morphologically at all. However, the distinction I am interested in here is not formal but semantic, and is more or less the distinction formulated by Smith (1991) as a distinction between situation aspect and viewpoint aspect (see also Filip 1993, 2000, and the discussion on the distinction between “telic” and “perfective” in Bertinetto 2001). Lexical aspect, sometimes called “Aktionsart” and corresponding to Smith’s situation aspect, covers distinctions between properties of event-types denoted by verbal expressions, which linguists have tried to capture by classifying verbs into verb classes. Grammatical aspect, in particular the contrast between perfective and imperfective, concerns the distinction in perspective on events, or Smith’s “viewpoint aspect.” (1) shows a contrast in lexical aspect between a state and an accomplishment, while (2) shows a contrast between an imperfective and perfective use of the verb *built* (where the imperfective can be naturally replaced by the progressive):

- (1)a. Mary *loved* John very much. (*state*)
b. Mary *built* a house. (*accomplishment*)
- (2)a. He lived in a hotel while he *built/was building* the house. (*imperfective*)
b. He *built* the house and then sold it for profit. (*perfective*)

This book is concerned with lexical aspect and the properties we can ascribe to event types in the denotations of particular lexical items. I assume that the events in the denotation of *build a house* have essentially the same properties whether the expression is used imperfectively or perfectly, and that it therefore makes sense to ask what these properties are. The interaction of lexical aspect and grammatical aspect is an important and fascinating question (see, for example, Smith 1991), but it is beyond the scope of this book.

A number of questions stand at the center of the study of lexical aspect. First are aspectual properties, properties of linguistic expressions or of events “in the real world.” Aristotle’s original discussion of the aspectual distinction between “kinesis” (movements) and “energia” (actualities), both in the *Metaphysics* 1048 and in the *Nicomachean Ethics* 1074, naturally reads as a characterization of kinds of actions, rather than expressions. He contrasts actions which are complete in themselves (energia) and classified as atelic, such as seeing and thinking and being happy (roughly what we call states and activities), and actions which are inherently incomplete and which are directed towards an end, such as building a house or learning a poem, which we call accomplishments and classify as telic. Much recent linguistic work has stressed that aspectual distinctions are distinctions between linguistic expressions and are not properties of events in themselves. Thus Krifka (1998) writes:

it is misleading to think that a particular event can be called “telic” or “atelic”. For examples, one and the same event of running can be described by *running* (i.e. by an atelic predicate, or by *running a mile* (i.e. a telic, or delimited, predicate). Hence the distinction between telicity and atelicity should not be one in the nature of the object described, but in the description applied to the object. (p. 207)

While linguists have continued to talk as if aspectual properties are properties of entities “out there” in the world (see, for example, Bach 1981, 1986, and Parsons 1990, chapter 3), the idea that aspectual properties are properties of event descriptions, or of events under a particular description, is supported by the theory of fine-grained event individuation argued for in Parsons (1990) and Landman (2000). They argue that events are only individuable under particular descriptions, and do not have any inherent atomic structure themselves (see also Partee 1999 and Filip 1993). On the other hand, a strong argument in favour of a theory in which events themselves have properties comes from Kamp (1979a,b), who argues that *change* is a primitive concept, and that the distinction between static events and events of change is a primitive distinction in any theory. That a particular collection of real world “happenings” can be described by both telic and non-telic expressions is undeniable, and I shall assume that lexical aspect deals with properties of linguistic expressions. However, we will come back to the challenge of Kamp’s theory in chapter 8, where we will discuss what the basis of aspectual classification is.

A separate but related issue concerns the nature of lexical aspectual classifications. Vendler (1957, 1967) showed that a classification into states, activities, achievements and accomplishments is very useful in terms of predicting the linguistic behavior of verbal predicates, and it is this classification which has become most influential over the last 35 years. But are lexical classes just accidental generalizations over properties of lexical items, or are they constraints on possible meanings, and if the latter, where do they come from?

A third set of issues concerns the relation between the telic/atelic distinction and the classification of predicates into lexical aspectual classes, and the related issue of at what syntactic “level” the classifications should apply. Intuitively, states and activities are atelic, as they do not involve changes of state, whereas achievements and accomplishments are telic. Does this mean that verb classes just subdivide the telic/atelic groups one stage further? And is it verbs or Verb Phrases which should be so categorized anyway? It was Verkuyl (1972) who pointed out that accomplishment verbs such as *build* differ in telicity depending on the properties of their direct objects. *Build* normally heads a telic VP, but it heads an atelic VP when it has a bare plural or mass nominal as a direct object. “Telic” *build* can be modified by *in α time*, while “atelic” *build* is naturally modified by *for α time*. If a verb is an activity, the properties of the direct object do not affect the telicity of the VP:

- (3)a. Mary built two houses *for an hour/in an hour.
- b. Mary built houses for a week/*in a week.
- (4)a. John pushed the cart for an hour/*in an hour.
- b. John pushed carts for an hour/*in an hour.

Some (e.g., Dowty 1979) have taken the data in (3) to mean that it is really VPs that should be classified as accomplishments or activities. This position is strengthened by the contrast between (4) and (5), where *push* also heads a telic VP:

- (5) John pushed the cart a mile/to the edge of the park in an hour/*for an hour.

Verkuyl himself has argued (Verkuyl 1972, 1993) that the data in (3–5) shows that it is minimally VPs which should be classified as telic and atelic, and that there is good evidence that telicity is really a property of sentences. This is because of sentences such as (6), where the properties of the subject nominal determine the telicity of the sentence:

- (6)a. John discovered the secret room in a few weeks.
- b. Children have been discovering that secret room for generations.

Verkuyl claims, more strongly, that classification into Vendlerian verb classes is linguistically irrelevant, and that the only relevant question is how the

aspectual properties of the VP are derived compositionally. He argues that verbs can be classified essentially into dynamic or non-dynamic (what he calls [$\pm$ ADD ON]), and that nominals are classified according to whether or not they determine a specified quantity [$\pm$ SQA]. VPs denote stative eventualities when the V is [$-$ ADD-ON] and the nominal is [$\pm$ SQA]. Atelic VPs are derived when the V is [$+$ ADD-ON] and the nominal is [$-$ SQA], and telic VPs are derived when the V is [$+$ ADD-ON] and the nominal is [$+$ SQA]. He claims explicitly that any more fine-grained aspectual classification of verbal heads is linguistically irrelevant. This gives a classification into states, activities and accomplishment VPs, making no reference to achievements, and treating lexical classes as by-products of the theory, rather than theoretical entities in themselves.

In this book, I am going to argue against this position. I assume that events are countable entities which are individuable, relative to a particular description. Verbs denote sets of events and are classified into lexical classes depending on the properties of the events in their denotations relative to that particular description. I shall assume, following Parsons (1990) and Landman (1995, 2000), that verbs denote sets of events or an event (or eventuality) type, and that thematic roles denote functions from sets of events to their participants; and we can thus talk of the event-type denoted by V as showing the properties which determine the lexical class of the V.

I will argue in the course of the book that lexical aspectual classes are not generalizations over verb meanings, but sets of constraints on how the grammar allows us to individuate events. Telicity and atelicity are properties of verb phrases, and the status of the VP with respect to telicity will depend on the interaction of the meaning of the V with other elements in the VP. It will follow from the meaning (or properties) of an accomplishment that the structure of its direct object will determine whether it heads a telic or atelic VP, and it will follow from the meaning of the activity that a VP consisting only of an activity V+direct object will always be atelic regardless of the properties of that direct object. Certain measure and directional phrases, though, can make such VPs telic. This is essentially the standpoint taken by Krifka (1986, 1989, 1992, 1998) but I shall differ from him over what constitutes the relevant properties of accomplishments. I show why we can expect bare plural subjects to affect the telicity of achievement VPs in the same way that bare plural direct objects affect telicity of accomplishments; the atelicity of (6b) comes from the same sources as the atelicity of (3b).

These theoretical claims require an account of what the properties of the lexical aspectual classes are, so that we can explain how they interact with arguments and modifiers to get the effects in (1)–(6), and in order to explain how apparent movement between lexical classes is possible. The aim of this book is to give an account of the semantic basis of the lexical classes and to support the claims made in the previous paragraph.

The structure of the book is as follows. This chapter gives an introduction to the well-known linguistic properties of verb classes and the semantic

properties which are assumed to underlie them, in particular homogeneity, cumulativity and quantization. We identify states, achievements, activities, and accomplishments, as well as a fifth class, semelfactives. Chapters 2 and 3 provide in-depth case studies of two constructions in English in which we get aspectual shift: operations in which a VP headed by a verb from one aspectual class denotes a set of events in a different verbal class. In the first case, progressive VPs are headed by achievement verbs. This is intuitively problematic since it makes little sense to talk of near punctual events as being “in progress,” and there are indeed achievements which cannot naturally appear in the progressive, such as (7a,b). However, (7c) and (7d) are perfectly acceptable and the question is how:

- (7)a. #John is spotting his friend.
- b. #Mary is noticing that it is raining.
- c. The tram is arriving at the tram stop.
- d. We are reaching the mountain top.

The second construction is the resultative construction, illustrated in (8), where an atelic activity verb heads a VP which can be telic when a resultative predicate is added:

- (8)a. Mary hammered the metal for an hour/*in an hour.
- b. Mary hammered the metal flat *for an hour/in an hour.
- c. John sang for an hour/*in an hour.
- d. John sang the baby asleep *for an hour/in an hour.

The data in (7/8) could be taken as evidence against assigning verbs to particular aspectual classes, but I argue against this conclusion and show that the original lexical head is incorporated, with its original meaning, into a derived accomplishment. These case studies will be of central importance to the theory: the fact that there are shifting operations into accomplishment structures is evidence that lexical classes are not accidental generalizations over lexical meanings, but are independently characterizable templates, or schemas, which constrain lexical meanings. In chapter 4, I present a theory of the structure of accomplishments, and in chapter 5 I show how this supports the shift operations postulated in chapters 2 and 3. Chapters 6 and 7 discuss telicity. I argue against Krifka’s account of telicity in terms of quantization *vs.* cumulativity, and show that telicity is not about being able to calculate the endpoint of an event in VP, but about being able to identify the atoms in VP and thus being able to count them. Chapter 8 returns to the question of where the aspectual classes come from. I argue that the aspectual classes constitute a set of constraints on what eventualities are linguistically individuable, and draw some general conclusions about what a theory of aspect based on the results in this book should look like.

1.2 Aspectual Classes of Verbs

1.2.1 The four aspectual classes

The classic twentieth-century philosophical sources for classifying verbs into aspectual classes are Ryle (1949), Vendler (1957, 1967), and Kenny (1963). Ryle crucially distinguished between achievements and accomplishments; accomplishments are changes of state which have some “task” associated with them, whereas achievements are changes of state without such an associated task – in other words the bare change of state itself. Kenny ignores Ryle’s distinction and concentrates on the differences between states, activities and performances, where performances are events which have a natural endpoint. He is concerned mainly with accomplishments, but tacitly he would probably categorize achievements as performances. It is Vendler’s (1957) four-way classification into states, activities, achievements, and accomplishments, encompassing both Ryle’s and Kenny’s intuitions, which has proved most fruitful and relevant for linguistic research, and which provides the basis for Dowty’s seminal semantic analysis (1979). This is the classification which I will present below. Smith (1991) adds a fifth class, semelfactives, which I will largely ignore here, but these will come into their own and play a crucial role in the theory of why we have the lexical classes we do, which I will present in chapter 8.

Dowty (1979) discusses and develops Vendler’s (1957, 1967) classification of verbal predicates into four different classes according to their logical entailments, interactions with temporal modifiers, and interaction with tense. The account I present here draws heavily on his discussion.

The four-way classification is into **states**, **activities**, **achievements**, and **accomplishments**. Crudely, states are non-dynamic situations, such as *be happy* or *believe*; activities are open-ended processes, such as *run*; achievements are near-instantaneous events which are over as soon as they have begun, such as *notice*; and accomplishments are processes which have a natural endpoint, such as *read the book*. Further examples from Dowty are given below:

States	Activities	Achievements	Accomplishments
<i>know</i>	<i>run</i>	<i>recognize</i>	<i>paint a picture</i>
<i>believe</i>	<i>walk</i>	<i>spot/notice</i>	<i>make a chair</i>
<i>have</i>	<i>swim</i>	<i>find/lose</i>	<i>deliver a sermon</i>
<i>desire</i>	<i>push a cart</i>	<i>reach</i>	<i>draw a circle</i>
<i>love</i>	<i>drive a car</i>	<i>die</i>	<i>recover from an illness</i>
<i>understand</i>			<i>build a house</i>
<i>be happy</i>			

Dowty (1979, chapter 3) discusses a number of problems with this classification, and revises and refines some of the distinctions, including subdivisions into verbs which do and verbs which do not have agentive subjects. But while we will be concerned (in chapter 8) with some of the problems which he

raises, including the nature of the distinction between activities and accomplishments, the fruitfulness of the original Vendlerian distinction has proved itself, and this will be our starting point.

The four-way Vendlerian classification is an expression of the intuition that there are two properties which are crucial in categorizing eventualities or event types. The two properties are whether an event type has a natural stopping point (whether it is telic) and whether we can analyze it as progressing or developing (whether it is dynamic, or has stages). I will discuss each of these briefly, before going on to look at the properties of each aspectual class, but I will not try to give a formal definition of what either telicity or dynamicity is. Also, for the moment, we will discuss only event types with singular arguments, such as *build a house*. We will not make a distinction between event types denoted by V and those denoted by VP until section 1.3.

The first property, [$\pm$ telic], groups states and activities together on the one hand, and achievements and accomplishments on the other. [$\pm$ telic] targets the Aristotelian distinction *kinesis* *vs.* *energia*. Eventualities of the first kind are [+telic] or **telic**, and are movements towards an endpoint where the properties of the endpoint are determined by the description of the event. Eventualities of the second kind are [–telic] or **atelic**; once they have started, they can go on indefinitely, since the nature of the eventuality itself does not determine its endpoint. The telic point is often called the **culmination** or **set terminal point**. Achievements and accomplishments are [+telic], and states and activities are [–telic]. Thus if John loves Mary, there is nothing in the nature of the loving state which will necessarily bring that event to a close, and similarly, if Mary ran, the description of the event does not say when or if the running event stopped. *Mary ran yesterday and she hasn't stopped yet* is a perfectly coherent and non-contradictory piece of discourse. Of course we know that in the “real world” people don't usually carry on running indefinitely (although machines may), and that people often do stop loving, but there is nothing in the description of the event itself which makes it the case that such a stopping-point occurs. By contrast, achievements and accomplishments have a natural endpoint which is determined by the description of the eventuality. An event which makes *Mary arrived at the station* true is over when Mary becomes “at the station.” Whatever happens after that is not part of the arrival event. And if Mary read *War and Peace*, then that event is over when Mary finishes reading *War and Peace*. What counts as the end may be a bit fuzzy; it may be when she reads the last page of the book, or when she reads the last page of the story proper and decides to skip the final section on the philosophy of history, or when she finishes rereading the bits she particularly liked and puts the book back on the shelf. But this imprecision, which leaves room for contextual determination of what the endpoint of an event actually is, does not take away from the fact that the description of the event entails that there is a point (in part contextually determined) at which the event is over. If Mary finishes the book and immediately starts reading it again, this is a new event of reading *War and Peace* and not a continuation of the original one. The standard test for

telicity is the use of temporal modification: *in α time* modifies telic VPs and *for α time* modifies atelic VPs as in (9):

- (9)a. John knew Mary for years/*in a year.
- b. John danced for hours/*in an hour.
- c. John spotted Mary in a few minutes/*for a few minutes.
- d. John built the house in a few weeks/*for a few weeks.

Krifka (1986, 1989, 1992, 1998) has probably gone furthest toward giving a precise characterization of telicity. He characterizes a predicate as telic if the following holds (1998, p. 207): if *e* is in the denotation of *X*, then all parts of *e* (subevents of *e*) which are also in the denotation of *X* must have the same starting and stopping points. Read “*War and Peace*” is telic because for any event *e* in its denotation, any subparts of *e* which are also events of reading *War and Peace* will have to start at the same point and end at the same point. Events which do not last as long as *e* will not be big enough to count as events of reading *War and Peace*. *Run* is atelic, since an event of running which lasts from 9 a.m. to 10 a.m. has subevents of running (for example, the event of running from 9.15 to 9.45) which are also in the denotation of *run*. Krifka’s definition is too strong for some cases; the predicate *run to Paris* is telic according to the test in (9) since *run to Paris in two hours* is acceptable, but subevents of an event of running to Paris will also fall in the denotation of the predicate as long as they are runnings which end at Paris, even if they start after the original event had started. What apparently is crucial for telicity is that all subevents of *e* end at the same point.

Krifka identifies **cumulativity** and **quantization** as crucial properties of verbal predicates which lead to atelicity and telicity, respectively. A predicate *P* is cumulative if it has at least two distinct entities in its denotation, and for any *x* and *y* in *P*, their sum is also in *P*, where the sum operation is essentially that from Link (1983):

- (10) *X* is **cumulative** iff:

$$\exists x \exists y [X(x) \wedge X(y) \wedge \neg x \sqsubseteq y \wedge \forall x \forall y [X(x) \wedge X(y) \rightarrow X(x \sqcup y)]]$$

Krifka argues that *run* is cumulative because the sum of two running events is also in the denotation of *run*, while *eat three apples* is non-cumulative because the sum of two such events is not an event of eating three apples but an event of eating six apples. A closer look shows that if a verbal predicate *P* is cumulative, then it must be a mass predicate. If we assume that *run* is a count predicate, then the sum of two events of running must be in the denotation of the plural predicate *run*, and the predicate meets the criterion in (10) only because English does not show a morphological difference between singular and plural predicates. But if the sum of two running events is in the denotation of the plural predicate *run*, then telic predicates will have a cumulative

reading in the same distributive sense. The sum of two events of *eat three apples* is in the denotation of the plural predicate *eat three apples*, as in the distributive reading of *Dafna and Nomi ate three apples*, or *Dafna ate three apples twice*. So simple cumulativity can distinguish between atelic and telic predicates only if we allow that atelic predicates are verbal mass terms. However, there is good evidence that this is not the case. I earlier argued (Rothstein 1999) on the basis of a variety of modification facts that verbal predicates always have their denotation in the count domain (we will review this evidence in chapter 5). Landman (2000) argues that distributivity in the verbal domain reduces to semantic pluralization, which presupposes a count denotation. Since distributivity and collectivity phenomena appear with atelic predicates as much as with telic predicates, we must assume that both have a count denotation, and then (10) cannot make the distinctions that we want. Intuitively, however, there is a distinction between atelic and telic predicates. Two events of running can be summed to form a plural event, but they can also, in the appropriate contexts (usually temporal adjacency), be put together to make a new **singular** event. Thus an event of running from 2 p.m. to 3 p.m. and an event of running from 3 p.m. to 4 p.m. can be seen either as two distinct events of running or as a single event of running from 2 p.m. to 4 p.m. So what is relevant is not whether two eventualities in *P* can be summed to form a plural event in $*P$ (where $*$ is the plurality operator), but whether two events in *P* can be put together to form a new singular event which is also in *P*. While two events in *run* can form a singular event in *run*, two distinct events in *eat three apples* cannot be put together to form a new singular event in *eat three apples*. So what distinguishes atelic from telic predicates is what we may call formally S-cumulativity (although for convenience I'll continue to talk about cumulativity except where the distinction between (10) and (11) is relevant). S-cumulativity is defined in (11), where *R* is a relation, and s is the operation forming a singular entity out of a sum:

(11) *X* is **S-cumulative** iff:

$$\exists e \exists e' [X(e) \wedge X(e') \wedge \neg e \sqsubseteq e' \wedge \forall e \forall e' [X(e) \wedge X(e') \wedge R(e, e') \rightarrow X(^s(e \sqcup e'))]]$$

From the examples given, it seems clear that “standing in an appropriate contextual relation” involves temporal adjacency and sharing the same arguments, but we won't go any further into this issue here.

It is clear that S-cumulativity results in atelicity. If *e*, *e'* and $^s(e \sqcup e')$ are all in the denotation of *X* and *e* is not part of *e'*, then either *e* or *e'* end before $^s(e \sqcup e')$ does. But then there is an event which is part of $^s(e \sqcup e')$, which had an ending point earlier than $^s(e \sqcup e')$, which falls under the same predicate. This means that the stopping point of $^s(e \sqcup e')$ is not determined by the content of the predicate, and thus the predicate is not telic.

Krifka uses quantization to identify lexical predicates which are telic. If *x* and *y* are in the denotation of *X*, and *X* is quantized, then neither can be a proper part of the other.

- (12) A predicate X is **quantized** iff:
 $\forall x \forall y [X(x) \wedge X(y) \rightarrow [x \sqsubseteq y \rightarrow x=y]]$

So, if e is an event in the denotation of X , and X is quantized, there can be no proper part of e which is also in the denotation of X . It follows that any part of e which is also in X will be identical to e and thus X will be telic. An event of eating exactly three apples has no proper subpart which is also an event of eating three apples; *eat exactly three apples* is quantized and telic. (Note, however, that *run to Paris* continues to cause problems since it is telic but non-quantized.)

A related property is homogeneity. There are several definitions of homogeneity: very weak homogeneity in (13a), weak homogeneity (13b) and strong homogeneity in (13c):

- (13a). X is **very weakly homogeneous** iff:
 $\exists x [X(x) \rightarrow \exists y [y \sqsubseteq x \wedge \neg y=x \wedge X(y)]]$
- b. X is **weakly homogeneous** iff:
 $\forall x [X(x) \rightarrow \exists y [y \sqsubseteq x \wedge \neg y=x \wedge X(y)]]$
- c. X is **strongly homogeneous** iff:
 $\forall x [X(x) \rightarrow \forall y [y \sqsubseteq x \wedge \neg y=x \wedge X(y)]]$

A predicate X is **very weakly homogeneous** if there is some x in X which has a proper part also in X . Thus very weak homogeneity is equivalent to non-quantized, since a predicate is quantized if this never occurs. A predicate X is **weakly homogeneous** if every x in X has a proper part which is also an X . *Run to Paris* is weakly homogeneous, since every event of running to Paris has a proper part which is also a running to Paris, but the remainder is not an event of running to Paris. (An event e of running from Amsterdam to Paris is in the denotation of *run to Paris*, and so is the subpart of e which is running from Brussels to Paris, but the remainder of e , the running from Amsterdam to Brussels, is not in *run to Paris*.) A predicate X is **strongly homogeneous** if every subpart of it is also in X . Thus *love Mary* and *run* are strongly homogeneous, since they can be subdivided into a number of events all of which are also events in *love Mary* and *run*, respectively.

While very weak homogeneity is equivalent to non-quantized, strong homogeneity is related to S-cumulativity (in a non-finite model). S-cumulativity says that if a predicate holds of contextually related x and y , it also holds of ${}^s(x \sqcup y)$, whereas homogeneity says that if a predicate holds of an entity, it also holds of distinct parts of it. (In Rothstein (1999) I called homogeneity “downward homogeneity” and cumulativity “upward homogeneity”: here I will stick to “homogeneity” and “cumulativity.”) Homogeneous predicates tend to be cumulative. If X is strongly homogeneous and x and y are in X , and x is a proper part of y , then there must be some z which is also a proper part of x

and which is in X . But then ${}^S(x \sqcup z)$ is also in X , which indicates that X is cumulative. But this is not an entailment relation. Problems arise with transitive activities such as *push the cart*, where homogeneity does not entail cumulativeness (neither simple cumulativeness or S-cumulativeness), since *push the cart* is homogeneous, but two events of *push the cart* can form a singular event in the denotation of the same predicate only if the referent of the cart is kept constant (see also discussion in Ramchand 1997). We can continue to consider *push the cart* as S-cumulative if identity of participants is one of the factors contributing to the contextually defined relation R . We will discuss this further below, and in chapter 8.

Cumulativeness does not entail homogeneity either; it only entails homogeneity down to minimal parts (see the discussion in Dowty 1979, chapter 3). 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. The distinction between homogeneity down to instants and homogeneity down to small parts is crucial in distinguishing between states (which are homogeneous down to instants) and activities (which are homogeneous down to small parts), and because of this we will use cumulativeness as the defining characteristic of atelicity.

The second property which is important in characterizing the Vendlerian classes, in addition to the $[\pm\text{telic}]$, is whether the verbs can appear in the progressive. States and traditionally achievements (Vendler 1957, and others) generally do not appear in the progressive, while activities and accomplishments do, as illustrated in (14):

- (14)a. *John is believing in the afterlife/loving Mary. (*state*)
- b. *Mary is recognizing John/losing her pen. (*achievement*)
- c. Mary is running/walking. (*activity*)
- d. John is reading a book.

There are groups of counter-examples to this generalization. In chapter 2, I discuss achievements which occur freely in the progressive as in *our pizza is arriving*, but, I shall argue, this happens only after the VP has undergone a shift in meaning. Also, there is a group of stative predicates including *lie*, *hang*, *sit*, and *live*, termed “interval states” by Dowty (1979), which have progressive uses such as *The socks are lying on the bed*, *This year we are living in Amsterdam*. But for the moment, we will take the criterion at face value, based on intuitions such as those in (14).

The reason why the progressive test is important is phrased differently depending on your theory of the progressive, but the intuition behind it is the same in each case. A sentence with a verb in the progressive asserts that an eventuality of a particular kind is “in progress” or going on. We understand naturally what this means for activities and accomplishments. (14c) asserts that Mary is in the middle of the running activity, and (14d) that John is in the middle of reading the book. However, there is no natural sense in which either

states or achievements can be said to “go on.” States do not go on or progress because they are inherently non-dynamic, and achievements do not go on or progress, because they are near instantaneous, and are over as soon as they have begun. Landman’s (1992) account of the progressive allows an insightful formulation. He argues that the meaning of a progressive sentence is that a **stage** of the eventuality given by the verb occurred, or is occurring, where *e* is a stage of *e*’ if *e* develops into *e*’. Thus (14c) asserts that a stage of a running event with Mary as agent is going on, and (14d) that a stage of a reading a book event with John as agent is going on. Although it is not explicit in his paper, states and achievements cannot (and should not) occur in the progressive because they do not have stages, and there are two different reasons for this. Achievements are too short: they do not extend over time but are instantaneous events, and thus stages cannot be distinguished. States, on the other hand, are long enough, but they are non-dynamic so that every bit is exactly the same as every other bit and therefore no stages can be distinguished.

We thus have two crucial aspectual properties which can distinguish the four verb classes; whether or not they naturally head telic VPs (which we will call [$\pm$ telic]) and whether or not they naturally occur with the progressive (which we will call [$\pm$ stages]). This leads to the classification in (15):

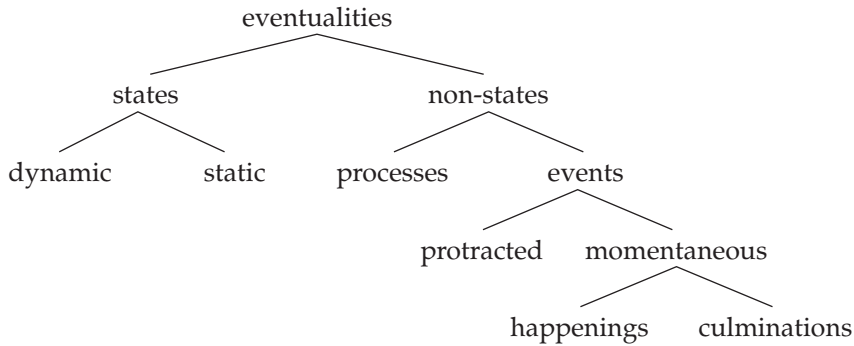
- (15) States: [–telic, –stages]
- Activities: [–telic, +stages]
- Achievements: [+telic, –stages]
- Accomplishments [+telic, +stages]

Reformatting this data in (16) we can see at a glance which event types pattern together:

(16)

	[$\pm$ stages]	[$\pm$ telic]
States	–	–
Activities	+	–
Achievements	–	+
Accomplishments	+	+

It is important to see that the classification of eventuality types need not be done in terms of featural opposition. Bach (1986), for example, classifies eventualities via a tree diagram which he bases on Carlson (1981), and which looks like this:



From his examples, it is clear that Bach's states correspond to our states, his processes are our activities, his protracted events are our accomplishments and his momentaneous events are our achievements, subdivided into those which "happen to you", such as *notice* or *recognise*, and those which can be seen as the culmination of some kind of activity or process, such as *reach the top of the mountain* or *die*. But his representation, or any partial order of this kind, expresses an approach in which aspectual categories are related via set and subset relations: states and non-states partition the set of eventualities: non-stative eventualities themselves can be divided into atelic processes and telic events, which are further subdivided into accomplishments and achievements, and so on. Another ordering of structural relations between aspectual classes is to analyze accomplishments as a subset of activities, namely activities with telic points (ter Meulen 1995). Yet a third approach, e.g. Verkuyl (1972), sees achievements as a subset of accomplishments, namely accomplishments whose process or activity stage is so short as to be negligible.

Relating lexical classes to each other through partial orders or through a feature system makes a different set of predictions about how the classes are related to each other and allows a different set of linguistic generalizations. A partial order relates an aspectual class to its sister nodes and linearly back to its point of origin, while a feature system such as that proposed in (16) proposes a set of oppositions, and thus makes a different set of generalizations about how the linguistic classes are related to each other. The table in (16) should make predictions about what kind of movement between classes, or aspectual shift, is possible. States share one feature with both activities and achievements, but none with accomplishments, and thus we would expect *prima facie* that it would be easier to coerce or shift a state into either an activity or an achievement reading than into an accomplishment reading, and this seems to be the case. A second prediction of a feature system concerns how many classes there are, since n features will give 2^n classes. Since it also allows us to ask why the particular features used are the relevant ones, it gives us a way to address the question of why we have the particular lexical classes that we do. These are the questions that I shall discuss in chapter 8.

Let us now look at the four verbal classes in more detail, and see how the various tests discussed in Vendler (1957, 1967) and Dowty (1979) work, and why.

1.2.1.1 States [–telic, –stages]

States, or stative eventualities, are cumulative and non-dynamic, i.e. [–telic, –stages]. They are also totally homogeneous. Note that here I am considering only states in the denotation of verbal predicates, and not those denoted by adjectival predicates. I argued earlier (Rothstein 1999) that all verbal predicates, including verbal stative predicates, have their denotations in the count domain, while the denotation of adjectival predicates is in the mass domain. State verbs thus denote sets of countable stative eventualities, and as this book is concerned with the internal temporal constitution of individual eventualities, these are the only states we discuss here (see the discussion in chapter 7).

According to (11), states are clearly cumulative. If John was in the state of believing in the afterlife from 1970 to 1980 and he was in the same state from 1980 to 1990 then he believed in the afterlife from 1970 to 1990. We cannot identify stages in the development of a state, and thus a state is non-dynamic and [–stage]. This is because no change necessarily takes place while a state holds. Although it is a real world fact that, for example, the quality of John's love for Mary may change over twenty years, this is not encoded in *John loved Mary for twenty years*. States are also strongly homogeneous, and thus (17) holds:

- (17) If a predicate is homogeneous then *x P-ed for y time* ENTAILS that at any time during *y*, *x P-ed* was true.

John loved Mary for twenty years entails that at any time during those twenty years he loved her (allowing for contextually irrelevant pauses, which we shall discuss when we get to activities). States are unqualifiedly homogeneous since they are homogeneous down to instants. If John loved Mary for twenty years (without any pauses), then he loved her at each instant during that twenty-year period, and there is in principle no subpart of that period which is too small to contain an event which will verify *John love Mary*. And if John believed in the afterlife till the age of twenty-five, the sentence *John believed in the afterlife* was true at any instant during that interval, no matter how small. So stative eventualities are homogeneous down to instants and contrast with the other atelic eventuality type (activities), since we cannot say that *John ran* is true at an instant, but only at an interval, although a very small one (see Taylor 1977 and Dowty 1979).

Note that although homogeneity is often thought to result in atelicity, it is actually crucial in determining the other characterizing property of states, that they cannot be analyzed into stages. If a stative predicate *P* hold at an interval, it holds in the same way at each instant in that interval. And if each instant

looks identical with respect to P, then there is no way of determining change or development with respect to P during that interval.

The following are classic tests for identifying states.

- Stative eventualities do not generally occur in the progressive (although see Dowty's 1979 discussion of "interval states", and modified states such as *John is resembling his father more and more*, discussed in Zucchi 1998):

(18)a. *John is knowing the answer.

b. John is running.

c. John is building a house.

- With stative eventualities, the simple present has a non-frequentive, non-habitual reading, which is impossible with any other verb class. Except for (19a), all of the sentences in (19) must be habituais. This test is particularly crucial because, unlike (18), it also distinguishes between statives and achievements.

(19)a. John knows the answer.

b. John runs.

c. John builds a house.

d. John reaches the top of the mountain/arrives on time.

Statives are also for the most part non-agentive (although, as Dowty notes, there are crucial exceptions, notably with the "interval statives" which may occur in the progressive). Thus we find the following four patterns:

- Stative eventualities do not generally occur in the complement of *force* and *persuade*:

(20)a. *John forced Harry to know the answer.

b. John forced Harry to run.

c. John forced Harry to build a house.

- Stative eventualities do not generally occur as imperatives:

(21)a. *Know the answer.

b. Run.

c. Build a house.

- Stative eventualities do not generally occur with the adverbs *deliberately*, *carefully* and *willingly*, or any other adverb indicating agentivity:

(22)a. *John deliberately knew the answer.

b. John deliberately ran.

c. John deliberately built a house.

- Stative eventualities do not generally occur in pseudo-cleft constructions:

- (23)a. *What John did was know the answer.
 b. What John did was run.
 c. What John did was build a house.

Vendler (1957, 1967) argues that with states, *could* entails *would*. A careful study of counterfactuals would probably show that this is too strong, but it is noteworthy that “I could like him if he didn’t make such bad jokes” can be paraphrased as “I would like him if he didn’t make such bad jokes”, while “Even if I could like him, I wouldn’t” sounds nonsensical. In contrast, “Even if I could run/tell you the answer, I wouldn’t” make perfect sense. The non-agentive relation between a participant and the state that she is in, means that often the ability to be in a state and actually being in it are indistinguishable.

The data in (16) indicated that statives shared the property of atelicity with activities, and so we expect them to pattern with activities with respect to some appropriate test. The relevant test is modification by *for α time*; this assigns to a non-measured eventuality a particular temporal length (Krifka 1998). Statives and activities co-occur with *for x time*, while achievements and accomplishments do not. Thus we have:

- (24)a. John loved Mary for years.
 b. John ran for hours.
 c. *John arrived for hours.
 d. *John built a house for years.

Similarly, (16) predicts that statives should pattern with achievements in at least one way, and this should be a test which makes reference to whether an event can be analyzed into stages. As we saw in (7) and (18), neither states nor achievements normally occur in the progressive. Furthermore, if stative verbs are coerced out of their natural stativity, they are coerced into an inchoative or achievement reading. Thus, telic predicates naturally occur with the temporal modifier *in x time*, which locates the endpoint or telic point of the event as occurring within x amount of time from a contextually relevant point. If a stative occurs with *in x time* the effect is an inchoative reading:

- (25) John was curious to find out where his grandfather had been born, and with the help of the record office he knew the answer in a few hours.

(25) really asserts that within a few hours, John began to be in a state of knowing the answer, or changed from a state of not knowing to a state of knowing. Such an event of changing from one state to another is characteristic of events in the denotation of achievement predicates. Similarly, a state can be coerced into an achievement reading in contextually situated imperatives. (26) contrasts with (21a):

- (26) Teacher to student: "Know the answer by tomorrow, or there will be big trouble."

1.2.1.2 Activities [*-telic, +stages*]

Activities, like states, are atelic, but unlike states, they are dynamic. We saw in (24) that the *for α time* test shows that VPs headed by activities are atelic, and we see from (7) and (18b) where they occur naturally in the progressive, that they can be analyzed into stages – although, so far, we have left the concept "stage" undefined. Activities are S-cumulative with respect to contextually related events, where the contextual relation frequently involves temporal adjacency. If Mary ran from 4 p.m. to 5 p.m., and from 5 p.m. to 6 p.m., we can reasonably assert from one perspective that there was one event of her running from 4 p.m. to 6 p.m. We may also want to distinguish two events of running within that time – perhaps she ran in two different races, or with two different friends – but in any of these situations, the assertion that she ran from 4 p.m. to 6 p.m. is true, and the predicate comes out as cumulative, and thus atelic. As mentioned already, intransitive singular predicates such as *run* are straightforwardly cumulative. With transitive activity predicates such as *push the cart*, it is not so simple. As Ramchand (1997, p. 225) shows, the sum of two events in the denotation of *push the cart* forms an event in the denotation of the same predicate only if we keep the cart constant. Otherwise the sum of two *push the cart* events normally falls under *push two carts* or *push carts*.

However, we can still use S-cumulativity to distinguish between activities and accomplishments. First, if we keep the direct object constant we get cumulativity effects with activities but not with accomplishments. The sum of two distinct (but contiguous) events of Mary pushing a single cart comes under the denotation of the singular predicate *push the cart*, but the sum of two contiguous events of John reading the same book is not normally in the denotation of the singular *John read the book*. So in (27a) either discourse A or B can be appropriate, but in (27b), only discourse B is appropriate.

- (27)a. Mary pushed the cart for an hour. And then without stopping, she pushed it again for another hour.
- A. So she really pushed it once for a long time.
 - B. So she really pushed it twice.
- b. John read a book. And then without stopping he read it again.
- A. #So he read it once for a long time.
 - B. So he read it twice.

Second, if we compare VPs with indefinite objects like *push a cart* and *write a letter*, then at least some speakers find a difference in whether the predicate can distribute to different events involving different entities. These speakers find the following differences:

- (28)a. Yesterday I minded a baby all day. In the morning I minded John's baby, and in the afternoon I minded Bill's baby.
 b. #Yesterday I wrote a letter all day. In the morning I wrote to John and in the afternoon I wrote to Mary.

In (28a), the singular activity predicate, *mind a baby*, can be interpreted as formed out of the sum of two "mind a baby" events each involving a different baby, but with the accomplishment *write a letter* this is impossible. Some people who accept (28a) add that they would prefer to use a plural predicate like *mind babies* but, despite this, the contrast between (28a) and (28b) is telling.

Given the subtlety involved in this discussion, wouldn't (strong) homogeneity be a better criterion for atelicity rather than cumulativity? On the surface, activities are straightforwardly homogeneous, as the entailment test in (17) shows. If John ran for two hours, then *John ran* was true at any time during those two hours (ignoring temporary pauses). And since activities, unlike states, can be used in the progressive, we can use a second entailment test relating to homogeneity, dating back to Aristotle (*Metaphysics* 1048), which Dowty originally formulates as:

- (29) If P is an activity predicate, then *x is (now) P-ing* ENTAILS *x has P-ed*.

Thus, *Mary is now pushing a cart/minding a baby* entails that Mary has pushed a cart or minded a baby because the fact that the event is already started means that part of it has already gone on, and that part must itself be in the denotation of the activity predicate.

However, homogeneity is not a good test for atelicity because, while states are truly homogeneous, activities are homogeneous only down to intervals of a minimal size. Dowty (1979, pp. 166–72) discusses this in depth. He begins with Taylor (1977), who was the first to make the problem explicit. Taylor shows that a stative predicate which is true at I is true at all moments within I, but that an activity predicate can only be true at intervals larger than a moment.

Dowty explains this in the following way. Suppose we look at a film of a ball rolling down a hill. He writes:

A single frame of this film does not in itself offer us the evidence to say that the ball is really in motion, assuming that the film does not show any blurs, but any two frames (adjacent or not) showing the ball in slightly different locations do provide evidence of movement. . . . If we attempted to tie the truth conditions for basic predicates to physical properties represented in the model by "logical space" . . . then quite clearly the truth conditions for "motional" predicates and others denoting a change in physical properties of some sort would require access to information about the physical state of the world at least two moments in time. (p. 168)

If we need evidence about more than one moment in order to say whether an event in P has occurred, then it must be the case that e is true only at an

interval and not at an instant. But then, *P* is not a truly homogeneous predicate. Let us look more closely at a different activity predicate: *walk*. What has to be the case for it to be true that one has walked. Take a step? Take two steps? Lift one's foot in the air? Begin to lift one's foot in the air? One may reasonably disagree about how many steps one needs to take in order for it to be true that one is walking (consider parents who are sitting around discussing whether their child has yet walked), but presumably we would all agree that just moving one's foot or lifting it is not by itself walking. These are actions which are necessary parts of walking, but do not by themselves constitute walking. So, "walk" events break up into smaller entities, events which are not in themselves in the denotation of *walk*, but which hold at short intervals, maybe even instants, as part of an event of walking. Then if *x walked for half an hour* is true, it doesn't entail that *x walked* is true at these shorter intervals during the half hour, but only that some constituent event holds. Suppose we agree that taking one step is enough to make it true that one has walked (although Dowty suggests that we need at least two steps, if only to distinguish the predicate *walk* from the predicate *take a step*). Then, if *x walked for half an hour* is true at *I*, *x walked* can only be true at those subintervals of *I* which are big enough to take a step. There must be some defined, minimal event of walking, and *x walked* will be false at any interval which is not long enough to contain such a minimal event. In terms of temporal measurement, the minimal length of the interval is context dependent. If a minimal event of walking is taking a step, it will take an old man with a stick much longer to take a step than it does a five-year-old child, but both of them are walking.

Dowty discusses other problematic examples (p. 171), showing that some predicates by definition require a sequence of events to occur in order for one to say that a minimal event of the right kind has happened. He discusses the problem of *waltz*, where a minimal event requires the participant to take at least three steps in a specific order. This means that in many cases we need more than evidence from two moments to verify that an event in *P* has occurred; what we need is evidence that a particular minimal sequence has been completed.

Dowty argues that minimal activity events are minimal changes of state, where the lexical meaning of the verb determines the relevant change of state. A minimal event of the ball moving is a minimal movement of the ball from location *l* to a different location *l'*, and a minimal activity event of walking is a movement from *l* to *l'* effected by a taking of one (or two) steps. So an activity predicate *P* denotes a set of events which includes minimal events of type *P*, and an activity predicate can hold at any interval at least as big as the interval required for a minimal event in *P* to occur. If *x P-ed* is true, then it is true either because some minimal event of type *P* occurred, or string of such events occurred. Activity predicates will thus be homogeneous down to minimal events, and the entailment which does go through is the one formulated in (30):

- (30) If x is P -ing holds at y , and P is an activity predicate, then at any subinterval of y containing a non-minimal event in P , x ϕ -ed is true.

The imperfective paradox will occur with activities whenever the event witnessing the progressive is not big enough to contain a minimal event. *John is walking* entails that *John has walked* if and only if the event which makes *is walking* true is already bigger than a minimal event. If John is in the middle of taking his first step, *John is walking* is true at the present instant, since the event is likely to turn into at least a minimal event of John's walking. But *John walked* is not true, because although it is the case that a minimal event of walking is in progress, it is not the case that a minimal event of walking has happened. So (29) does not hold.

However, if the entailment which ensures that activities do not lead to the imperfective paradox is formulated as in (30), we trivialize the entailment, and also the fact that progressive accomplishments do not entail the simple past. *Mary is building a house* entails *Mary built a house* whenever the event verifying the progressive is at least a minimal event. The difference between the accomplishment and the progressive is that the singular predicate *build a house* denotes a set of minimal events, while *walk* denotes a set containing minimal and non-minimal events. So a singular accomplishment predicate in the progressive can never entail the simple past. *Walk* includes non-minimal singular events in its denotation where *build a house* doesn't because the former but not the latter is cumulative. Thus we see that the attempt to distinguish between activities and accomplishments in terms of homogeneity brings us back to the fact that it is cumulativeness which is the crucial distinction between activities and accomplishments, and thus between atelic and telic predicates. We return to this topic in chapters 7 and 8.

Going back to the discussion about the relation between activities and states, we have seen that, as postulated in (16), they are both atelic, but they differ with respect to whether they have stages. Atelicity follows from the fact that both are cumulative with respect to contextually related events. They differ with respect to whether they have stages because states are homogeneous down to instants, while activities are homogeneous only down to minimal events. If a stative predicate P holds at interval I , it holds at every instant of I , and every instant in I must be identical with respect to P . This means that there can be no changes within I , and P must be a static predicate. Activities are homogeneous down to minimal events, since within each minimal event there is a change of state or movement; according to Dowty (1979), this is characteristically a movement from l to l' . Thus each minimal event is dynamic, and an activity consisting of a string of minimal events is a series of changes of state strung together. It is this which makes activities dynamic.

It is worthwhile here clarifying the status of pauses and pause stages. Landman (1992) recognizes pause stages in activities. If John ran for two hours, we allow him to pause briefly to tie his shoelace or to wait for the traffic lights to turn to green so that he can cross the road safely. But presumably such

pause stages occur with states too: if John asserts “I believed in the afterlife for my whole life,” we don’t fault him for a transient moment of doubt somewhere in the middle of an 80-year period. The point is that pause stages are accidental breaks in an event and not essential parts of the event which differ in type from the event itself, and so they do not conflict with homogeneity. In particular, a pause is not evidence against the claim that states are homogeneous down to instants. A pause in a stative eventuality *P* is an interval at which *P* does not hold, but this does not take away from the fact that when *P* does hold, it holds at instants. So states, which do not have distinguishable stages, can have pause stages.

The fact that activities are [+stages] means that there should be important properties which they share with accomplishments, which are also [+stages], and indeed this shared feature expresses itself in the fact that both activities and accomplishments occur naturally in the progressive. Landman (1992) analyses the progressive making direct reference to event stages. His analysis makes it obvious why these two aspectual classes can appear in the progressive whereas others cannot: if the interpretation of the progressive requires analyzing the event denoted by the verbal predicate into stages, then the non-dynamic [–stages] classes will not naturally be interpretable. In chapter 8, we discuss in more detail how the “stage” property might be characterized.

Since it doesn’t make much sense to review the tests for activities without being able to compare activities with accomplishments and achievements, I will first discuss these aspectual classes, and then give a general review of the tests below.

1.2.1.3 Accomplishments [+telic, +stages]

Accomplishments are telic, and thus behave differently from both states and activities, but they have stages, and in this way are similar to activities. Typical accomplishments are given in (31):

- (31)a. John ate a sandwich.
 b. Mary mended the chair.
 c. Jane worked out the solution to the problem.
 d. Bill painted the house.

Intuitively, an accomplishment is an activity which moves toward a finishing point, or “set terminal point,” or “culmination” or “telic point” as it has variously been called in the literature. Another way of putting this is that an accomplishment is a non-cumulative activity: it is an activity which has an internally determined point at which it ends, and therefore it cannot be part of a bigger singular event of the same kind without changing its internal structure. Thus, (31a) reports an accomplishment event of John eating a sandwich. The event is over when the sandwich is over. If John then goes on to eat another sandwich, it is not part of the same *eat a sandwich* event, but a different

event. The sum of the two events cannot be described by *eat a sandwich*, but only by *eat two sandwiches/eat some sandwiches/eat sandwiches*. Telicity then is indicated by non-cumulativity: while both state and activity events can be extended or iterated under the same description, this is not the case with accomplishments. Accomplishments also fail to be homogeneous: a part of an *eat the sandwich* event cannot also be described as an *eat the sandwich* event precisely because the whole sandwich isn't eaten. This property of downward non-homogeneity is Krifka's property of [+quantized].

While telicity distinguishes accomplishments from activities and states, accomplishments share with activities the property of having stages. The crucial test for this, as we have already mentioned, is that both activities and accomplishments occur easily in the progressive, as in (32):

- (32)a. John is eating a sandwich.
 b. Mary is building a house.
 c. Bill is running/crying.

Traditionally, the progressive also allows us to distinguish between them with respect to the imperfective paradox. Thus the entailments in (33a and b) are supposed to contrast with the lack of entailments in (33c and d):

- (33)a. John is running ENTAILS John has run/ran.
 b. Bill is crying ENTAILS Bill has cried/cried.
 c. John is eating a sandwich DOES NOT ENTAIL John has eaten/ate a sandwich.
 d. Mary was building a house DOES NOT ENTAIL Mary has built/built a house.

We have already seen that despite the intuitively obvious contrast between the examples in (33), it is difficult to formalize the imperfective paradox precisely in a non-trivial way which will actually distinguish between the activities and the accomplishments. The contrast in the way the imperfective paradox works seems to reduce to a contrast in cumulativity. We will come back to this in chapter 8.

1.2.1.4 Achievements [+telic, –stages]

Achievements are similar to accomplishments in their telicity. They are not (downward) homogeneous, since a part of a dying event is not in itself an event of dying (and in fact they cannot be homogeneous, since, as we shall see, they have no internal structure). They are also not cumulative with respect to contiguous events: two contiguous events of John recognizing a friend cannot together form a single event in the denotation *recognize a friend*.

Achievements are best thought of as “near instantaneous changes of state” (Dowty 1979; Piñon 1997). For example, an event which is in the denotation of

die is crucially a change of state from being alive to not-being alive, while an event in the denotation of *recognize* is a transition from not being able to categorize information to being able to categorize it; the actual transition event occurs in next to no time, and “none of its internal structure is accessible for description” (ter Meulen 1995, p. 7). Temporal modification shows the non-cumulativity of both accomplishments and achievements, but also the contrast in the temporal properties that the events have. Since achievements, like accomplishments, are non-cumulative, we can ask how long they took, as in (34):

- (34)a. How long did it take John to read *War and Peace*?
- b. How long did it take John to recognize Mary?
- c. #How long did it take John to be short? (*on the non-inchoative reading*)
- d. #How long did it take John to push carts?

However, this test shows the contrasts between them. Since achievements are instantaneous, (34b) can only be interpreted as asking how long it was before the event took place, and not, as with (34a), how long the event lasted. It makes no sense to ask how long a recognition took, although one can ask how long it took before a recognition took place. (35b) is a paraphrase of (34b), but (35a) is not a paraphrase of (34a):

- (35)a. How long did it take before John read *War and Peace*?
- b. How long did it take before John recognized Mary?

And (36a) is itself a paraphrase of (35a), while (36b) is nonsensical:

- (36)a. How long did it take before John started/finished reading *War and Peace*?
- b. #How long did it take before John started/finished recognizing Mary?

Vendler (1957) quotes Ryle (1949) as pointing out that the present perfect is used to report occurring achievements; as achievements are near instantaneous, they **have** occurred as soon as they **are** occurring. This is illustrated in (37):

- (37)a. Now he has found it.
- b. Now she has noticed the new curtains.

The data thus collect to support Ryle’s original characterization of the difference between achievements and accomplishments: unlike accomplishments, achievements are changes of state which are not associated with any preceding task or activity.

The [–stage] property also traditionally shows itself in the fact that achievements are not felicitous in the progressive. If achievements are instantaneous, and cannot be analyzed into temporal parts, then it makes no sense to assert

than they are “in progress.” As has by now often been pointed out, achievements do very frequently appear in the progressive (Verkuyl 1989, Mittwoch 1991, Smith 1991). This problem or paradox is the topic of chapter 2, where I shall argue that achievements do appear in the progressive, but that the semantics of progressive achievements is sufficiently different from progressive accomplishments for the construction to show up the differences between the two classes, rather than blurring or obliterating them.

1.2.2 Testing for temporal constitution

Several of the central linguistic tests for distinguishing between aspectual classes have already been discussed above, in particular, the tests involving entailments and the progressive, but others, including modification by different expressions of temporal modification, have not been discussed systematically. At the risk of being repetitive, I shall sum up the contrasts between the aspectual classes by reviewing the standard tests briefly.

1.2.2.1 Expressions of duration: “for α time”

Expressions of duration such as *for α time* denote sets of intervals and modify VPs (or Vs). The condition is usually expressed as follows: *x P-ed for two hours* is true if at every subinterval of a two-hour period, *x P-ed* is true. These expressions can thus occur with downwardly homogeneous expressions, namely states and activities (on the assumption that homogeneity is homogeneity down to minimal intervals, rather than instants). They do not occur with singular achievements. To the degree to which they occur with accomplishments, they force a non-telic activity reading of what is usually an accomplishment verb. Thus we have the judgments in (38):

- (38)a. Mary was happy with John for twenty years. (*state*)
- b. Bill believed in Marxism for twenty years. (*state*)
- c. John ran for half an hour. (*activity*)
- d. #Bill arrived for half an hour. (*achievement*)
- e. #Mary built a house for years. (*accomplishment*)
- f. ?Jane read a book for half an hour. (*non-telic accomplishment*)

Here, (38a–c) are grammatical, (38d–e) are unacceptable, and (38f) is acceptable, but only if a non-telic reading is forced on the accomplishment. *Jane read a book* normally entails that the event ended with the reading of the whole book and that the book consequently became “read,” but (38f) – which focuses on the activity of reading – does not have this entailment. Thus there is no contradiction in saying “Jane read *War and Peace* for two hours, but she never read *War and Peace*.” Not all accomplishments can be pushed to this non-telic reading, as the unacceptability of (38e) shows, and some issues relating to this are

discussed in chapter 4. Achievements cannot be coerced into this non-telic reading. Achievements and accomplishments occur comfortably with *for α time* only if there is a plural argument which allows an iterative interpretation, as in (39). With accomplishments this is normally the object, whereas with achievements this is normally the subject.

- (39)a. Dafna read *Moomintroll* books for some years.
 b. Guests arrived for two hours.

These assert that at every (contextually determined) minimal interval of some/two hours, there was an event of Dafna reading a *Moomintroll* book, or of a guest arriving.

Another durational expression which reflects differences between aspectual classes is *spend α time*. *Spend* has an agentive participant as subject, and thus does not occur with statives except with a semi-ironic reading, but other than that, it discriminates in the same way as *for α time*. It occurs freely with activities, it does not occur with achievements, and when it occurs with accomplishments, it forces an activity/non-telic reading on the predicate. Again (40d) does not entail that the book was read.

- (40)a. Bill spent twenty years believing in Marxism. (*state*)
 b. John spent half an hour running. (*activity*)
 c. #Bill spent half an hour arriving. (*achievement*)
 d. Mary spent twenty minutes reading a book.

1.2.2.2 Punctually locating expressions: “at α time”

The punctually locating expression *at α time* gives an event a temporal location at a particular point in time, and discriminates between aspectual classes in such a way as to classify states and achievements together. This is demonstrated in (41):

- (41)a. At that moment, John believed in miracles. (*state*)
 b. Mary was happy at midnight. (*state*)
 c. John ran at 9 p.m. (*activity*)
 d. The guest arrived at midnight. (*achievement*)
 e. #Mary painted a picture at midnight. (*accomplishment*)

States can occur with *at α time* since they are totally homogeneous, and thus hold at instants, as in (41a and b), and achievements, which are instantaneous changes of states, can also be punctually located, as in (41d). When an activity occurs with a punctual adverb, the effect is to assert that the activity **began** at the temporal point given, presumably since this is the only privileged instantaneous event available. (41c) has only the reading that John began to run at 9 p.m. Accomplishments do not have even this reading.

1.2.2.3 *Adverbials which locate the end of eventualities:
“in α time” and “take α time”*

These place an eventuality within a temporal period of a certain size (Dowty 1979), although for Gricean reasons, the sentence carries a scalar implicature that the measure of the eventuality is equal to the temporal period stated. Thus *in an hour* locates the eventuality it is predicated of within a particular period of an hour by locating the end of the event as being within an hour, with the hour measured from a contextually determined point. The scalar implicature is that, unless otherwise indicated, the whole of the hour period is relevant, i.e. that the endpoint of the eventuality is just within the hour. These adverbials apply naturally to telic VPs, accomplishments and achievements, since these are the events which have endpoints to be located. They have derived readings with some states and activities, as in (42a and c):

- (42)a. John was happy in an hour. (*acceptable on an inchoative reading*)
- b. *John pushed the cart in an hour.
- c. John ran in an hour. (*acceptable with an understood specified distance*)
- d. The critic noticed the picture in a few minutes.
- e. Dafna fell asleep in ten minutes.
- f. Mary painted a picture in an hour.
- g. Dafna read a book in twenty minutes.

With the achievements and accomplishments in (42d–g), which are acceptable, the adverbial locates the telic point of the eventuality at (or very near) the end of the time period specified. Since achievements, as in (42d and e), consist only of an telic point, this is equivalent to asserting that the achievement event happened at the end of the relevant time period, and the time period itself begins, or is counted from, some contextually specified point. With the accomplishments in (42f and g), the whole event must be located within the hour period. Thus we have the entailment in (43), which holds for accomplishments and not for achievements (Dowty 1979, p. 59):

- (43) x *P-ed in α time* ENTAILS x *was P-ing during α time*.

Thus (44a) is valid, but not (44b) or (44c):

- (44)a. Dafna read that book in twenty minutes $\rightarrow$ Dafna was reading that book during twenty minutes.
- b. Dafna fell asleep in ten minutes $\rightarrow$ Dafna was falling asleep during ten minutes.
- c. The critic noticed the picture in a few minutes $\rightarrow$ The critic was noticing the picture during a few minutes.

Achievements may be preceded by a preparatory activity, but this is not a lexical entailment. Thus (44b) is true if there was an activity of dropping

gently off to sleep which took ten minutes, but it can also be true if Dafna sang songs loudly for ten minutes and then suddenly lay down, shut her eyes, and fell asleep. This contrasts with (44a) where the activity entailment is lexically determined. (44c) cannot have a preparatory activity associated with it, because an event of “noticing” is by definition an event which “happens” to you without an associated preparatory activity.

Usually, although not necessarily, the beginning point of the hour is calculated from the beginning of the activity. Thus (45a) and (45b) can be true of the same review, depending on whether the contextually relevant point for determining the beginning of the time period is the beginning of the writing event (as in 45a), or some other point such as when I got the request to write the review (in 45b):

- (45)a. I wrote that reader’s report in a week.
- b. I wrote that reader’s report in two months.

Activities cannot normally occur with *in α time* as (42b) showed, unless the eventuality is given a contextually telic reading. Thus (42c) is acceptable if *run* is interpreted as “run a specified distance,” and then it means that this telic running event began and ended within the hour. States are non-telic. The only reading available for (42a) is one in which the state has been given an inchoative/achievement reading, meaning “begin to be happy,” and the sentence asserts that John’s happy state started within the hour. (46) shows that the verbal expression *take α time* works essentially the same way as *in α time*, again with the initial point of the time period contextually determined:

- (46)a. It took John an hour to be happy (again).
- b. *It took John an hour to push the cart.
- c. It took John an hour to run.
- d. It took the critic a few minutes to notice the picture.
- e. It took Dafna ten minutes to fall asleep.
- f. It took Mary an hour to Mary paint a picture.
- g. It took Dafna twenty minutes to read that book.

(46a) has only the inchoative reading, (46b) is infelicitous, and (46c) is felicitous only on the same telic reading as is available for (42c). (46d–g) are all felicitous, but only the last two entail that a particular activity was going on during the stated period. I shall return to the distinction between achievements and accomplishments with respect to these tests in the beginning of chapter 2.

1.2.2.4 *Complementation with aspectual verbs: finish vs. stop*

Finish occurs with eventualities which are dynamic ([+stages]) and a telic point. It thus occurs naturally with accomplishments. It occurs with activities only to the degree to which these can be given a telic reading contextually, and it does not occur with either of the [–stage] predicates. States and activities occur with

stop. If an accomplishment occurs with *stop*, the implication is that the eventuality was interrupted and the telic point was not reached. Achievements occur with neither, and as they are over as soon as they have begun, they cannot be stopped (or interrupted), and since *finish* also requires its complement to denote an eventuality with duration, they cannot occur with *finish* either.

- (47)a. John stopped/*finished being happy.
- b. John stopped/?finished running.
- c. *The critic stopped/finished noticing the picture.
- d. *The guest stopped/finished arriving.
- e. Mary finished/stopped painting the picture.
- f. Dafna finished/stopped reading the book.

Dowty (1979) points out that achievements like *find* are acceptable as complements of these aspectual matrix verbs if there is a “well-defined procedure” associated with the achievement; for example, a librarian might say to her assistant:

- (48)a. Have you finished finding those books?
- b. Why have you stopped finding those books?

We will come back to Dowty’s example and other related cases in chapter 5.

1.2.3 Semelfactives

It has often been pointed out that there is another class of eventualities, called semelfactives. In particular, these are discussed in Smith (1991) and are the type of eventuality exemplified in (49):

- (49)a. John kicked the door.
- b. Dafna winked.
- c. Mary coughed.

Smith argues that these events are “conceptualized as instantaneous” (1991, p. 29) like achievements, but they seem to be atelic. That they are instantaneous (or punctual) is indicated by the fact that they occur with *at α time* as in (50):

- (50) John coughed/winked at 10 p.m.

They are argued to be atelic since, unlike achievements such as *die*, *break the glass* and *arrive*, they do not seem to bring about an explicit change of state.

Semelfactives are a problem for the kind of theory of aspectual classes we have been presenting here. First, a theory that deals with features should be uncomfortable with five aspectual classes. Our two features [$\pm$ telic] and

[±stages] gave us four classes. A third feature would give us eight classes. A fifth class is thus a problem for a feature-based theory. Secondly, if we try to analyze semelfactives in terms of the features we already have, they should come out as [–telic] and [–stages], which would make them identical to states. While analysis via the features that we have reveals interesting properties about the other four verb classes, they do not give an insightful account of semelfactives. In chapter 8, I shall look at the problem raised by semelfactives in detail; here we will briefly look at how they relate to the data in (16).

Semelfactives have a natural place as the minimal event types of activities. As far as I know, every semelfactive has a homonym which is an activity, and indeed this seems to be the fact which has led people to assume that semelfactives are not an independent class. So while we have the data in (50) indicating that semelfactives are punctual, we also have the examples in (51) and (52) in which the same lexical items behave as activities.

- (51)a. John kicked the door for half an hour.
- b. Dafna winked (furiously) for several minutes.
- c. Mary coughed for the ten remaining minutes of the lecture.
- (52)a. John was kicking the door.
- b. Dafna was winking.
- c. Mary was coughing.

Note that in the progressive examples in (52), activity-type entailments hold. Each progressive activity in (52) entails the corresponding simple past sentence in (49). Since activities have minimal, non-homogeneous event parts, the natural conclusion is that semelfactives are activities used in this minimal way. We assume that this is why they do not have an independent feature classification, and return to this issue in chapter 8.

1.3 Can Verbs, as Opposed to VPs, be Aspectually Categorized?

One of the central questions in the theory of aspectual classes is whether verbs should be aspectually classified at all, or whether aspectual classification should apply only to Verb Phrases. (Here, VP covers both VPs and V's: on the assumption that adverbial modifiers are the daughters of VP, they must be sensitive to the aspectual properties of the V+complement which form V' level.) The *prima facie* evidence that only non-lexical verbal projections can be categorized is that the same verb may head VPs with different aspectual properties. We have already seen several ways in which verbs look as if they move between aspectual classes, but it is worthwhile itemizing the different problems: (i) cases where the aspectual properties of the VP are determined by the internal structure of the direct object; (ii) cases where the aspectual properties are

determined by the presence or absence of a modifier/non-subcategorized complement; (iii) cases where contextual factors seem to force a re-analysis; (iv) cases where the subject is plural; and (v) cases where the tests we have used above just don't seem to work.

(i) The first case includes the examples discussed originally in Verkuyl (1972). Verbs traditionally called accomplishments head VPs which are either telic or atelic depending on the properties of their direct object/theme. Thus, tests for telicity show that verbs like *write*, *build* and *eat* are telic when their theme arguments have definite, quantified or numerical determiners and are atelic when the same argument is a mass noun or a bare plural. Activity verbs with direct object themes do not show such an alternation:

- (53)a. John ate a sandwich/three sandwiches/every sandwich/the sandwiches in ten minutes.
- b. *John ate a sandwich/three sandwiches/every sandwich/the sandwiches for ten minutes.
- c. *John ate sandwiches/bread in ten minutes.
- b. John ate sandwiches/bread for ten minutes.
- (54)a. *John pushed a cart/three carts/every cart/the cart in ten minutes.
- b. John pushed a cart/three carts/every cart/the cart for ten minutes.
- c. *John pushed carts/granite in ten minutes.
- d. John pushed carts/granite for ten minutes.

(ii) The second case includes activity verbs which head an accomplishment VP if some complement or XP other than the direct object is added under V'. Striking cases are examples such as (55) where path arguments have been added to both intransitive and transitive activities respectively, and (57) and (58) where a resultative predicate forces an accomplishment reading on a predicate headed by an activity. (56) shows that a path argument forces a telic reading only if the path is bounded:

- (55)a. John ran for hours/*in an hour.
- b. *John ran to the store for hours.
- c. John ran to the store in an hour.
- d. Mary pushed the cart for hours/*in an hour.
- e. *Mary pushed the cart to the store for hours.
- f. Mary pushed the cart to the store in an hour.
- (56)a. John ran along the street for hours/*in an hour.
- b. John ran to the end of the (very long) street *for hours/in an hour.
- (57)a. Mary hammered the metal for an hour/*in an hour.
- b. Mary hammered the metal flat *for an hour/in an hour.

- (58)a. Bill sang for an hour/*in an hour.
- b. Bill sang the baby asleep *for an hour/in an hour.

Note also that in cases like (55), (57) and (58), the derivation of the telic reading is dependent on the theme argument being quantized, as in any accomplishment. Thus (55c/57b/58c) contrast with (59):

- (59)a. John pushed carts to the store *in an hour/for an hour.
- b. Mary hammered metal flat *in an hour/for an hour.
- c. Bill sang babies asleep *in an hour/for an hour.

(iii) In some cases, context causes a verb to be interpreted as if it belongs to a different aspectual class. A classic example is (60), where context allows the activity verb *run* to be interpreted as a telic predicate with the meaning “run the specified distance,” and so appear with the telic modifier *in α time*.

- (60) *Context:* we know that Jan is a marathon runner and that last Sunday there was a marathon in Amsterdam.
He says: “Last Sunday I ran in 2 hours and twenty minutes.”

These kinds of example, which we saw in (42c) and (46c), have been called instances of “coercion”: the modifier *in α time* forces an interpretation of the verbal predicate as telic. Unlike cases like (55a), the context makes such an interpretation available.

(iv) The examples in Sections (i)–(iii) above are cases where the shift is between activity and accomplishment. A well-known shift between achievement and activity is caused by plural subjects as in (61), noted in Verkuyl (1972):

- (61)a. *John discovered this village for years/all summer.
- b. Tourists discovered this village all summer.

(v) There are a variety of other cases where the tests used above seem to be suspect. Similar to (61), verbs “suddenly” appear in constructions where we would expect them to be impossible. Zucchi (1998) discusses a number of such cases, including statives which appear in the progressive, as in (62a and b), and accomplishments (with quantized objects) which are atelic, as in (62c). Another well-known example is that of achievements which appear in the progressive with either a “normal” reading (see Verkuyl 1989, Mittwoch 1991, Smith 1991), or a “slow motion” reading, first noted, I believe, by Sandro Zucchi. These are illustrated in (62d and e). And then there are statives which acquire an inchoative/achievement reading, as in (62f):

- (62)a. John is resembling his father more and more recently.
- b. I think I am understanding you.

- c. Bake the cake/Cook the soup on a low heat for an hour.
- d. Our pizza is arriving!
- e. Mary is finally noticing that John has shaved off his beard.
- f. She was ready in five minutes.

The combined effect of these examples is to convince some linguists that there is no real distinction between verbs in different aspectual classes. Maybe the most notable in this group is Verkuyl (1972, 1993), who argues that aspectual distinctions should all be calculated at least at the level of the VP. Verkuyl (1972) argues that most of the alternations described above are the result of the interaction between the V and its complement, although the data in (61) indicate that aspect is properly a property of sentences and not of VPs. Verkuyl (1993) claims that even if aspectual classes can be distinguished at the verbal level and verbs can be classified aspectually, this is simply not relevant for explaining the aspectual properties of sentences. Verkuyl develops a theory in which the crucial distinction is between telic and atelic. There is a bivalent classification of verbs into [$\pm$ ADD-ON], essentially [$\pm$ dynamic], and a parallel division of nominals into [$\pm$ Specified Quantity (SQA)]. Telicity results when a verb which is [+ADD-ON] combines with an argument which is [+Specified Quantity]. Various technical glitches need to be accounted for, such as the fact that [+SQA] verbs are atelic if they have no direct object. But Verkuyl runs into difficulties with transitive activity verb phrases such as *push the cart* which are clearly dynamic and thus [+ADD-ON], with a [+SQA] nominal, but which are none the less atelic. He argues that this is because *push* has incorporated its presumably [-SQA] direct object, and should be paraphrased as *give pushes to*; its surface direct object cannot then affect its telicity. (Note that Verkuyl would also have to assume two verbs *push*, one derived from *give pushes to* which would allow an activity reading, and another derived from *give a push to* which would allow the semelfactive reading.) But this approach cannot explain transitive activities such as *entertain*, where the verb cannot have incorporated a direct object since the relevant nominal is *entertainment*, which is derived from the verb itself. Then there are verb phrases such as *wipe the table* which are ambiguous between the telic and the atelic reading, but where there is presumably only one verb, and activities such as *hammer* where the incorporated argument is intuitively the instrument and not the direct object at all. The impossibility of generalizing the explanation leads us back to the task of clarifying what these transitive verbs have in common which allows the atelic reading with a quantized direct object, in other words exploring what an activity, or an activity reading, is.

Other linguists have been more open to the idea that an aspectual classification of verbs may be useful, without diminishing the significance of the data in (53–62). Krifka (1986, 1989, 1992, 1998) has attempted to make explicit the relation between a verb and its object which allows the telicity (or quantization) of the VP to be dependent on the properties of the nominal rather than the verb. He argues that accomplishment verbs which display the alternation in

(53) have a **gradual** relation with their patient argument. This means that the denotation of the patient argument is involved incrementally in the event denoted by the verb: we assign a part structure to the event and a part structure to the patient participant and as the running time of the event grows bigger, the proportion of the patient involved in the event will increase too. Thus the degree to which the sandwich is eaten (= the extent of the sandwich physically involved in the eating event) will grow incrementally as the event continues, and the extent of the sandwich will thus determine how long the *eat a sandwich* event continues. When there is no more sandwich left, the event will stop. By contrast, no property of the cart determines the extent of an event in the denotation of *push the cart*. Krifka thus attempts to make precise the intuition discussed in Verkuyl (1972), Dowty (1991), Tenny (1987, 1994), and others, that in telic accomplishments the **extent** of the theme argument (Dowty's 1991 expression is "incremental theme") determines the extent of the event. I will discuss problems with Krifka's theory in chapters 4 and 6; what is relevant at the moment is his claim that it is possible to give a coherent account of the activity/accomplishment distinction, while still recognizing the alternation in (53–8) as a real one. In Krifka's theory, the accomplishment/activity distinction is an aspectual distinction between those predicates which allow a patient argument to determine the extent of the eventuality in their denotation and those which do not, and I agree with him that this constitutes a genuine distinction between the two kinds of verbal predicates – although we will disagree about how the patient determines the extent of the event. This kind of theory makes space both for the validity of the aspectual classification of verbs and for the statement of why the same verb may head VPs with different aspectual properties. As Krifka (1998) shows, PPs such as *to the store*, can also indicate an incremental measure on an event. In *push the cart to the store*, it is the quantized property of the PP which determines the endpoint of the eventuality and makes it telic. Since different classes of verbal predicates interact with modifiers in different ways, an aspectual classification of verbs may also make predictions about what kinds of modifiers will affect the telicity of VP. So the data in (16) should not be interpreted too crudely. The opposition between activities and accomplishments is not that the first is atelic and the second telic, but a much finer opposition: an activity does not have a telos determined by its relation with its arguments, whereas an accomplishment may have a telic point determined by the verb's relation with its theme.

To sum up: I am going to argue that verbs can be classified into verb classes, that this classification reflects the properties of the events in their denotation, and that it can be used to make predications about how verbs from particular verb classes interact with arguments and modifiers. So "state," "activity," "achievement," and "accomplishment" will be properties of verbs. Telicity and atelicity, however, will be properties of VPs, and it will be a characteristic of a particular verb class that it allows telicity or atelicity to be determined in one way but not another. *Build a house* and *build houses* are, respectively, telic

and atelic VPs headed by an accomplishment verb, and *run to the store*, or *run a mile* are both telic VPs headed by an activity verb. Contrary to what is often assumed, and to what is implied in (16), telicity is not a property which is appropriately ascribed to verbs.

I shall argue that in addition to the aspectual effects of VP modification, a theory of lexical aspect must consider shifting operations which shift a verbal meaning from one class into another, or more precisely, build new verbal meanings which incorporate the original verb meaning into a new structure with the aspectual characteristics of a different verbal class. This operation of aspectual shift is analogous to the type-shifting operation which shifts syntactic expressions from one type to another, from the type *d* (of entities) into the type $\langle d, t \rangle$ (the type of one-place predicates) or into the type $\langle \langle d, t \rangle, t \rangle$ (the type of generalized quantifiers). I shall argue that the aspectual class of the verb determines what shifting operations it may be input to, and in what contexts. The data in (16) makes predictions as to what shifting operations should be straightforward. The shift from achievement to accomplishment should be relatively natural since both sets of event types are telic, and differ with respect to dynamicity. The shift from activity to accomplishment should also be natural, since activities and accomplishments share the feature [+stages], but differ with respect to the telic feature. We will discuss instances of both kinds of shifting operation in chapters 2 and 3 respectively. Shifting from a state to an accomplishment should be much less natural since states differ from accomplishments in both features. States can naturally be shifted to inchoative readings though, as we saw in (62f): inchoatives are essentially achievement readings, and states and achievements are both [–stages], although they differ in terms of cumulativity. But rather than taking these predictions too strictly, I shall show that aspectual shift operations, like type-shifting operations, must preserve the information conveyed by the original predicate. This strong constraint on the operations will guarantee the “naturalness” constraints implied by (16).

The discussion in this book will focus in particular on the semantics of accomplishments. I shall examine in depth the ways in which achievements can be incorporated into accomplishment meanings and used in the progressive, and the ways in which activities can be incorporated into accomplishment VPs through the resultative construction. I’ll argue that these kinds of movements do not blur aspectual distinctions but make use of them: for example, the meaning of progressive achievements is sufficiently different from “normal” progressive accomplishments that the construction strengthens – rather than weakens – our conviction that achievements and accomplishments are different. I shall use the analyses of both the progressive achievements and the resultative constructions as a basis for developing a semantic analysis of accomplishments, and show how this allows an account of the interaction between accomplishment verbs and telicity. This whole discussion will be the basis for re-evaluating the data in (16) and re-analysing the structure of the system of aspectual class.

How to represent the aspectual properties of verbal classes is a question which will be discussed at length in the course of the book. For heuristic reasons, I begin by assuming the following templates for verb meanings.

(63) **Verb class templates**

- | | |
|--------------------|---|
| a. States | $\lambda e.P(e)$ |
| b. Activities | $\lambda e.(DO(P))(e)$ |
| c. Achievements | $\lambda e.(BECOME(P))(e)$ |
| d. Accomplishments | $\lambda e.\exists e_1\exists e_2[e=\sup(e_1\sqcup e_2) \wedge (DO(P))(e_1) \wedge Cul(e)=e_2]$ |

These are approximate reconstructions of Dowty's (1979) verbal templates, translated into an neo-Davidsonian theory of verb representation, in which verbs are predicates of events and thematic roles denote functions from events into their participants. (These templates, however, make reference only to the properties of the verbal predicate, and not to any arguments.) In these representations, P is a variable over the idiosyncratic content of particular lexical items. (63a) represents states as consisting of bare event predicates. (63b) represents the meaning of activities as an bare event predicate under the scope of a DO operator, while (63c) represents the meaning of an achievement as a bare event predicate under the scope of a $BECOME$ operator, in an attempt to capture Dowty's intuition that an achievement is a near-instantaneous change of state from a state in which x has the property $\neg P$ to a state in which x has the property P . Accomplishments are represented as complex event predicates constructed by summing an activity and a culmination or telic point, where we assume that $cul(e)$ is also a near-instantaneous event. The superscript ^s indicates that unlike the summing operation used in the formation of plural entities (Link 1983, Lasersohn 1992, Landman 2000), the summing operation involved here forms a singular entity.

These representations are heuristic devices which attempt to capture the basic relations between the aspectual groups. They are not explanatory, since we do not know what "BECOME" means or how "DO" captures the crucial properties of activities (or even what these properties are). For example, although the use of DO implies that both activities and accomplishments are agentive, this is clearly not the case, as Dowty points out. However, these definitions are sufficiently usable to get us through the first part of the book, until we can reconsider matters.

Chapter 2

Progressive Achievements

2.1 Introduction

In this chapter I look at a use of the progressive which has puzzled linguists considerably, as the analysis of aspectual classes presented in chapter 1 predicts that it ought not to be possible. The problem concerns the use of achievement verbs in the progressive. Since achievement verbs denote eventuality types which are near instantaneous and which are over as soon as they have begun, they ought to be incompatible with the progressive mode which asserts that an event is “in progress,” and which we expect to be restricted to activities and accomplishments. But, achievements do occur in the progressive and an account of how this happens throws light both on the structure of achievements and on the structure of accomplishments.

The received wisdom has always been that achievement verbs cannot occur in the progressive. Proof of this is the relative unacceptability of examples such as (1):

- (1)a. #Jane is reaching the summit of the mountain.
- b. #Mary is spotting her friend at the party.

However, it has long been noticed that there are many achievement verbs which are fine in the progressive, as the examples in (2) indicate, with the comparison between (2f) and (1a) indicating that modification may improve an otherwise unacceptable progressive.

- (2)a. Susan was arriving at the station when she heard that trains to Jerusalem had been cancelled because of the state of the line.
- b. Dafna is finding her shoes.
- c. Fred and Susan are finally leaving.
- d. The old man is dying.
- e. The plane is landing.
- f. Jane is just reaching the summit. (cf. 1a)

The examples in (2) all have a “normal” progressive reading, by which I meant that they don’t seem any different from the accomplishment progressives in (3):

- (3)a. Dafna is painting a picture.
- b. Mary is building a house.

There is also a reading of progressive achievements which makes sentences such as (1b) acceptable. These are what have been called “slow-motion” or “film-strip” readings, first noticed by Sandro Zucchi, where a normally instantaneous event is perceived as being “stretched” over time. I’ll return to these in the last section of this chapter, but mostly what we will be interested in here is how progressive achievements like those in (2) are possible.

The central problem is that, given the aspectual characterization of verb classes in chapter 1, progressive achievements should be impossible. Progressive VPs are understood as denoting eventualities in progress, which occur at an interval, over time; this means that it should not be possible to use the progressive operator with achievements, which according to the characterization we gave in chapter 1, do not occur over time, but are near-instantaneous. Dowty (1979) characterizes achievements as typically not occurring in the progressive. He cites exceptions such as *find* as in *the librarian is finding the book*, but suggests that this is because *finding* here is associated with a “well-defined procedure.” This explanation can’t account for all the examples in (2), although it turns out to be a special case of the more general explanation I offer below.

Possible solutions to the problem raised by the examples in (2) have been that achievements really are just disguised accomplishments with a very short activity period which is “activated in the progressive” (Verkuyl 1989) and that achievements essentially shift into an accomplishment reading in the progressive (Mittwoch 1991). Both these accounts imply that accomplishment and achievement verbs should show the same behaviour in the progressive, and I shall show below that this is not true. Smith (1991) suggests that progressive achievements focus on “detachable” preliminary stages of the achievement (see also Kamp and Reyle 1993). I shall argue that the intuition behind this statement is right and I propose a semantic account of what underlies it: while the progressive does not treat the achievement as a special kind of lexical accomplishment verb, it does trigger a type-shifting operation which results in an accomplishment being derived from the achievement. This will explain how achievements can occur in the progressive and why they have many of the properties that they have. The operation will allow progressive achievements in too many cases, and I shall argue that we need to know more about the incremental structure of accomplishments before we can explain what constraints there are on using the type-shifting rule.

2.2 Progressive Achievements and the Imperfective Paradox

The first crucial piece of evidence about progressive achievements is that they introduce the imperfective paradox. As we saw in chapter 1, telic accomplishments can be distinguished from atelic activities because accomplishments induce the imperfective paradox in the progressive whereas activities do not. Thus we have the contrasts in (4):

- (4)a. Neta is/was running ENTAILS Neta ran.
- b. Dafna is/was singing ENTAILS Dafna sang.
- c. Mary is/was building a house DOES NOT ENTAIL Mary built a house.
- d. Jane is/was writing a paper DOES NOT ENTAIL Jane wrote a paper.

The following “interruption” scenarios demonstrate this:

- (5)a. Mary was building a house when the council took away the permit, so she didn’t build it.
- b. Jane was writing a paper on achievements when her analysis collapsed, so she never wrote it.

The contrasts in (4) are because the homogeneity of atelic activities allows the entailment in 1:(26), repeated here (ignoring minimal activity events) while accomplishments do not:

- (6) x is (now)/was P-ing ENTAILS x has P-ed.

Accomplishments induce the imperfective paradox because proper parts of a P-event are not themselves P-events. We can take this as evidence of the **incremental structure** of accomplishments. Much of this book is about the nature of incrementality, but for a starting point, the following definition will do:

- (7) An event e in the denotation of P has an incremental structure (is incremental) iff the stages of e are not themselves in the denotation of P .

Having an incremental structure is not equivalent to being quantized because of the reference in (7) to proper parts or stages. Accomplishments which are quantized and have stages are incremental, while activities (which have stages but are not quantized) and achievements (which are quantized but do not have stages), are both non-incremental.

“Imperfective paradox” is an odd name for the phenomenon in (5): there is nothing paradoxical about a telic event not allowing the entailment in (6). The paradox lies elsewhere: a progressive asserts that a part or stage e of a P-event is going on, where e may be a proper part of the completed event. However, if

P is incremental, how can we assert that e is a stage of a P-event if the P-event itself is not over and if it may be interrupted before its telic point is reached? In other words, if e is not itself a P-event, on what basis can we assert that it is a stage of one?

When achievements occur in the progressive, we get the same imperfective paradox as with accomplishments:

- (8)a. He was dying of disease X when they discovered the new wonder drug (so he didn't die of disease X).
- b. The plane was landing when it exploded in midair (so it didn't land).
- c. Jane was just reaching the summit when there was an avalanche (so she didn't reach it).

This means that here too the progressive VP *ing*+VP denotes a set of intermediate stages related to a telic point and that the occurrence of these stages is not enough to guarantee that the telic point is reached – in other words, that the progressive VPs in (8) denoted event-types with incremental structures. This is enough to convince us that, whatever our analysis of progressive achievements, they involve accomplishment-type structures rather than activity type-structures. But if achievements are near-instantaneous events, as we argued in chapter 1, then where do these intermediate stages and incremental structures come from?

An obvious hypothesis is that achievements are just like accomplishments, and they consist of an activity part and a telic point which is the BECOME-event, or change of state, indicated in the template in chapter 1:(63c). In other words, achievements do not have the structure in 1:(63c), repeated here as (9a), but instead they have the structure in (9c), in which the achievement meaning is pushed into the accomplishment template:

- (9)a. $\lambda e.(\text{BECOME}(P))(e)$ (achievement=1:(63a))
- b. $\lambda e.\exists e_1\exists e_2[e=\text{S}(e_1\sqcup e_2) \wedge (\text{DO}(P))(e_1) \wedge \text{Cul}(e)=e_2]$ (accomplishment=1:(63d))
- c. $\lambda e.\exists e_1\exists e_2[e=\text{S}(e_1\sqcup e_2) \wedge (\text{DO}(P))(e_1) \wedge (\text{BECOME}(P))(e_2) \wedge \text{Cul}(e)=e_2]$

Verkuy1 (1989) holds this view, arguing that achievements are really accomplishments with very short activity periods which can be “activated” in the progressive. Mittwoch (1991) argues for a milder version: she holds that achievements are basically different from accomplishments, but that the meaning of the achievement can be pushed or stretched into an accomplishment type meaning. Any version of the claim that achievements really are accomplishments or acquire accomplishment readings in the progressive predicts that they should behave exactly like accomplishments in the progressive. I show in the next section that, despite the similarities with respect to the imperfective paradox, this is not the case.

2.3 Achievements are not Accomplishments

2.3.1 Temporal modification

We already saw in chapter 1 that accomplishments and achievements interact differently with temporal modifiers, and I won't repeat that discussion here. But there are some additional points worth making in the context of the argument that achievements and accomplishments are genuinely distinct, as with the structures in (9a,b).

First, there are some accomplishments which occur with durational expressions such as *for α time* and *spend α time P-ing*. This forces a non-telic reading on the accomplishment, which behaves as an activity. This is never possible with achievements (unless the verb meaning is interpreted as iterative.) We have the contrasts in (10) and (11), with (10c,d) and (11c,d) interpreted as non-telic and not entailing that the picture was painted (and completed) or that the book was read to the end.

- (10)a. #The guest arrived for twenty minutes.
- b. #Ella reached the top of the/a hill for an hour.
- c. Neta painted a picture for an hour.
- d. Dafna read a book for an hour.
- (11)a. #The guest spent an hour arriving.
- b. #Ella spent an hour reaching the top of the hill.
- c. Neta spent an hour painting the/a picture.
- d. Dafna spent an hour reading a book.

If we assume that the activity reading can be forced on the accomplishment because it has an activity subevent, then (10a,b) and (11a,b) indicate that achievements do not have an activity subevent. In chapter 4 we will discuss why an atelic reading cannot be forced on predicates like *build a house*.

We saw in chapter 1 that achievements, but not accomplishments, occur with the punctual expression *at α point in time*, and there is nothing to add here. But there is more to say about expressions which locate the telic point of an event, such as *in α time*, which occur with both achievements and accomplishments, as in (12):

- (12)a. The guest arrived in an hour.
- b. Ella reached the summit in an hour.
- c. Neta painted a picture in an hour.
- d. Dafna read a book in an hour.

The adverb locates an eventuality within a certain period and a scalar implicature suggests that the telic point occurred at the end of that hour. With accomplishments, the beginning point of the hour is identified either as the

beginning of the accomplishment or some other contextually relevant point which precedes the accomplishment. Thus both (13a) and (13b) can be truthfully said about the same reader's report, if in (13a) the beginning of the two days is identified as the beginning of the writing event, while in (13b) the beginning of the three months is identified as a contextually relevant point preceding the eventuality, say the day when I got the request to write it.

- (13)a. I wrote that reader's report in two days.
- b. I wrote that reader's report in three months.

Since accomplishments have an activity subevent, the entailment in (14) (=1:(42)) holds:

- (14) x *P-ed in α time* ENTAILS x *was P-ing during α time*.

As Dowty points out, this entailment does not hold for achievements, indicating that they do not have an activity subevent however small. The contrasts are given in (15):

- (15)a. John painted a picture in an hour ENTAILS John was painting a picture during that hour.
- b. The helicopter landed in an hour DOES NOT ENTAIL The helicopter was landing during that hour.

In "real life," it may be hard to imagine an achievement event or telic point without a preparatory activity, but crucially with accomplishments the preparatory activity is given lexically, whereas with achievements it is a defeasible, contextual inference. Suppose you have access to a genie such as the one that came out of Aladdin's lamp, who can perform activities in a flash. Both examples in (16) are acceptable, but while (17a) is fine, (17b) is contradictory, as the implications of *in a flash* (namely that there was no preceding activity) contradict the implications of *in a few minutes*:

- (16)a. The genie arrived in a flash
- b. The genie painted a picture in a flash.
- (17)a. The genie arrived in a few minutes in a flash.
- b. #The genie painted a picture in few minutes in a flash.

We can make this difference in the internal structure of achievements and accomplishments show up clearly by paraphrasing (12) using *after* and *before* (Piñon 1997 also makes this point). While the semantics of *in an hour* locate the telic point within an hour, the pragmatic effect of a scalar implicature is to place the telic point just within that hour. While *V after an hour* and *take an hour before V-ing* have similar scalar implicatures, implying that an eventuality

occurred just at the end of an hour, they locate the **beginning** of the eventuality just after the hour is over. Given that practically speaking we often do not distinguish between the moment which is just within an hour and the moment which is just after it, (18a,b) and (19a,b) naturally paraphrase (12a,b), whereas (18c,d) and (19c,d) do not:

- (18)a. The guest arrived after an hour.
- b. Ella reached the summit after an hour.
- c. Neta painted a picture after an hour.
- d. Dafna read a book after an hour.
- (19)a. It took an hour before the guest arrived.
- b. It took an hour before Ella reached the summit.
- c. It took an hour before Neta painted that picture.
- d. It took an hour before Dafna read that book.

With achievement events, which are near instantaneous and over “as soon as they have begun,” there is no practical distinction between locating the beginning of the event and locating the end of the event. In contrast, while (12c,d) locate the telic point of an accomplishment (just) within the hour, (18c,d) and (19c,d) locate the beginning of the accomplishment just after the hour. Given that it is a lexical property of accomplishments that they have an activity subevent which must by definition have a duration, an assertion which locates the starting point of the eventuality cannot be a paraphrase of an assertion which locates its telic point at approximately the same time.

2.3.2 Progressive achievements are different from progressive accomplishments

Even more important than the data in chapter 1 and in section 2.3.1 above is the quite considerable data that shows that accomplishments and achievements behave very differently in the progressive. First, although all accomplishments are good in the progressive, the contrast between (1) and (2) shows that only some achievements are. The relevant examples are repeated here. Note that while some achievements such as *spot* and *notice* are never acceptable in the progressive, others such as *reach the summit* are improved by the addition of an adverb such as *just* or *finally* as we see from the contrast between (20a) and (20i).

- (20)a. #Jane is reaching the summit of the mountain.
- b. #Bill is noticing that Mary has dyed her hair.
- c. #Mary is spotting her friend at the party.
- d. Susan was arriving at the station when she heard that trains to Jerusalem had been cancelled because of the state of the line.

- e. Dafna is finding her shoes.
- f. Fred and Susan are finally leaving.
- g. The old man is dying.
- h. The plane is landing.
- i. Jane is just/finally reaching the summit.

Note also that all the examples in (20) have a “slow-motion” reading, but that these readings only become prominent in (20a–c), where the “normal” progressive readings are unavailable. Accomplishments never have a slow-motion reading.

Secondly, temporal modification in the futurate progressive shows up differences between achievements and accomplishments. A temporal modifier can always modify the activity part of an accomplishment, but it never temporally locates the telic point, whereas with achievements this is the most natural reading. Compare (21) and (22):

- (21)a. We are eating dinner in half an hour.
- b. I am writing a book in six months.
- (22)a. The plane is landing in half an hour.
- b. We are reaching Tel Aviv Central in five minutes.

In (21), the accomplishment verbs are naturally understood as giving information about when the activities of eating dinner and writing a book will occur, or as asserting that the whole eventuality will occur within the stated time. The achievement verbs have a different natural reading: (22a) naturally asserts that touchdown, the telic change of state, will occur in half an hour from the time of utterance and (22b) that the train will enter Tel Aviv Central in five minutes from now. These readings, in which the telic point of the event is temporally located, are not available with accomplishments; (21a) cannot be used on a futurate reading to say that dinner will be over in half an hour from now, or that the book that I am writing will be written six months from now.

Thirdly, there are no “stops along the way” with achievements (the original observation was made by Fred Landman, personal communication). In other words, a progressive achievement cannot naturally be seen as part of a bigger eventuality. Imagine that I am in Belgium and looking for someone to test the border facilities at the border with the Netherlands. You might say either (23a) or (23b), but they would have different implications:

- (23)a. Mary is running to the Netherlands. In fact she is running to Amsterdam.
- b. Mary is arriving in the Netherlands. In fact she is arriving in Amsterdam.

(23a) is appropriate if you are suggesting that Mary can test the facilities at some point on the Belgium–Netherlands border, with the second sentence

giving the extra information that Mary's running to the Netherlands is a proper part of her running to Amsterdam; first, she reaches the Dutch border and then she carries on to Amsterdam. But (23b) naturally implies that Mary is arriving in the Netherlands by arriving in Amsterdam, and she can check out only the Amsterdam airport. Mary's arrival at the Dutch border is identical to Mary's arrival in Amsterdam, and cannot be seen as a stage of it, whereas Mary's running to the border with the Netherlands can be a proper stage of her running to Amsterdam.

A related difference is that progressive achievements, unlike progressive accomplishments, cannot be modified by "halfway through" (this point emerged from a discussion with Manfred Krifka):

- (24)a. She is halfway through walking to the station.
- b. #She is halfway through arriving at the station.

Furthermore, progressive achievements can be paraphrased as "about to" in non-futurate use (many thanks to G. Cinque for this observation). The examples in (25) have the paraphrases indicated:

- (25)a. The vase is falling → The vase is about to fall.
- b. The train is arriving at the station → The train is about to arrive at the station.

But *Jane is building a house* is not a paraphrase of *Jane is about to build a house*.

Another point is that achievements are very odd in the perfective progressive. Whereas the accomplishment in (26a) is perfectly normal with or without the temporal modifier, (26b) is bizarre, and the addition of a temporal modifier makes the sentences felicitous only as an ironic comment, implying that Fred and Susan have been on the point of leaving for an hour.

- (26)a. She has been cooking dinner (for half an hour).
- b. #Fred and Susan have been leaving.
- c. ?Fred and Susan have been leaving for an hour.

Lastly, with achievements, the activity and the telic point can easily be modified independently. This is not naturally the case for accomplishments, although, as (27d) shows, it can be done. Still, the contrast between (27a,b) and (27c) is sharp and needs to be explained:

- (27)a. John was dying for a long time, but he actually died quickly.
- b. It was very turbulent while the plane was landing, but we (actually) landed smoothly.
- c. #Mary was writing a book slowly, but she actually wrote it quickly.
- d. At one point, Mary was writing her book very slowly, but when it came down to it, she actually wrote it quickly.

To sum up, accomplishments and achievements show differences with respect to temporal modification which imply that they have different aspectual structures. Achievements behave like instantaneous changes of state, whereas accomplishments have inherent duration and include an activity subevent. Achievements cannot be “concealed accomplishments” because of the number of differences between progressive accomplishments and progressive achievements. We would like an account of the progressive to interact with an account of the aspectual distinctions between accomplishments and achievements to explain how these differences occur. In the next section I shall present an account of how progressive achievements are derived which does this.

Before this, though, I want to mention one other account of progressive achievements. Piñon (1997) suggests that progressive achievements are derived by a lexical process which derives a new lexical item from the achievement. Thus *John is winning the race* would make use of a verb *win'* which must mean something like “do an activity which in a short time will lead to winning the race.” But it is extraordinarily difficult to formulate such a word-formation process. It would require each achievement to have an associated verb with an idiosyncratic lexical meaning. Depending on whether the new verb was an activity or an accomplishment, the modality would have to be formulated precisely so as to capture or avoid the imperfective paradox. We would have to explain why the new verb *win'* never appeared except in the progressive. And we would have no way to capture either the patterns in the relation between progressive achievements and the simple achievements, or the systematic differences between progressive achievements and other progressives.

2.4 Deriving Progressive Achievements

Achievements, then, do occur in the progressive, but they do not behave like accomplishments either in the simple or progressive forms. In this section, I develop an account of progressive achievements which explains both these apparently contradictory facts. The theory of the progressive that I will base my account on is that of Landman (1992), which has the double advantage of being event-based (unlike the intensional theory of Dowty 1979) and intensional (unlike the event-based theories of Parsons 1990 and Zucchi 1999).

Landman (1992) analyses the progressive *-ing* as an operator on VPs, as in (28):

$$(28) \quad \text{BE ING}(\text{VP}) \rightarrow \lambda e.\text{PROG}(e, \lambda e'.\text{VP}(e') \wedge \text{Ag}(e')=x).$$

An assertion of the form *x is VP-ing* is true iff there is an event *e* going on which is a stage of an event *e'*, where *e'* is in the denotation of VP. An event *e* is a stage of event *e'* if it develops into *e'*; in this case *e'* is a continuation of *e*. The crucial definitions are in (29):

- (29)a. An event e is a stage of event e' if it develops into e' . Let e be an event that goes on in w at i . Let e' be an event that goes on in w' at j , where i is a subinterval of j . e' is a continuation of e iff e is a stage of e' .
- b. The continuation branch for $C(e,w)$ is a set of pairs of events and worlds which allows you to trace the development of an event stage if it stops in a world.

This works in the following way. *Mary is building a house* is interpreted as an assertion that there is an event e going on in the world w which is a stage of, or is going to develop into, an event e' which is in the denotation of *build a house*. We check the truth value of this assertion by looking for an event in w which looks as if it has the characteristics of an activity of house-building (a “process stage” in Landman’s terminology) and by following the development of the event stage to see if it turns into an e' of the right kind. If, in w , the event stage e develops into an e' in the denotation of *build a house*, then the sentence is true. If e does not develop into an event in which a house gets built but is interrupted, then we jump to the closest possible world where e was not interrupted to see if it develops into an event in the denotation of *build a house* there. The closest world to w is the world w' which is identical to w except for what is necessary to allow e to continue and not be interrupted. If e is interrupted again, we jump to the next closest world, and so on. Eventually, we are in one of two situations: either we have found ourselves in a world in which e has developed into an event in the denotation of *build a house*, and the sentence is judged true, or we find ourselves in a world which is “too far” from the original world for what is going on to be analyzed as a continuation of the original event e , and the sentence is judged false. The progressive is intensional because the completed event e' may occur in a world other than the actual one. The continuation branch defined in (29b) allows us to keep track of the development of the event stage e as we move across worlds, and makes precise the history which allows us to assert that e is a stage of the completed event e' .

Landman gives the meaning of the operator PROG in (30).

- (30) $\| \text{PROG}(e,P) \|_{w,g} = 1$, iff $\exists e' \exists w' : \langle e', w' \rangle \in \text{CON}(g(e), w)$ and $\| P \|_{w',g}(e') = 1$
 where $\text{CON}(g(e), w)$ is the continuation branch of $g(e)$ in w .

The representation of the meaning of *Mary is building a house* is given in (31a), i.e. the sentence is true if there is an event e which stands in the PROG relation with the set of events denoted by MARY BUILD A HOUSE. And following (30), this relation is satisfied iff the event e stands in the relation to MARY BUILD A HOUSE expressed in (31b):

- (31) *Mary is building a house.*
 a. $\exists e [\text{PROG}(e, \lambda e'. \text{BUILD A HOUSE}(e') \wedge \text{Ag}(e') = \text{Mary})]$

- b. $\| \text{PROG}(e, \lambda e'. \text{BUILD A HOUSE}(e') \wedge \text{Ag}(e') = \text{MARY}) \|_{w,g} = 1$ iff
 $\exists e' \exists w': \langle e', w' \rangle \in \text{CON}(g(e), w) \wedge \| \text{BUILD A HOUSE}(e') \wedge \text{Ag}(e') = \text{MARY} \|_{w',g} = 1$

So *Mary is building a house* is true in the actual world iff there is an event e which has an event on its continuation branch for e in w in which Mary actually completes the building of a house.

The crucial element in Landman's theory is the relation **stage-of** as distinct from the relation "part-of." Both relations are partial orderings on the set of events. But the notion of event stage is intimately connected with event development. The part-of relation is dependent only on the idea that events are composed out of identifiable subelements. An event of Susan and Dafna making pancakes has a part which is Susan making pancakes and a part which is Dafna helping to make pancakes. It may also have a part which is Susan listening to the news on the radio, Dafna singing a song, etc. Stages of an event are related more intimately: if e is a stage of an event e' then there must be a sense (which remains at this point pre-theoretic) in which e' is "a more developed version" of e . So Dafna singing a song is not (normally) a stage of *Susan and Dafna make pancakes*. But the event e which runs from 6.30 p.m. to 6.40 p.m. in which Susan and Dafna mix pancake batter is a stage of the event e' which runs from 6.30 p.m. to 6.50 p.m. in which Susan and Dafna mix pancake batter and start to cook pancakes. Both e and e' are stages of the event completed, e'' , which runs from 6.30 to 6.55, where e'' is in the denotation of *Susan and Dafna make pancakes*, which culminates in Susan and Dafna putting a plate of pancakes on the table.

The question is how to identify an event e in this world as being a stage of an event e' in VP, when the event stage e is itself not in VP, and where the completed event e' which is in VP may not be an event in this world. We have already seen that events are not inherently telic or atelic, but are telic or atelic only under particular descriptions. But this means that events are only individuated under particular descriptions – as has been argued independently in Parsons (1990) and Landman (2000); see also the discussion of *sell* and *buy* in Chierchia (1984). Both Parsons and Landman argue that event structure is essentially fine-grained and that a happening going on at a particular interval may be identified as an instance of a number of different events. For example, Parsons argues that a particular movement of a snooker player which knocks two balls into different holes at the same time may be described as either an event of hitting the red ball violently into the side pocket on purpose or an event of hitting the green ball gently into the corner pocket accidentally. This is because we can identify the happening at interval I as having the characteristics of both event types mentioned. Given this, on what basis can we identify an event e as being a stage of an event e' in the denotation of VP, if e does not have the characteristics of the event type denoted by VP?

Landman (1992) identifies **process stages** of an event e as being stages of e which have the characteristics of an activity event. If e is itself an activity

event, then the process stages of e will have the same characteristics as e itself. If e is an accomplishment event, then the process stages of e will be the stages which have the characteristics of the activity component of e . The imperfective paradox follows from this: since process stages of an activity e have the same characteristics as e , then if e is in the denotation of P , a stage of e will also be in the denotation of P , and thus x is or was P -ing will entail that x has P -ed. But since the process stages of an accomplishment e have only the characteristics of the activity subevent of e , an event of x P -ing will entail only that an event with the activity characteristics of a P -event has occurred and not that a P -event itself has occurred.

Drawing out the implications of this, we see that an accomplishment as part of its lexical meaning gives information about what characteristics its activity subevent has, and thus gives information about what kind of event serves as a warrant for a progressive assertion.

We can now look at how progressive achievements work. We need a theory which explains (i) that a progressive achievement induces the imperfective paradox, and (ii) that it behaves differently from lexical accomplishments. Look at an example such as (32):

(32) Mary is arriving at the station.

According to the interpretation rule in (30), (32) asserts that there is an event e going on in the world (w) which is a stage of an event e' which is in the denotation of *arrive at the station*. This makes (32) false, for *arrive at the station* is an achievement and, therefore, cannot have stages. Suppose (32) is true. Intuitively, we must be asserting that there is an event going on which if not interrupted will culminate in Mary's arrival at the station, but unlike with progressive accomplishments, the process stage or activity which warrants this assertion cannot be a stage of an event in the denotation of the punctual *arrive at the station*. So what event is it?

Phrased like this, the event which verifies the assertion in (32) can only be a stage of an event which has as its telic point an arrive-at-the-station event. We posit an aspectual type shifting operation, triggered by PROG, which raises the achievement meaning into an "abstract" or "derived" accomplishment meaning denoting a set of events e , which are the sum of an activity e_1 whose particular properties are lexically unspecified, and a culmination event e_2 which is in the denotation of the lexical achievement. The shift rule is given in (33):

$$(33) \text{ SHIFT}(VP_{\text{punctual}}): \lambda e.(\text{BECOME})(e) \rightarrow \lambda e.\exists e_1.\exists e_2[e=\text{S}(e_1 \sqcup e_2) \wedge (\text{DO}(\alpha))(e_1) \wedge (\text{BECOME}(P))(e_2) \wedge \text{Cul}(e)=e_2]$$

$$\text{or } \text{SHIFT}(\beta)= \lambda e.\exists e_1.\exists e_2[e=\text{S}(e_1 \sqcup e_2) \wedge (\text{DO}(\alpha))(e_1) \wedge (\beta)(e_2) \wedge \text{Cul}(e)=e_2]$$

This raises the denotation of the VP into the structure of an accomplishment whose culmination is given by the lexical VP. The effect on *arrive at the station* is shown in (34):

- (34) SHIFT ($\lambda e.$ ARRIVE AT THE STATION(e) $\wedge$ Th(e)= x)
 $=\lambda e.\exists e_1\exists e_2[e=\textcircled{S}(e_1\sqcup e_2) \wedge (\text{DO}(\alpha))(e_1) \wedge \text{ARRIVE AT THE STATION}(e_2)$
 $\wedge \text{Th}(e_2)=x \wedge \text{Cul}(e)=e_2]$

The denotation of the shifted VP is a set of derived accomplishment events which are sums of an activity and a culmination, where the culmination is in the denotation of *arrive at the station*. The SHIFT operation thus preserves the meaning of the original lexical predicate intact, and uses it as a piece in the construction of a new derived predicate meaning.

The crucial thing about the rule in (33) is that while there are lexical constraints on the culmination event, dictated by the meaning of the original predicate, there is no lexical information about, nor lexically dictated constraints on, the activity and this is captured by the fact that the complement of DO is a free variable α . So, whereas the characteristics which identify the process stages of a lexical accomplishment (or activity) are determined by the meaning of the verb, the characteristics of the process stage of a derived accomplishment are not lexically specified but must be contextually determined. DO introduces no arguments of its own, and is thus a “raising” rather than an “equi” type operator (this is true of Dowty’s DO operator too), and the lexically expressed arguments of the abstract accomplishment are inherited from the lexical predicate. Thus the subject of an abstract accomplishment need not be agentive. If I have ordered pizza to be delivered, then when I hear the familiar motorcycle stop outside our door, I can say “Our pizza is arriving” without ascribing agentive properties to the pizza. The output of the SHIFT rule in (33) is the argument of PROG, as in (35). The denotation of the sentence in (32), *Mary is arriving at the station*, is given in (36a); it is true if there is an event e which stands in the PROG relation to an event e' in the denotation of SHIFT(ARRIVE AT THE STATION) – in other words, if there is an event e' which satisfies (36b):

- (35) $\| \text{PROG}(e, \text{SHIFT}(\text{ARRIVE AT THE STATION})) \|_{w,g} =$
 $\| \text{PROG}(e, \lambda e'.\exists e_1\exists e_2[e=\textcircled{S}(e'_1\sqcup e_2) \wedge (\text{DO}(\alpha))(e_1) \wedge \text{ARRIVE AT THE STATION}(e_2)$
 $\wedge \text{Th}(e_2)=x \wedge \text{Cul}(e')=e_2]) \|$

- (36)a. $\exists e[\text{PROG}(e, \lambda e'.\exists e_1\exists e_2[e'=\textcircled{S}(e_1\sqcup e_2) \wedge (\text{DO}(\alpha))(e_1) \wedge \text{ARRIVE AT THE STATION}(e_2)$
 $\wedge \text{Th}(e_2)=\text{MARY} \wedge \text{Cul}(e')=e_2]).$
 b. $\exists e'\exists w':\langle e', w' \rangle \in \text{CON}(g(e), w) \wedge \| \lambda e.\exists e_1\exists e_2[e=\textcircled{S}(e_1\sqcup e_2) \wedge (\text{DO}(\alpha))(e_1)$
 $\wedge \text{ARRIVE AT THE STATION}(e_2) \wedge \text{Th}(e_2)=\text{MARY} \wedge \text{Cul}(e)=e_2] \|_{w',g}(e')=1.$

In words, *Mary is arriving at the station* is true in world *w* iff there is an event *e* going on in world *w* which has on its continuation branch an event which culminates in an event in the denotation of *Mary arrive at the station*. But, crucially, *e* is not a stage of the arrive-at-the-station event.

The output of SHIFT is an “abstract accomplishment,” in the sense that it has the structure of an accomplishment, but it does not correspond to any lexical item. The only lexical information that we have about it is that its culmination, or telic point, is in the denotation of VP. We will use VP* as the term for the abstract accomplishment derived from a punctual achievement.

2.5 Explanations

Let us see what this account gives us.

First, the imperfective paradox occurs with progressive achievements because the VP input to the progressive operator is the output of the SHIFT rule in (33), namely a complex eventuality consisting of an activity plus telic point. The fact that an activity eventuality which looks like it is going turn into an event in the denotation of VP occurs in world *w* is not enough to guarantee that it does, in fact, turn into an event of that kind in *w*.

Secondly, as (15a) shows, the progressive is not entailed by the simple past.

- (15)a. The helicopter landed in an hour DOES NOT ENTAIL The helicopter was landing during that hour.

This is because the simple past form of the achievement uses only the non-shifted V, and this does not entail anything about an abstract accomplishment VP*.

Thirdly, the telic point of a progressive achievement can be modified independently of the rest of the abstract accomplishment because SHIFT applies to the whole lexical VP, including the achievement and its modifiers, and gives an accomplishment whose telic point is in the denotation of the original VP. Look again at the examples in (27):

- (27)a. John was dying for a long time, but he actually died quickly.
 b. It was very turbulent while the plane was landing, but we (actually) landed smoothly.
 c. #Mary was writing a book slowly, but she actually wrote it quickly.
 d. At one point, Mary was writing her book very slowly, but when it came down to it, she actually wrote it quickly.

In principle, the progressive operator defined in (30) allows for two different event modifications; the *e'* introduced by the lexical VP and the *e* introduced by PROG, which is the maximally relevant stage of *e'*, can be modified independently. However, in the normal case, the properties of completed events are derived from the properties of their stages. (27c) sounds contradictory,

since the maximal activity stage of a past event of the accomplishment *write a book* is the whole activity and if the activity subevent of *write a book* was slow, the entire accomplishment would normally take a long time. Only if we add information which indicates that the activity stage is non-maximal, as in (27d), does the apparent contradiction disappear. This problem doesn't arise with progressive achievements since the event stage introduced by the progressive is a stage of an event in the abstract accomplishment derived from the lexical VP, and not a stage of the event denoted by the lexical VP itself. In (27a), *quickly* lexically modifies the telic point of *die*, and SHIFT applies to the VP *die quickly*. There is no reason to assume a relation between the properties of an activity part of an accomplishment and the properties of its telic point, and thus there is no implication to be defeated, and (27a) is unproblematic. This difference shows up in the following paraphrases:

- (37)a. The activity part of the event which culminated in John's dying was very slow, although the actual death was quick.
- b. #The activity stage in the event of Mary writing a book was very slow, but she actually wrote it quickly.

Fourthly, temporal modification in futurate progressive is explained in the same way. The relevant contrasts are between (21a) and (22a):

- (21)a. We are eating dinner in half an hour.
- (22)a. The plane is landing in half an hour.

I assume that the futurate progressive locates the event stage introduced by PROG in the future. Since the SHIFT rule used in (22a) applies to the VP *land in half an hour*, it will derive an abstract accomplishment with an activity subeventuality which culminates in an event in the denotation of *land in half an hour*. So (22a) means that there is going to be an event which is a stage of an event whose telic point is in the denotation of *land in half an hour*, and the temporal modifier straightforwardly modifies the telic point. In the parallel accomplishment in (21a), the modifier *in half an hour* modifies the lexical accomplishment, and locates the whole accomplishment within half an hour. (21a) asserts that there is going to be an event which is a stage of an event in the denotation of *eat dinner in half an hour*. *In half an hour* can also modify the event stage introduced by PROG in both (21a) and (22a) and for accomplishments this is the most natural reading. (38a) gives the reading when the event stage is modified, and (38b) when the entire accomplishment is modified.

- (38)a. Don't tell them to call in half an hour. We will be eating dinner in half an hour! [the activity event stage will be going on in half an hour]
- b. He will get indigestion tonight! He is eating a five-course dinner in half an hour. [the whole event will take half an hour]

Fifthly, progressive achievements have a natural “about to” paraphrase, as we saw in (25). *The vase is falling* has the natural paraphrase “the vase is about to fall,” while *Mary is building a house* is not naturally paraphrased as “Mary is about to build a house,” since “about to P” implies that no stage of P is yet going on and this contradicts the meaning of the progressive (assuming a normal rather than a futurate use of the progressive). This “about to” paraphrase of the achievement is possible precisely because the activity part of an abstract accomplishment is not part of the eventuality denoted by the achievement. If there is an event going on which is a stage of the eventuality whose telic point is *the vase fall*, then we may indeed say that an event in the denotation of *the vase fall* is about to happen. With a lexical accomplishment, the stage provoking the progressive assertion is already part of the event denoted by the simple VP; it is thus inappropriate to assert that an event in the denotation of VP is about to happen since the accomplishment eventuality is already going on.

Sixthly, we can see now why not all achievements can occur in the progressive. In contrast to the examples discussed, achievements such as *notice* and *spot* do not have natural progressives:

- (39)a. #Dafna is spotting her mother at the party.
 b. #John is noticing that Mary has cut her hair.

These examples are infelicitous for pragmatic reasons. Applying the rule of progressive interpretation to these sentences, we understand them as asserting respectively that there is an event in progress which is a stage of an event culminating in *Dafna spotting her mother* and an event in progress which is a stage of an event culminating in *John noticing that Mary has cut her hair*. But since these events are non-agentive events which “happen” to the subject participant unexpectedly, they do not have preparatory events which can be recognized as stages of an event culminating in a recognition. And since we do not expect such event stages to exist at all, asserting (or denying) that a particular event is an event stage of this kind is infelicitous.

2.6 The Problem of Incrementality

The problem with the account as it stands is that, contrary to what is the case, it predicts that it should be easier to use achievements in the progressive than accomplishments. This is because accomplishments put lexical constraints on what kind of activity stage can be introduced by PROG; it must be an eventuality that has the characteristic properties of the activity part of the accomplishment. In *Mary is building a house* the event introduced by PROG must have the properties of an activity of building a house. However, as (33) shows, SHIFT(VP_{punctual}) puts no constraints on the activity stage in a progressive achievement, and the progressive sentence asserts only that there is an activity

stage of an accomplishment whose telic point is in the denotation of the achievement predicate. This should make it possible for any activity eventuality which ultimately leads into an achievement event to warrant an progressive assertion, but this is not the case. Use of progressive achievements is more restricted than use of progressive accomplishments, not less so. Thus, if Mary has set out on an hour's walk to the station, (40a) is felicitous, but not (40b), although our interpretation rules predict that they should be equally acceptable. There is a basic intuition that (40b) is being used "too soon"; even if this walk is very likely to lead to Mary's arrival at the station, if the telic point is an hour away, then it is too soon to say she is "arriving."

- (40)a. Mary is walking to the station.
- b. Mary is arriving at the station.

The same intuition is behind the judgement that (2f) is better than (1a):

- (1)a. #Jane is reaching the summit of the mountain.
- (2)f. Jane is just reaching the summit.

(2f) is more acceptable than (1a) because we would use the achievement *reach the summit* in the progressive when Jane is almost there. However, the issue does not seem to be simply "closeness" to the telic point, because of examples such as (41), based on the achievement verb *die*:

- (41)a. *Doctor*: "John is dying, but I don't know how long it will take."
- b. From the day we are born we are all dying.

This problem arises from the fact that what we have said so far about deriving an abstract accomplishment from the SHIFT rule in (33) is insufficient. (33) gives the right structure for a derived accomplishment, and it represents adequately the relationship between the achievement and the accomplishment derived from it. However, the eventuality derived via (33) lacks the incrementality normally associated with accomplishments, which is an essential part of an accomplishment meaning.

How are accomplishments incremental? The fact that accomplishments induce the imperfective paradox shows that they are incremental in the weak sense that the predicate which applies to the complete event does not necessarily apply to its parts. But there is also a stronger incrementality which is an inherent part of the meaning of lexical accomplishments and which must be a part of the meaning of derived, abstract accomplishments too. Accomplishments are strongly incremental in the sense that they progress gradually toward their completion. (This is implicit in Landman's 1992 discussion of event stages.) This is reflected in the fact that different stages of an accomplishment have an inherent ordering, by which I mean an ordering dependent on their internal properties and not just on the ordering of their run times. Tenny (1987, 1994),

Dowty (1991), and especially Krifka (1986, 1989, 1992, 1998) have shown how, for classic accomplishments such as *eat the sandwich*, the ordering of the parts of the eventuality are dependent on the relation between the event and its incremental theme. Thus, Krifka shows that if an accomplishment *e* has a thematic relation θ with an incremental argument *x*, then there is a homomorphism between parts of *e* and parts of *x*: distinct parts of *e* stand in the θ relation to distinct parts of *x*, and these can be ordered in terms of the size of the *x* parts. In an event like *eat the sandwich*, the development of the event can be tracked because increasingly larger parts of the event have as their theme argument increasingly larger portions of the sandwich. This incrementality allows the telic point to be identified: the telic point or culmination is reached when the whole sandwich is the argument of the event stage. Krifka (1998) extends this account to cover examples such as *walk from the university to the centre of town* where the incrementality is introduced via a path argument. We make essential use of this kind of incrementality or development in verifying a progressive assertion. Given two activity stages of an event, *e* and *e'*, where *e* is temporally a proper part of *e'*, we allow that the event *e'* is a continuation of *e* if the incremental argument of *e* is a proper part of the incremental argument of *e'*. So, if we follow the continuation branch for a stage *e* of reading *War and Peace* and identify *e* as a proper temporal part of *e'*, also a stage of reading *War and Peace*, *e'* will be a continuation of *e* if the part of the novel which is the theme argument of *e'* is sufficiently larger than the part of the novel which is the theme argument of *e* (where "sufficient" is contextually defined). More pragmatically, incrementality is used implicitly in building a continuation branch. Given two events, *e*₁ and *e*₂, both displaying the process characteristics of *read War and Peace*, with *e*₁ a proper part of *e*₂, deciding whether one is a stage of the other involves an implicit comparison of the theme of *e*₁ with the theme *e*₂ (each theme a part of *War and Peace*), to see if the theme of *e*₂ is bigger than the theme of *e*₁. In Landman's words (personal communication), assuming that an event *e* can in principle be a stage of an infinite number of events in an infinite number of worlds, the theory of the progressive must give you a way to pick out those events which we properly want to assert that *e* is a stage of. His theory makes essential use of the notion of continuation in doing this, and incrementality is an implicit but essential factor in defining continuation. But if incrementality is so essential to the progressive, then the derived accomplishments used in progressive achievements will need to be incremental in an analogous way. The incremental properties of *eat* and *read* may be derived from the gradual relation between the verb and its patient argument, and the incremental properties of *run to the store* from the relation between the verb and its path argument (Krifka 1992, 1998). Accomplishments derived from achievements via (33) include no such lexical information and they have no lexically determined characteristic activity or process stage. Each progressive achievement assertion requires the construction of an incremental relation specific to the particular event involved based on the available information which shows how the relevant activity

stage is related incrementally to the abstract accomplishment. Compare the following examples (ignoring the manner reading in each case):

- (42)a. Mary is building a house, but I don't know HOW she is going to finish it with the workmen on strike.
 b. #Mary is arriving at the station, but I don't know HOW she is going to get there with all the roads closed.

What makes (42b) infelicitous is that the "but" clause denies that the speaker has the information which warrants the assertion of the main clause; the speaker doesn't see that Mary can get from the relevant process stage to the telic point, and if she doesn't see how the process stage and the completed event are related, then the assertion is infelicitous. Since, with an achievement, there is no particular kind of "arriving" activity which is characteristically associated with the change of state denoted by *arrive*, we cannot look at a particular event stage and say "Ah, this looks like a stage of an event culminating in an arrival at the station." Therefore, some other relation between the specific event stage and the telic point must exist for the progressive assertion to be warranted. In a progressive achievement, the speaker must have evidence as to how the actual and specific activity event *e* which warrants the assertion is going to develop into an (abstract) accomplishment *e'*; the speaker cannot rely on a general picture of how "events of this kind" develop, since the nature of abstract accomplishment eventualities is such that "events of this kind" is not a recognizable category. Put differently, the speaker has to be able to "see the route" all the way from *e* to the telic point. In contrast, (42a) shows that these concerns don't affect the felicity of progressive accomplishments; the activity stage looks inherently like a stage of a house-building event, and this warrants the assertion that, if not interrupted, it will turn into one, even if the interruption seems very likely.

In general, the continuation branch in the progressive achievement is much shorter and much more "fragile." (40) and the original contrast between (1a) and (2f) show that a progressive achievement is used only to make an assertion about an event stage which is relatively close to the telic point. Further, progressive achievements cannot have temporary interruptions, or what Landman (1992) calls "pause stages," as we see in (43). Note also the contrast in (44), which shows that after an interruption one can "carry on" or resume the activity associate with a progressive accomplishment, although this is much less felicitous when describing the continuation associated with a progressive achievement.

- (43) *Context:* Mary is sitting in a field picking buttercups.
 a. Mary is walking to the station. She is just taking a rest.
 b. #Mary is arriving at the station. She is just taking a rest.
- (44)a. Mary was climbing to the top the mountain when she had to take refuge from an avalanche. Afterwards, she carried on to the top.

- b. #Mary was reaching the top of the mountain when she had to take refuge from an avalanche. Afterwards, she carried on to the top.

(44b) is better continued with “After the avalanche, she started climbing again.” As Polly Jacobsen (personal communication) pointed out, this correctly predicts that (45) is false as a continuation of the first sentence in (44a), but true as a continuation of the corresponding sentence in (44b):

- (45) So she didn’t make it that time.

Also, if, as I suggest, the incremental structure of a progressive achievement is defined relative to a particular event, we predicate that one abstract accomplishment cannot be seen as a stage of another. Suppose the incremental structure of an abstract accomplishment *e* is defined via constructing a path argument for the verb. This path has no definition outside the context of event *e*, and therefore cannot be seen as part of a path argument of another event *e*’. This explains the contrast in (23), repeated here.

- (23)a. Mary is running to the Netherlands. In fact she is running to Amsterdam.
- b. Mary is arriving in the Netherlands. In fact she is arriving in Amsterdam.

In chapter 5 we will make these notions precise, but before discussing incrementality in the abstract accomplishments derived by (33), we need a general theory of how incrementality works in lexical accomplishments.

2.7 Slow-motion Progressive Achievements

Before leaving this topic of progressive achievements, the phenomenon of slow-motion progressives must be mentioned. The achievements given in (39) do not have a normal progressive reading but do, nonetheless, have a “slow-motion” reading which is appropriate, for example, in film commentary situation. Look at the examples in (46) which are normally infelicitous:

- (46)a. Mary is spotting her arch enemy at the party at the moment.
- b. The critic is noticing the new picture/that the new picture is really good.
- c. Dafna is realizing that her mother has come to pick her up from kindergarten.

(46a/b) are appropriate if I am describing what is happening in a film which is being played before us (maybe being played at a slow pace), or if I am describing the events of a party to an onlooker. (46c) could be used in the same context, but could also have a “natural” slow-motion reading if I am reporting that Dafna has seen her mother and is in transition from being without her

mother to the state of being with her, which, at the age of two, is a change which it takes some time to get used to. Note that progressives which have a normal progressive reading also have a slow-motion reading. Thus we could use (47) in a film commentary:

(47) Now John is arriving at the station; now he is entering the train.

An interesting fact about these slow-motion readings is that they do not seem to induce the imperfective paradox. The following seem contradictory:

- (48)a. #Mary is spotting her arch enemy at the party but she hasn't yet spotted her.
 b. #The critic is noticing the new picture but she hasn't noticed it yet.
 c. #Dafna is realising that her mother has come to pick her up from kindergarten, but she hasn't realized it yet.

This means that in these contexts, the progressive achievements are behaving more like progressives of activities than of accomplishments. (Note that we can improve (48c) by changing the second conjunct into *but she hasn't fully realized it yet*. But this is because adding the measure phrase *fully* allows us to treat VP as denoting an accomplishment eventuality *realize fully* with a telic point determined by the extent of the realization. We will come back to this kind of accomplishment in chapter 4.) Note that we can distinguish a normal from a slow-motion reading of a progressive achievement such as *is arriving* precisely by looking at the imperfective paradox. *John is arriving at the station but he hasn't arrived yet* is fine as an assertion using the mechanisms set up in section 2.5. However, assume a context in which a friend has just walked in the door and is busy taking off her coat, counting her suitcases and paying the taxi driver. If I say "Mary is still arriving, don't talk to her," it would normally be taken as entailing that Mary had in essence arrived but was still involved in the activities associated with arriving.

This means that we want an account of the slow-motion readings in which the verb is treated as an activity. Intuitively, the activity eventuality is triggered by the achievement and consists of the activity usually associated with the achievement having occurred. For DO(BECOME(REALISE)), this may be the instant of realization plus the assimilation of information. For DO(BECOME(ARRIVE)), this may be the change from not being at *x* to being at *x*, followed by performing the actions normally immediately associated with such a change of state. I therefore assume an operation analogous to the SHIFT operation in (33), which we can represent as in (49a) and interpret as in (49b):

- (49)a. $\text{SHIFT}(\text{VP}_{\text{punctual}}): \lambda e.(\text{BECOME}(P))(e) \rightarrow \lambda e.(\text{DO}(\text{BECOME}(P)))(e)$
 b. $\text{SHIFT}(\lambda e.\text{SPOT MARY}(e) \wedge \text{Ag}(e)=x) =$
 $\lambda e.(\text{DO}(\text{SPOT MARY}))(e) \wedge \text{Ag}(e)=x.$

But this operation differs from the operation in (33) in that the meaning of the original lexical item as a predicate of events is not preserved. As a consequence, we do not know exactly what (49a) means, nor what it means to “DO” an achievement. Thus the operation in (49) is not a natural operation of aspectual shift, since it does not preserve structure or information. For this reason, activity readings of achievements are much less natural than the “ordinary” progressive achievements we have been discussing in the previous sections. I will use this criterion of preservation of structure and information as the factor which distinguishes between natural aspectual shift operations, which preserve the structure of the shifted lexical predicate and the kind of operation which is known as coercion, and in the course of which the original lexical predicate is restructured.

Chapter 3

Resultative Predication

3.1 Introduction

In this chapter we look at the semantics of resultative predication. I show that many cases of resultative predication involve an operation which derives an accomplishment predicate from an activity. In the well-known example given in (1), the activity eventuality denoted by *hammer the metal* shifts to the accomplishment denoted by *hammer the metal flat*:

- (1)a. Mary hammered the metal for hours/*in two hours.
- b. Mary hammered the metal flat in two hours/*for hours.

These constructions contrast with progressive achievements, which involve an operation deriving an accomplishment from an achievement predicate. As in the earlier case, we see that although the structure of the shift operation deriving the accomplishments is straightforward, we cannot explain when it applies without an account of how derived accomplishments are incremental. The studies of the two constructions together provide the background for the analysis of accomplishments in chapter 4.

Resultative predication is one of the two kinds of secondary predication available in the grammar of English, the other being depictive predication. I have argued elsewhere (Rothstein 2003) that both depictive and resultative predicates are aspectual modifiers in the sense that they introduce a new event and define a relation between it and the event introduced by the main predicate. So, a compositional semantics for resultatives must be explanatory not only for a theory of lexical aspect, but also for an account of the relation between resultative and depictive predication. I therefore begin this chapter by reviewing the general theory of secondary predication presented in Rothstein (2003). After that, I discuss resultative predication in some depth.

3.2 The Syntax of Secondary Predication: a Fast Review

Examples (2) and (3) illustrate classic cases of depictive and resultative predication respectively.

- (2)a. John_i drove the car drunk_i.
 b. Mary_i drank the coffee_i hot_i.
 (3) John painted the house_i red_i.

(2a) is an instance of subject-oriented depictive predication, and means roughly “John drove the car when John was drunk.” (2b) and (3) are object-oriented predicates. (2b) is a depictive, and means roughly “Mary drank the coffee when the coffee was hot,” and (3) is a resultative, meaning more or less “John painted the house and at the end of the painting, the house was red.” These examples have been discussed in the general literature at least since Halliday (1967) and in the generative literature since Dowty (1979) and Simpson (1983). Simpson pointed out that resultatives can be directly predicated only of direct objects, so that (4a,b) are ungrammatical with the purported readings “John painted the house and as a result he was red” and “John laughed and as a result he was sick”; however, with intransitives like *laugh*, a so-called “fake reflexive” may be used, so that (4b) has the grammatical counterpart in (4c). Furthermore, these “non-thematic” objects, as I shall call them, need not be reflexives, as (4d) shows:

- (4)a. *John_i painted the house red_i.
 b. *John_i laughed sick_i.
 c. John laughed himself_i sick_i.
 d. John sang the baby_i asleep_i.

There has been much discussion of the properties of resultatives and of the direct object restriction in the literature (including Dowty 1979, Tenny 1987, 1994, Levin and Rapoport 1988, and others). Some, more recent papers (including Wechsler 1997, Levin and Rappaport Hovav 1999, Rappaport Hovav and Levin 2001) have also claimed that there are counter-examples which make the direct object restriction invalid. As far as I know, there has been no explicit discussion of the impossibility of analogous non-thematic objects occurring with depictives. (5) cannot have the reading “John ran while Mary was drunk,” and I will show why.

- (5) *John ran Mary drunk.

The structures for the two types of secondary predicates are given in (6). I assume that object-oriented secondary predicates (both resultatives and

depictives) are generated under V' , whereas subject-oriented depictives are generated under VP (following arguments for VP structure in Andrews 1982).

- (6)a. John_i [[drove the car]_{V'} drunk_i]_{VP}
- b. Mary [[drank the coffee_i hot_i]_{V'}]_{VP}
- c. John [[painted the house_i red_i]_{V'}]_{VP}

This can be shown in a variety of ways. First, there are the standard tests of fronting, and pseudo-clefting: subject-oriented secondary predicates may be stranded by these tests, but need not be, showing that they are daughters of VP, while object-oriented secondary predicates may never be stranded, showing that they are daughters of V' :

- (7)a. What Mary did was paint the house drunk.
- b. What Mary did drunk was paint the house.
- c. What Mary did was drink the coffee hot.
- d. *What Mary did hot was drink the coffee.
- e. What Mary did was paint the house red.
- f. *What Mary did red was paint the house.

Secondly, secondary predicates may stack, as shown in (8), with the proviso that the resultative must be lower than any depictives, that object-oriented predicates are lower than any subject-oriented predicates (*broken* in (8c,d) is to be interpreted as a depictive), and that these depictives may be predicated of direct objects, but not goals, or prepositional objects (Williams 1980).

- (8)a. Bill_j [[drove the car_i broken_i]_{V'} drunk_j]_{VP}
- b. Jane_j [[painted the car_i red_i]_{V'} drunk_j]_{VP}
- c. ?Jane_j [[painted the car_i red_i broken_i]_{V'} drunk_j]_{VP}
- d. *Jane_j [[painted the car_i broken_i red_i]_{V'} drunk_j]_{VP}
- e. John visited Mary_i drunk_i.
- f. *John spoke to Mary_i drunk_i.

That secondary predicates are not predicated of objects of prepositions means that they cannot be predicated of arguments of either nominal or adjectival heads.

Thirdly, secondary predicates do not form a constituent with their subject. This is obvious for subject-oriented depictives, as the stranding facts in (7) show. It also holds for object-oriented predicates, and this can be shown via contrasts with small-clause predicates. If an object-oriented predicate and its subject formed a constituent, then that constituent would be the direct object of the matrix verb, and this is exactly what happens with small-clause predicates such as those in (9) (see Rothstein 2001a for a detailed discussion).

- (9)a. Mary considers [John intelligent]_{SC}
- b. Mary made [it seem that John was on time]_{SC}

But in these constructions, the entailments are very different from those in secondary predicate constructions, as the following data show. (10a, 11a) do not entail (10b, 11b), whereas (12a, 13a, 14a) do entail (12b, 13b, 14b), and the contrast between the examples in (15) demonstrate the same point. (With regard to (11b): see Higginbotham (1983) and others for arguments that seeing an event does not entail seeing its participants).

- (10)a. Mary believes/considers John foolish.
b. Mary believes/considers John.
- (11)a. Mary saw the president leave.
b. Mary saw the president.
- (12)a. Mary drank her coffee hot.
b. Mary drank her coffee.
- (13)a. Mary painted the house red.
b. Mary painted the house.
- (14)a. Mary drove the car drunk.
b. Mary drove the car.
- (15)a. #Mary drank her coffee hot though she never drank her coffee.
b. John believes Bill a liar, and he doesn't believe Bill.

Fourthly, secondary predicates are optional (again the contrast is with small-clause predicates):

- (16)a. *I thought/believed that problem.
b. Mary drank her coffee/drove the car/painted the house.

Fifthly, secondary predicates assign a thematic role to their arguments (subjects). There is no morphological difference between secondary predicates and small-clause predicates and they are subject to the same structural condition on predication (see Rothstein 2001a), and I assume that this indicates that in both constructions they have the same thematic properties. I assume also (following Higginbotham 1983, Parsons 1990, Kratzer 1995, Greenberg 1998, and Rothstein 1999, 2001a) that adjectival predicates introduce some kind of eventuality argument into the representation. (For simplicity, I will assume that this is an *e* variable, and not introduce the distinction between mass eventualities denoted by adjectives and count eventualities denoted by verbs which I argue for in Rothstein 1999.)

Assuming then a neo-Davidsonian framework, in which verbs and adjectives denote sets of events, and thematic roles introduce functions from events to

participants (Parsons 1990, Landman 2000), the AP predicate “drunk” as it occurs in both (17a) and (17b) will translate as an expression like (18):

- (17)a. I consider Mary drunk.
- b. I met Mary drunk.

(18) $\text{drunk}_{\text{AP}}: \lambda x \lambda e. \text{DRUNK}(e) \wedge \text{Arg}(e)=x$

For completeness, secondary predicates need to be distinguished from a number of other kinds of modifiers. They can be distinguished from nominal modifiers by checking entailments and by looking at pronominalization facts. With respect to entailments, we see that when an AP is used as a secondary predicate, then the property it expresses must hold of the denotation of its subject for the whole time that the matrix event is going on (for depictives) or for the whole time that the culmination of the matrix event is going on (for resultatives). With nominal modifiers this is not so, since the modifier is not temporally related to the matrix verb but combines with N to form an NP (or common noun) expression. Thus we get the contrasts in (19)–(21):

- (19)a. I met the drunk man again, but this time he was sober.
- b. #I met the man drunk again, but this time he was sober.
- (20)a. The drunk man drove the car home, after he had sobered up.
- b. #The man drove the car drunk, after he had sobered up.
- (21)a. They paint the red house once every year. Last year they painted it white and this year they painted it green.
- b. #They paint the house only once a year, and they always paint it red. Last year they painted it white and this year they painted it green.

When these modifiers are syntactically part of the nominal argument expression, they disappear as a result of pronominalization, whereas secondary predicates are not affected:

- (22)a. I met the drunk man today ENTAILS I met him today
DOES NOT ENTAIL I met him today and he was drunk when I met him.
- b. I met the man drunk today ENTAILS I met him today and he was drunk when I met him.

Comparing entailments also allows us to distinguish secondary predicates from adverbs, although this is more subtle (especially in languages such as Dutch where the adjective, used in the secondary predicate, is morphologically identical to the adverb). (23a) entails that John was drunk, whereas (23b) is compatible with no one being drunk. And as a correlate, as (24) shows, the secondary predicate, but not the adverb, needs a lexically expressed subject.

- (23)a. John drove the car drunk.
 a'. #John drove the car drunk, although he was sober.
 b. John drove the car drunkenly.
 b'. John drove the car drunkenly, although he was sober.
- (24)a. The car went (drunkenly) round the corner (drunkenly).
 b. #The car went round the corner drunk.

So, secondary predicates are unlike adverbs because they must be predicated of a subject to which they assign a thematic role. If we make this the test for distinguishing between adverbs and secondary predicates, then an obvious question is what about subject-oriented adverbs, such as “enthusiastically” or “reluctantly,” as illustrated in (25), which appear also to assign some sort of thematic role to the subject:

- (25) John greeted Mary enthusiastically/reluctantly.

But it seems to me that, although these adverbs are subject-oriented (or more properly, agent-oriented), and must introduce a relation between the denotation of the subject and the event, this orientation is not equivalent to predication. These adverbs are manner adverbs, saying how the agent of the event participated in it – enthusiastically or reluctantly – but they do not entail that the agent had the property of being himself/herself enthusiastic or reluctant. (26a) entails that John was reluctant about something, but not that he was enthusiastic about anything, and the converse is true of (26b). Similarly, (26c) is not a contradiction, and neither is (26d), where the AP is used as a secondary predicate:

- (26)a. John greeted Mary enthusiastically, although he was secretly very reluctant to meet her.
 b. John greeted Mary reluctantly because he was so shy, although he was secretly very enthusiastic about meeting her.
 c. John welcomed Mary enthusiastically although he was not enthusiastic about welcoming her.
 d. John greeted Mary drunkenly, although he did not, in fact, greet her drunk.

I assume that the grammatical relation of α assigning a theta-role to an argument β , or standing in a thematic relation to β , is interpreted as the denotation of β being assigned a particular participatory role in the event introduced by α . Where α is adjectival, the role assigned to the external argument (or “Arg₁,” as I shall call it) is that of bearer of the property expressed by α . Under this assumption, the data in (26) are sufficient basis for asserting that adjectives, or rather APs, do assign a thematic role to their external arguments, but that subject- or agent-oriented adverbs do not assign thematic roles.

Following Davidson (1967), Parsons (1990), and Landman (2000), we treat adverbials as modifiers of events. (23b), “John drove the car drunkenly,” is represented as (27), with the adverb “drunkenly” translating as the expression in (28), where **VP** is the denotation of VP.

(27) $\exists e[\text{DRIVE}(e) \wedge \text{Ag}(e)=\text{JOHN} \wedge \text{Th}(e)=\text{THE CAR} \wedge \text{DRUNKENLY}(e)]$

(28) $\text{drunkenly}_{\text{ADV}}: \lambda \text{VP} \lambda e. \text{VP}(e) \wedge \text{DRUNKENLY}(e)$

This contrasts with the translation for “drunk” given above in (18), and repeated here, where the adjective introduces its own event argument and dictates what participants there must be in that event:

(18) $\text{drunk}_{\text{AP}}: \lambda x \lambda e. \text{DRUNK}(e) \wedge \text{Arg}(e)=x$

The contrast between the denotations of adverbs and adjectives correctly predicts that adverbs, unlike adjectives, can never be predicated of syntactic arguments in predication structures, as in (29):

- (29)a. *I consider the driving drunkenly.
 b. I consider the driver drunk.

3.3 The Semantic Interpretation of Secondary Predication

3.3.1 Secondary predication as a summing operation

On the assumption that (18) represents a typical translation of an adjectival predicate, whether used as a primary (i.e. clausal) or secondary predicate, what kind of semantic operation must secondary predication be? Lasnik (1992) argues on the basis of conjoined predicates such as *hot and cold alternately* that conjunction of predicates must involve a summing operation rather than set intersection. Secondary predication must involve a summing operation of the same kind. If secondary predication were interpreted via set intersection, (30) would have the interpretation given in (31):

(30) John drove the car drunk.

(31) $\exists e[\text{DROVE}(e) \wedge \text{Ag}(e)=\text{JOHN} \wedge \text{Th}(e)=\text{THE CAR} \wedge \text{DRUNK}(e) \wedge \text{Arg}_1(e)=\text{JOHN}]$

But (31) entails that the event of John driving the car and the event of John being drunk were the same event, and this is not what we want. Lasnik (1992) in his discussion of conjunction shows that *hot and cold alternately* entails that the instances of being hot and the instances of being cold are temporally distinguishable, and are thus distinguishable events. Since secondary predicates

are always temporally dependent on the main verb, this kind of evidence is not available for our structures. However, we can still argue that the events introduced by the matrix verb and the secondary predicate must be distinguished using the arguments for fine-grainedness presented by Parsons (1990), from which it follows that the representation in (31) cannot be correct. Parsons argues that different event predicates which hold of an argument at the same run time can be modified by contradictory modifiers. So, suppose with one stroke of a broom I sweep away both a pile of dirt and an earring, then it can be true that I intentionally swept away the pile of dirt and accidentally swept away an earring. But since an event cannot be both intentional and accidental at the same time, Parsons argues, the two expressions *swept away the pile of dirt* and *swept away an earring* must be descriptions of different sweeping events, distinguished by the fact that they have different theme participants, which take place at the same time. A parallel argument can be made for secondary predication. We have seen that AP predicates, unlike adverbs, introduce thematic roles; this means that they denote entities which have participants, which means that they denote events which can be identified via their participants. So, while an event of driving is an event which must have two participants (an agent and a theme), an event of being drunk must have one participant, which we have called for convenience the “bearer” of the property, or some times the “experiencer,” but which crucially is not an agent. A being drunk event can thus be distinguished from a driving event both in terms of how many participants it has, and in what their relationship to the eventuality is. We can present this argument more clearly by looking at examples like those in (32).

- (32)a. John drove the car drunk from the cognac.
 b. John drove the car scared out of his wits.

In (32a) where the adjectival head of AP introduces two thematic roles, we can clearly distinguish the event introduced by *drive*, which has John as the agent and the car as the theme, and thus denotes an event with John and the car as participants, and the event introduced by *drunk*, which has John as its external argument and the cognac as the internal argument, and which thus denotes an eventuality with John and the cognac as participants. We can also see that the two events belong to two different aspectual classes: JOHN DRIVE THE CAR is an activity whereas JOHN DRUNK FROM THE COGNAC is a state. But if these are the appropriate distinctions to make, then the reading in (31), which asserts that there was one event of which both these predicates can be predicated, will just be false. Similarly, in (32b) John may be driving the car of his own free will, but may be scared out of his wits despite himself. If we grant that relative to one event he cannot be both a willing agent and an unwilling experiencer, we must assume a distinction between the event of driving the car and the event of being scared out of his wits, and ascribe him the willing agent role as participant of the first, and the unwilling experiencer role as participant in the second.

I assume (following Lasnik 1992, Krifka 1992, 1998, Landman 2000) that the domain of events E has an atomic structure and that there is a sum operation defined such that $x \sqsubseteq y$ iff $x \sqcup y = y$ which derives the plural domain from the atomic domain. However, I will also assume an operation from $E \times E$ into E , which sums two atomic events e_1 and e_2 and forms from them a new singular event $^s(e_1 \sqcup e_2)$. This is the operation used in secondary predication. I will also assume the theory of predication in Rothstein (1995b, 2001a), in which VPs and APs denote sets of events (i.e. expressions of type $\langle e, t \rangle$), and (usually) contain a distinguished free variable x of type d , as the value of the external thematic role (where e is the type of events and d is the type of individuals). Predicate formation operates on the denotation of the maximal projections, i.e. VPs and APs, by lambda abstracting over the distinguished x variable, and raising the type of the XP from $\langle e, t \rangle$ to $\langle d, \langle e, t \rangle \rangle$. (For details, see Rothstein 2001a, chapter 6.)

Secondary predicate formation, then, involves an operation of the form in (33):

$$(33) \quad \text{SUM}[\alpha(e_1), \beta(e_2)] = \lambda e. \exists e_1 \exists e_2 [e = ^s(e_1 \sqcup e_2) \wedge \alpha(e_1) \wedge \beta(e_2)].$$

This gives (34a) as the translation of the VP “drive the car drunk,” and (34b) as the translation of (30), *John drove the car drunk*:

- (34)a. $\lambda e. \exists e_1 \exists e_2 [e = ^s(e_1 \sqcup e_2) \wedge \text{DRIVE}(e_1) \wedge \text{Ag}(e_1) = x \wedge \text{Th}(e_1) = \text{THE CAR} \wedge \text{DRUNK}(e_2) \wedge \text{Arg}(e_2) = \text{JOHN}]$
 b. $\exists e \exists e_1 \exists e_2 [e = ^s(e_1 \sqcup e_2) \wedge \text{DROVE}(e_1) \wedge \text{Ag}(e_1) = \text{JOHN} \wedge \text{Th}(e_1) = \text{THE CAR} \wedge \text{DRUNK}(e_2) \wedge \text{Arg}(e_2) = \text{JOHN}]$

(34b) is true if there is an atomic event which has both an event of John driving the car as part and an event of John being drunk as a part.

It is the VP in (34a) which, in the framework of Rothstein (2001a), is the input to further operations such as predicate formation. This correctly predicts that this VP should be the input to adverbial modification:

- (35)a. John drove the car drunk **twice**.
 b. John drove the car drunk **for an hour**.
 c. John drove the car drunk **soberly**.

The adverbials in bold in (35) all modify the VP *drive the car drunk* with the meaning in (34a), and as we would predict, have the meanings in (35') respectively. (Thanks to Manfred Krifka for suggesting that I make this explicit.)

- (35')a. There were two distinct events that are sums of a driving event and a being drunk event.
 b. There was an event which was the sum of a driving event and a being drunk event which lasted an hour.

- c. There was an event which is the sum of a driving event and a being drunk event which took place in a sober manner.

As follows from the discussion of (23)–(28) above, (35c) entails that there was a drunk participant in the event, in this case John, and that the event took place in a sober manner, but not that there was a sober participant. So (35c) is not contradictory.

3.3.2 Semantic constraints on the secondary predication operation

I assume that the summing operation is the basic mechanism involved in interpreting secondary predicates. However, as it stands in (34) it is not enough. In addition to the fact that the output is a singular event, there are constraints on summing via secondary predication which distinguish it from simple predicate conjunction with *and*. Furthermore, there are a series of questions about the nature of secondary predication, and we would like the answers to fall out from the properties of the operation. Here are some of the issues:

1. What are the constraints on the summing relation which distinguish secondary predication from event conjunction?
2. Why are there no intransitive depictives? i.e. why does *I sang the baby asleep* not have the reading “I sang while the baby was asleep”?
3. Why are the two kinds of secondary predicates depictive and resultative (e.g. why are there no “inceptives”)?
4. Why are resultatives not predicated of subjects?
5. What are the effects on aspectual class of adding a secondary predicate?
6. How can we account for the restricted set of examples discussed in Wechsler (1997) and Rappaport Hovav and Levin (2001) which are purported to be subject-oriented resultatives?

As for the first question, there are two constraints on the relation between the summed events in secondary predication. The first is a constraint about temporal dependency, and the second about shared participants. We look first at temporal dependency. Example (30), *John drove the car drunk*, doesn’t merely assert that an event occurred which had a driving part and a being drunk part; it asserts that these events were going on at the same time. Simple conjunction doesn’t require this. *Yesterday I wrote a letter and read a book* doesn’t imply that these events were going on simultaneously. This becomes even clearer if we look at (35b), which requires that the events of driving and being drunk which are summed must be related in such a way that every part of the hour-long event must have a driving part and a drunk part. Contrast (35b) with (36):

(35)b. John drove the car drunk **for an hour**.

(36) I played with the child and read her stories for an hour.

(36) requires that the complex event which had a playing part and a reading the child stories part went on for an hour, but doesn't specify what the temporal relation between the two subevents is. It can be true if we play *Happy Families* for ten minutes and then read for 50 minutes, or any other combination. (35b) doesn't allow this.

The contrast between (35b) and (36) shows that the temporal dependency constraints on the interpretation of (35b) follow from the secondary predication relation and not from any homogeneity requirements of durative adverbials. The same contrast between (37a), on the one hand, and (37b,c), on the other, shows that the temporal dependency constraint in secondary predication does not follow from any independent constraint that conjoined matrix sentential predicates must each be independently marked for tense, or that non-verbal predicates may not be.

- (37)a. Mary made John drive the car to Tel Aviv drunk.
- b. Mary made John drive to Tel Aviv and be drunk.
- c. Mary made John drive to Tel Aviv and John be drunk.

The complement in (37a) is a secondary predicate construction involving temporal dependency between the driving and the being drunk event. (37b,c) are true if Mary made there be a sum of events which had an event of John driving and an event of John being drunk as a part, but there is no indication of any temporal relation between these events; the first can precede the second or vice versa, or the first can be contained in the second or vice versa, or one can overlap the other.

We assume a temporal trace function " τ " as defined in Krifka (1998), which maps an event e onto its running time such that $\tau(e_1 \sqcup e_2) = \tau(e_1) \sqcup \tau(e_2)$ (the run time of the sum of e_1 and e_2 is the sum of the run time of e_1 and the run time of e_2). Thus if e_1 is "John sing" and e_2 is "John dance," the running time of the plural event "John run $\sqcup$ John dance" is the time it took for both these events to go on, i.e. $\tau(\text{John run}) \sqcup \tau(\text{John danced})$.

Secondary predication puts an additional constraint on the event summed, namely that their run times must coincide.

$$(38) \quad \text{SUM}[\alpha(e_1), \beta(e_2)] = \lambda e. \exists e_1 \exists e_2 [e = {}^S(e_1 \sqcup e_2) \wedge \alpha(e_1) \wedge \beta(e_2) \wedge \tau(e_1) = \tau(e_2)].$$

(30) will have the denotation in (39):

(30) John drove the car drunk

$$(39) \quad \exists e \exists e_1 \exists e_2 [e = {}^S(e_1 \sqcup e_2) \wedge \text{DRIVE}(e_1) \wedge \text{Th}(e_1) = \text{THE CAR} \wedge \text{Ag}(e_1) = \text{JOHN} \\ \wedge \text{DRUNK}(e_2) \wedge \text{Arg}(e_2) = \text{JOHN} \wedge \tau(e_1) = \tau(e_2)]$$

(39) asserts that there occurred an event which was the sum of an event in the denotation of *John drive the car* and an event in the denotation of *John drunk*, where both events were going on at the same time. It need not be the biggest event of its kind and, crucially, it can be part of another event of John driving

the car, which is not an event of his being drunk, or it can be part of another event of his being drunk which is bigger than the event of his driving the car.

The formalization in (39) indicates that the temporal dependency between e_1 and e_2 is symmetrical. Examples such as (40) indicate that perhaps it should be asymmetrical, since clearly it is the event introduced by the verb, namely the event of driving from Jerusalem to Tel Aviv, which determines the run time of the summed event.

(40) John drove the car from Jerusalem to Tel Aviv drunk.

However, this asymmetry follows not from the semantics of the secondary predication operation, but from the (independent) distinction between quantized and non-quantized verbal predicates in the sense of Krifka (1992). In (30) both *drive the car* and *drunk* are homogeneous predicates, the first an activity and the second a state. This means that for any event e_1 in the denotation of *drive the car*, any part of that event will also be an event of driving the car, and similarly, for any event e_2 in the denotation of *drunk*, any part of e_2 will also be a drunk event. So for any two events of John driving the car and John being drunk which have an overlapping running time, any part of that overlap can contain an event which we describe as *John drive the car drunk*. However, in (40) the matrix event is an accomplishment, *drive the car from Jerusalem to Tel Aviv*, which is quantized, which means, that for any event in the denotation of this verbal expression, no part of it can be in the denotation of the same verbal expression. This means that in this case the run time of the event introduced by the verbal predicate e_1 will determine the size of the summed event, $^s(e_1 \sqcup e_2)$. The fact that the secondary predicate is constrained for independent reasons (in English) to be an AP (or, rarely, a DP) but is never verbal, means that the secondary predicate is always homogeneous and thus never dictates the size of the summed event, and hence the felt asymmetry.

In addition to the constraint of temporal dependency, there is a well-known constraint that the secondary predicate and the matrix verb must share a thematic argument (Williams 1980, Rothstein 1983). It is this constraint which rules out intransitive depictives such as (41), with the reading “John drove while Mary was drunk.”

(41) John drove Mary_i drunk_i.

Under this reading, *John* is the single argument of *drove*, while *Mary* is the single argument of *drunk*, and the two predicates *drunk* and *drove* do not share an argument.

The two constraints, temporal dependency and argument-sharing, combine to form the content of a relation which we can call “Time-Participant Connected” (or TPCONNECT for short), which holds between two events and an individual, such that $\text{TPCONNECT}(e_1, e_2, y)$ holds for the following circumstances:

- (42) $TPCONNECT(e_1, e_2, y)$ iff:
- (i) $\tau(e_1) = \tau(e_2)$ (i.e. the run time of e_1 is the same as the run time of e_2);
 - (ii) e_1 and e_2 share a participant y .

This relation is reflexive and symmetrical, but of course not transitive, since if e_1 and e_2 share both a run time i_1 and a participant x , and e_2 and e_3 share the same run time i_1 but participant y , then e_1 and e_3 will share a runtime, but not necessarily a participant. $TPCONNECT$ thus does not define a partial order/equivalence class.

The $TPCONNECT$ relation is a symmetrical version of the temporally asymmetric $PART-OF$ condition on secondary predication, which I formulated in Rothstein (2000). The idea was then, and still is, to capture a relation between eventualities which reflects some intrinsic connection between events stronger than the relation between elements in an equivalence class. The analogy from the domain of individuals is the way in which the set of cells making up John's body are related to John, although both are singularities with respect to coordination relation. It is clear that while the set of cells making up John's body are part of John in a very fundamental way, the relation between these two elements is not an equivalence relation since it is obviously non-transitive; if the cells making up John's body are part of John and John is part of the debating team, it does not mean that the cells making up John's body are part of the debating team. The cells making up John's body are part of John in the sense that they both share "stuff," but despite this inherent relation between them, John and the cells making up his body remain independent and the grammar treats them as such. For example, they can be conjoined in the appropriate circumstances. Imagine that John is visiting a holistic doctor who says to him:

- (43) I can't just treat the set of cells making up your body. I have to treat the cells making up your body and you.

It is this kind of non-transitive relation, reflecting an inherent connection between two entities, that I claim holds between the eventualities involved in secondary predication. When we assert "John drove the car drunk," we assert that there is a sum of two events, the driving the car event and the being drunk event which do not just occur at the same time, but which are inextricably attached to each other since they share a participant which is involved in both these events at the same time. Suppose that John is driving the car and at the same time he is missing Mary who has gone to a conference in another town. Then the event e_1 of John driving the car is inherently connected to the event e_2 of John missing Mary, and the event of John missing Mary is inherently connected to the event e_3 of Mary being away at a conference. However, the event of John driving the car is not inherently connected to Mary being away at the conference. As a correlate, the grammaticality judgements are as in (44):

- (44)a. John drove (the car) missing Mary.
 b. John missed Mary, away at a conference.
 c. *John drove the car Mary away at a conference.

Notice that (ii) of the TPCONNECT relation is formulated in terms of a thematic participant y . This is because (45) is ungrammatical on the intransitive reading of “drive,” with the purported reading “John drove when he was asleep.”

- (45) *John drove himself asleep.

This shows that the shared participant condition is actually a grammatical condition on sharing an argument. In (45), the two events mentioned, John driving and John being asleep, do share a “real-world” participant, namely John, but the sentence is still ungrammatical.

3.3.3 The semantic interpretation of depictive predication

3.3.3.1 Object-oriented depictive predication

Based on the above, I assume that the secondary predication operation is an operation which sums two predicates of the same type with the constraint that the two stand in the TPCONNECT relation with respect to a thematic participant. (46) gives the operation for object-oriented depictive secondary predication, which (in the framework of Rothstein 2001a) sums predicates at type $\langle d, \langle e, t \rangle \rangle$.

- (46) **Summing operation for object-oriented depictive secondary predication:**

$$\text{OSUM}[\alpha, \beta] = \lambda y \lambda e. \exists e_1 \exists e_2 [e = {}^S(e_1 \sqcup e_2) \wedge \alpha(e_1, y) \wedge \beta(e_2, y) \wedge \text{TPCONNECT}(e_1, e_2, y)].$$

This is the operation which is used in the interpretation of object-oriented depictive predication, for example in (47):

- (47)a. Mary drank her coffee_i hot_i.
 b. The police arrested John_i drunk_i.

In interpreting (47b), we use the operation in (46) to sum the predicates in (48a) to give the VP in (48b). The derivation is given below:

- (48)a. $\lambda y \lambda e. \text{ARREST}(e) \wedge \text{Ag}(e) = x \wedge \text{Th}(e) = y$
 $\lambda x \lambda e. \text{DRUNK}(e) \wedge \text{Arg}(e) = x$
 b. $\lambda y \lambda e. \exists e_1 \exists e_2 [e = {}^S(e_1 \sqcup e_2) \wedge \text{ARREST}(e_1) \wedge \text{Ag}(e_1) = x \wedge \text{Th}(e_1) = y$
 $\wedge \text{DRUNK}(e_2) \wedge \text{Arg}(e_2) = y \wedge \text{TPCONNECT}(e_1, e_2, y)]$

Derivation: *The police arrested John_i drunk_i*

$$[\text{arrest}]_V \rightarrow \lambda y \lambda e. \text{ARREST}(e) \wedge \text{Ag}(e)=x \wedge \text{Th}(e)=y$$

$$[\text{drunk}]_A \rightarrow \lambda e. \text{DRUNK}(e) \wedge \text{Arg}(e)=x$$

$$[\text{drunk}]_{AP} \rightarrow \lambda x \lambda e. \text{DRUNK}(e) \wedge \text{Arg}(e)=x \text{ (by predicate formation)}$$

$$\begin{aligned} [\text{arrest John}_1 \text{ drunk}_1]_{V'} &\rightarrow \text{OSUM}([\llbracket \text{arrest} \rrbracket_V, [\llbracket \text{drunk} \rrbracket_{AP}] \text{ (JOHN)}) \\ &= \text{OSUM}[\lambda y \lambda e. \text{ARREST}(e) \wedge \text{Ag}(e)=x \wedge \text{Th}(e)=y, \lambda x \lambda e. \text{DRUNK}(e) \wedge \text{Arg}(e)=x] \\ &= \lambda y \lambda e. \exists e_1 \exists e_2 [e = {}^S(e_1 \sqcup e_2) \wedge \text{ARREST}(e_1) \wedge \text{Ag}(e_1)=x \wedge \text{Th}(e_1)=y \wedge \text{DRUNK}(e_2) \\ &\quad \wedge \text{Arg}(e_2)=y \wedge \text{TPCONNECT}(e_1, e_2, y)] \text{ (JOHN)} \\ &= \lambda e. \exists e_1 \exists e_2 [e = {}^S(e_1 \sqcup e_2) \wedge \text{ARREST}(e_1) \wedge \text{Ag}(e_1)=x \wedge \text{Th}(e_1)=\text{JOHN} \wedge \text{DRUNK}(e_2) \\ &\quad \wedge \text{Arg}(e_2)=\text{JOHN} \wedge \text{TPCONNECT}(e_1, e_2, \text{JOHN})] \end{aligned}$$

$$\begin{aligned} [\text{arrest John}_1 \text{ drunk}_1]_{VP} &\rightarrow \\ \lambda x \lambda e. \exists e_1 \exists e_2 [e = {}^S(e_1 \sqcup e_2) \wedge \text{ARREST}(e_1) \wedge \text{Ag}(e_1)=x \wedge \text{Th}(e_1)=\text{JOHN} \wedge \text{DRUNK}(e_2) \\ &\quad \wedge \text{Arg}(e_2)=\text{JOHN} \wedge \text{TPCONNECT}(e_1, e_2, \text{JOHN})] \text{ (by predicate formation)} \end{aligned}$$

$$\begin{aligned} [\text{arrested John}_1 \text{ drunk}_1]_I &\rightarrow \\ \lambda x \lambda e. \exists e_1 \exists e_2 [e = {}^S(e_1 \sqcup e_2) \wedge \text{ARREST}(e_1) \wedge \text{Ag}(e_1)=x \wedge \text{Th}(e_1)=\text{JOHN} \wedge \text{DRUNK}(e_2) \\ &\quad \wedge \text{Arg}(e_2)=\text{JOHN} \wedge \text{TPCONNECT}(e_1, e_2, \text{JOHN}) \wedge \text{PAST}(e)] \end{aligned}$$

$$\begin{aligned} [\text{The police arrested John}_1 \text{ drunk}_1]_{IP} &\rightarrow \\ \lambda x \lambda e. \exists e_1 \exists e_2 [e = {}^S(e_1 \sqcup e_2) \wedge \text{ARREST}(e_1) \wedge \text{Ag}(e_1)=x \wedge \text{Th}(e_1)=\text{JOHN} \wedge \text{DRUNK}(e_2) \\ &\quad \wedge \text{Arg}(e_2)=\text{JOHN} \wedge \text{TPCONNECT}(e_1, e_2, \text{JOHN}) \wedge \text{PAST}(e)] \text{ (THE POLICE)} \\ &= \lambda e. \exists e_1 \exists e_2 [e = {}^S(e_1 \sqcup e_2) \wedge \text{ARREST}(e_1) \wedge \text{Ag}(e_1)=\text{THE POLICE} \wedge \text{Th}(e_1)=\text{JOHN} \\ &\quad \wedge \text{DRUNK}(e_2) \wedge \text{Arg}(e_2)=\text{JOHN} \wedge \text{TPCONNECT}(e_1, e_2, \text{JOHN}) \wedge \text{PAST}(e)] \end{aligned}$$

Existential quantification leads to:

$$\begin{aligned} \exists e \exists e_1 \exists e_2 [e = {}^S(e_1 \sqcup e_2) \wedge \text{ARREST}(e_1) \wedge \text{Ag}(e_1)=\text{THE POLICE} \wedge \text{Th}(e_1)=\text{JOHN} \\ \wedge \text{DRUNK}(e_2) \wedge \text{Arg}(e_2)=\text{JOHN} \wedge \text{TPCONNECT}(e_1, e_2, \text{JOHN}) \wedge \text{PAST}(e)] \end{aligned}$$

“There was an singular event which was the sum of an event of the police arresting John and John being drunk, where the arresting was time-participant-connected to the drunk event.”

With regard to the shared-participant condition, note that the formulation of the operation in (46) in fact guarantees that there will be a shared participant, as it applies both predicates simultaneously to the same argument. So instead of the time-participant connect relation expressed in (46), we could have an explicit condition concerning identity of run times, and rely on the functional application operation to guarantee the shared participant. However, I am not going to take this step because I want it to be explicit that it is not accidental that

(46) is formulated the way it is, and that the shared time-participant condition is a crucial element in licensing the relation. The shared time-participant condition doesn't follow from the formulation of the operation; instead, the operation is formulated the way it is because of the shared time-participant condition.

3.3.3.2 Subject-oriented secondary predication

Subject-oriented depictive secondary predication involves conjunction at the VP level. Using the predication theory in Rothstein (2001a), this means conjoining at $\langle e, t \rangle$ before predication formation has taken place. The depictive predicate is already a predicate and thus is at type $\langle d, \langle e, t \rangle \rangle$; before it can be conjoined with the verbal predicate it must first be applied to a distinguished variable x to bring it to the right type (see Rothstein 2001a for details of this operation, which I call there “predicate absorption”):

- (49) **Summing operation for subject-oriented depictive secondary predication:**

$$\text{SSUM}[\alpha_{\langle e, t \rangle}, \beta_{\langle d, \langle e, t \rangle \rangle}(x)] = \lambda e. \exists e_1 \exists e_2 [e = {}^S(e_1 \sqcup e_2) \wedge \alpha(e_1) \wedge (\beta(x))(e_2) \wedge \text{TPCONNECT}(e_1, e_2, x)]$$

The derivation of (30), *John_i drove the car drunk_i*, is as follows:

Derivation: *John_i drove the car drunk_i*

$[\text{drive}]_V \rightarrow \lambda y \lambda e. \text{DRIVE}(e) \wedge \text{Ag}(e)=x \wedge \text{Th}(e)=y$

$[\text{drive the car}]_{V'} \rightarrow \lambda y \lambda e. \text{DRIVE}(e) \wedge \text{Ag}(e)=x \wedge \text{Th}(e)=y \text{ (THE CAR)}$
 $= \lambda e. \text{DRIVE}(e) \wedge \text{Ag}(e)=x \wedge \text{Th}(e)=\text{THE CAR}$

$[\text{drunk}]_A \rightarrow \lambda e. \text{DRUNK}(e) \wedge \text{Arg}(e)=x$

$[\text{drunk}]_{AP} \rightarrow \lambda x \lambda e. \text{DRUNK}(e) \wedge \text{Arg}(e)=x \text{ (by predicate formation)}$

$[\text{drive the car drunk}]_{V''} \rightarrow \text{SSUM}([\llbracket \text{drive the car} \rrbracket_{V'}, [\llbracket \text{drunk} \rrbracket_{AP}(x)])$
 $= \text{SSUM}([\lambda e. \text{DRIVE}(e) \wedge \text{Ag}(e)=x \wedge \text{Th}(e)=\text{THE CAR}]_{V'}, [\lambda x \lambda e. \text{DRUNK}(e) \wedge \text{Arg}(e)=x]_{AP}(x)])$
 $= \lambda e. \exists e_1 \exists e_2 [e = {}^S(e_1 \sqcup e_2) \wedge \text{DRIVE}(e_1) \wedge \text{Ag}(e_1)=x \wedge \text{Th}(e_1)=\text{THE CAR} \wedge \text{DRUNK}(e_2) \wedge \text{Arg}(e_2)=x \wedge \text{TPCONNECT}(e_1, e_2, x)]$

$[\text{drive the car drunk}]_{VP} \rightarrow$
 $\lambda x \lambda e. \exists e_1 \exists e_2 [e = {}^S(e_1 \sqcup e_2) \wedge \text{DRIVE}(e_1) \wedge \text{Ag}(e_1)=x \wedge \text{Th}(e_1)=\text{THE CAR} \wedge \text{DRUNK}(e_2) \wedge \text{Arg}(e_2)=x \wedge \text{TPCONNECT}(e_1, e_2, x)] \text{ (by predicate formation)}$

$[\text{drove the car drunk}]_I \rightarrow$
 $\lambda x \lambda e. \exists e_1 \exists e_2 [e = {}^S(e_1 \sqcup e_2) \wedge \text{DRIVE}(e_1) \wedge \text{Ag}(e_1)=x \wedge \text{Th}(e_1)=\text{THE CAR} \wedge \text{DRUNK}(e_2) \wedge \text{Arg}(e_2)=x \wedge \text{TPCONNECT}(e_1, e_2, x) \wedge \text{PAST}(e)]$

$[John\ drove\ the\ car\ drunk]_{ip} \rightarrow$

$$\lambda x \lambda e. \exists e_1 \exists e_2 [e =^S (e_1 \sqcup e_2) \wedge DRIVE(e_1) \wedge Ag(e_1) = x \wedge Th(e_1) = THE\ CAR \wedge DRUNK(e_2) \\ \wedge Arg(e_2) = x \wedge TPCONNECT(e_1, e_2, x) \wedge PAST(e)] (JOHN) \\ = \lambda e. \exists e_1 \exists e_2 [e =^S (e_1 \sqcup e_2) \wedge DRIVE(e_1) \wedge Ag(e_1) = JOHN \wedge Th(e_1) = THE\ CAR \wedge \\ DRUNK(e_2) \wedge Arg(e_2) = JOHN \wedge TPCONNECT(e_1, e_2, JOHN) \wedge PAST(e)]$$

Existential quantification leads to:

$$\exists e \exists e_1 \exists e_2 [e =^S (e_1 \sqcup e_2) \wedge DRIVE(e_1) \wedge Ag(e_1) = JOHN \wedge Th(e_1) = THE\ CAR \wedge \\ DRUNK(e_2) \wedge Arg(e_2) = JOHN \wedge TPCONNECT(e_1, e_2, JOHN) \wedge PAST(e)]$$

“There was a singular event which was the sum of an event of John driving the car and John being drunk where the driving event was time-participant connected to the drunk event”.

3.4 The Semantics of Resultatives

3.4.1 The interpretation of simple resultatives

The account given above is sufficient to get us the essential semantics of depictive predicates. The next stage is to extend the account to explain how the more complex resultatives work. The goal is to formulate an account which is minimally different from the account of depictive predication and thus maintains the claim that secondary predication is a unitary phenomenon, while explaining the crucial differences between depictive and resultative predication.

We established in chapter 1 that we are assuming an approach to the semantics of aspectual classes in which accomplishments are analysed as culminating activities. The structures we assume for activities and accomplishments are repeated in (50):

- (50)a. Activities: $\lambda e. (DO(P))(e)$
 b. Accomplishments: $\lambda e. \exists f_1 \exists f_2 [e =^S (f_1 \sqcup f_2) \wedge (DO(P))(f_1) \wedge Cul(e_1) = f_2]$

Deriving simple resultatives such as (3), repeated here as (51), is straightforward.

- (51) Mary painted the house₁ red₁.

I assume that the basic summing operation is the same that is used in depictive predication. Resultative predication differs from depictive predication because in resultative predication, the TPCONNECT relation holds between the *culmination* of the event introduced by the matrix verb and the event of the adjectival predicate. The difference is summed up in (52):

- (52) depictives: $\dots \wedge TPCONNECT(e_1, e_2)$
 resultatives: $\dots \wedge TPCONNECT(Cul(e_1), e_2)$

Resultative conjunction is object-oriented, and thus the process conjoins expressions at type $\langle d, \langle e, t \rangle \rangle$:

(53) **Summing operation for resultative secondary predication:**

$$\begin{aligned} \text{RSUM}[\alpha, \beta] &= \lambda y \lambda e. \exists e_1 \exists e_2 [e =^S (e_1 \sqcup e_2) \wedge \alpha(e_1, y) \wedge \beta(e_2, y) \wedge \\ &\quad \text{TPCONNECT}(\text{Cul}(e_1), e_2, y)] \end{aligned}$$

Resultative summing in the interpretation of (51) sums the verbal predicate in (54a) and the adjectival predicate in (54b):

- (54)a. $[\text{paint}]_V \rightarrow \lambda y \lambda e. \text{PAINT}(e) \wedge \text{Ag}(e)=x \wedge \text{Th}(e)=y$
 b. $[\text{red}]_{AP} \rightarrow \lambda x \lambda e. \text{RED}(e) \wedge \text{Arg}(e)=x$

Derivation: *Mary painted the house_i red_i*

$$[\text{paint}]_V \rightarrow \lambda y \lambda e. \text{PAINT}(e) \wedge \text{Ag}(e)=x \wedge \text{Th}(e)=y$$

$$[\text{red}]_A \rightarrow \lambda e. \text{RED}(e) \wedge \text{Arg}(e)=x$$

$$[\text{red}]_{AP} \rightarrow \lambda x \lambda e. \text{RED}(e) \wedge \text{Arg}(e)=x \text{ (by predicate formation)}$$

$$\begin{aligned} [\text{paint the house red}]_V &\rightarrow \text{RSUM}([\text{paint}]_V, [\text{red}]_{AP}) \text{ (THE HOUSE)} \\ &= \text{RSUM}[\lambda y \lambda e. \text{PAINT}(e) \wedge \text{Ag}(e)=x \wedge \text{Th}(e)=y, \lambda x \lambda e. \text{RED}(e) \wedge \text{Arg}(e)=x] \text{ (THE HOUSE)} \\ &= \lambda y \lambda e. \exists e_1 \exists e_2 [e =^S (e_1 \sqcup e_2) \wedge \text{PAINT}(e_1) \wedge \text{Ag}(e_1)=x \wedge \text{Th}(e_1)=y \wedge \text{RED}(e_2) \wedge \\ &\quad \text{Arg}(e_2)=y \wedge \text{TPCONNECT}(\text{Cul}(e_1), e_2, y)] \text{ (THE HOUSE)} \\ &= \lambda e. \exists e_1 \exists e_2 [e =^S (e_1 \sqcup e_2) \wedge \text{PAINT}(e_1) \wedge \text{Ag}(e_1)=x \wedge \text{Th}(e_1)=\text{THE HOUSE} \wedge \text{RED}(e_2) \\ &\quad \wedge \text{Arg}(e_2)=\text{THE HOUSE} \wedge \text{TPCONNECT}(\text{Cul}(e_1), e_2, \text{THE HOUSE})] \end{aligned}$$

$$\begin{aligned} [\text{paint the house red}]_{VP} &\rightarrow \\ \lambda x \lambda e. \exists e_1 \exists e_2 [e =^S (e_1 \sqcup e_2) \wedge \text{PAINT}(e_1) \wedge \text{Ag}(e_1)=x \wedge \text{Th}(e_1)=\text{THE HOUSE} \wedge \text{RED}(e_2) \\ &\quad \wedge \text{Arg}(e_2)=\text{THE HOUSE} \wedge \text{TPCONNECT}(\text{Cul}(e_1), e_2, \text{THE HOUSE})] \end{aligned}$$

$$\begin{aligned} [\text{painted the house red}]_r &\rightarrow \\ \lambda x \lambda e. \exists e_1 \exists e_2 [e =^S (e_1 \sqcup e_2) \wedge \text{PAINT}(e_1) \wedge \text{Ag}(e_1)=x \wedge \text{Th}(e_1)=\text{THE HOUSE} \wedge \text{RED}(e_2) \\ &\quad \wedge \text{Arg}(e_2)=\text{THE HOUSE} \wedge \text{TPCONNECT}(\text{Cul}(e_1), e_2, \text{THE HOUSE}) \wedge \\ &\quad \text{PAST}(e)] \end{aligned}$$

$$\begin{aligned} [\text{Mary painted the house red}]_{IP} &\rightarrow \\ \lambda e. \exists e_1 \exists e_2 [e =^S (e_1 \sqcup e_2) \wedge \text{PAINT}(e_1) \wedge \text{Ag}(e_1)=\text{MARY} \wedge \text{Th}(e_1)=\text{THE HOUSE} \wedge \\ &\quad \text{RED}(e_2) \wedge \text{Arg}(e_2)=\text{THE HOUSE} \wedge \text{TPCONNECT}(\text{Cul}(e_1), e_2, \text{THE HOUSE}) \\ &\quad \wedge \text{PAST}(e)] \end{aligned}$$

Existential quantification leads to:

$$\begin{aligned} \exists e \exists e_1 \exists e_2 [e =^S (e_1 \sqcup e_2) \wedge \text{PAINT}(e_1) \wedge \text{Ag}(e_1)=\text{MARY} \wedge \text{Th}(e_1)=\text{THE HOUSE} \wedge \\ \text{RED}(e_2) \wedge \text{Arg}(e_2)=\text{THE HOUSE} \wedge \text{TPCONNECT}(\text{Cul}(e_1), e_2, \text{THE HOUSE}) \\ \wedge \text{PAST}(e)] \end{aligned}$$

“There was a singular event which was the sum of an event of Mary painting the house and the house being red, where the culmination of the painting event was time-participant connected to the red event.”

We can collapse OSUM and RSUM (=depictive and resultative predication respectively at the $\langle d, \langle e, t \rangle \rangle$ type) in the following way:

- (55) $SUM[\alpha, \beta] = \lambda y \lambda e. \exists e_1 \exists e_2 [e =^s (e_1 \sqcup e_2) \wedge \alpha(e_1, y) \wedge \beta(e_2, y) \wedge TPCONNECT(\Delta(e_1), e_2, y)]$
 if $\Delta = id \langle e, e \rangle$ (i.e. the identity function on events) then the interpretation is depictive
 if $\Delta = Cul \langle e, e \rangle$ then the interpretation is resultative.

We are now in a position to answer some of the questions raised at the beginning of Section 3.3.3. We have seen what depictive and resultative predication have in common, namely the SUM operation in (55). I suggest that these are the only two forms of secondary predication available in English because the verb class distinctions make available only the “highest” e , and the two kinds of subevents represented in the accomplishment template in (50b). If the sum operation relates the highest e and the secondary predicate, then we have depictive predication. If the sum operation relates $Cul(e)$ in (50b) and the secondary predicate, then we have resultative predication. In (50b) the event variable introduced by (DO(P)) is also in principle available for secondary predication, but since $Cul(e)$ is a near-instantaneous event part of e , the activity part of e is equal in time to the whole accomplishment. Thus a TPCONNECT relation between the activity subevent in (50b) and the predicate is equivalent to a TPCONNECT relation between the whole accomplishment and the predicate, and the effect is depictive predication. We now look at a central issue in the grammar of resultative predication, namely why there is a direct object restriction on resultatives.

3.4.2 The direct object restriction

A central fact about the resultative construction is that there is what is apparently a direct object restriction; we have no reading for *Mary painted the house red* in which *red* is predicated of the subject, as in (56), although an assertion that Mary became red as a result of painting the house is perfectly plausible.

- (56) / $Mary_i$ painted the house red_i .

The reason for this is as follows. $TPCONNECT(Cul(e_1), e_2, y)$ requires $Cul(e_1)$ and e_2 to share thematic argument y . The culmination of an accomplishment is determined by what happens to its theme: *Mary built a house* culminates at the point at which a house “comes into existence” or “becomes built.” So, the argument of the culmination event, y , is the incremental theme of the matrix

verb. As TPCONNECT requires the secondary predicate to share the argument of the culmination event, the secondary predicate must have as its argument the incremental theme of the matrix verb. So the direct object restriction reduces to the restriction that resultatives must be predicated of the theme of the matrix verb, and this itself derives from the interpretation rule. This predicts that subject-oriented resultatives can occur when subjects are incremental themes, as the subject is then the argument of the culmination event. For this reason, we find subject-oriented resultatives with unaccusative and passive verbs, but not with unergatives.

- (57)a. The house_i was painted red_i.
- b. The river_i froze solid_i.
- c. Mary_i grew up smart_i.
- d. *John_i ran tired_i.

We can tell that the subjects in (57a–c) are incremental themes because of the lack of entailments between the progressive versions of (57a–c) and the simple pasts (i.e. the test of the imperfective paradox), whereas in (57d) the entailment goes through. *The house was being painted* does not entail *The house was painted*; *the river was freezing* does not entail *the river froze*; and *Mary was growing up* does not entail *Mary grew up*. In contrast, *John was running* does entail *John ran*.

Note that according to the rule for resultative predication, the resultative does not give the culminating event, which is defined in terms of the incremental theme, but gives a property of the culminating event. In (51) and (57a), Cul(e) is defined by when the house gets painted, and the secondary predicate gives a property of that event: it is time-participant connected to the event of the house being red.

3.5 Non-accomplishment Resultatives

3.5.1 Type shifting in non-accomplishment resultatives

The rule we have formulated so far allows us to add a resultative predicate to a verb whose meaning includes a culmination event in its denotation, namely an accomplishment verb. However, as is well known, resultatives can be added with great freedom to VPs headed by activity verbs (see, for example, Levin and Rappaport Hovav 1995). The following are some examples:

- (58)a. Mary hammered the metal flat.
- b. John sang the baby asleep.
- c. John sang himself asleep.
- d. *John sang asleep.

In (58a), the resultative predicate has been added to a VP headed by a transitive activity verb, and the predicate is predicated of the verb's theme argument. In (58b), the matrix V is an intransitive activity, and the resultative is predicated of an argument which has been added as direct object, although it is apparently not thematically related to the verb. The contrast between (58c) and (58d) shows that, while a resultative cannot be predicated of the subject of an unergative, a "fake reflexive" (to use the term from Simpson 1983) can be added in direct object position, and the result is grammatical. So we need to answer the following questions:

- (i) Given the rule in (53), how is a resultative summed with a non-accomplishment verb which does not have a culmination subevent, without violating the TPCONNECT condition?
- (ii) Why does (58b) not doubly violate the TPCONNECT condition, as the matrix verb is not thematically related to the subject of the resultative, and so does not share an argument with it?
- (iii) If we can sum resultatives and non-accomplishment verbs, then why only with activities?
- (iv) Why is the fake reflexive necessary in (58c)?

Beginning with (i), we can make the issue more specific. The interpretation of a resultative requires the matrix verb to have a culmination, as expressed in the rule in (53), and yet the examples in (58) indicate that the resultative is added to activities which do not already have culminations. If we assume a single resultative rule which applies in all resultative constructions, then the resultative rule should not itself add a culmination to (58). An event can, by definition, have only one culmination point, and resultatives occur with lexical accomplishments for which the culmination is lexically specified, indicating that resultatives cannot in general introduce culmination points. In (56), the accomplishment VP *paint the house* defines when the culmination of the painting event occurs, namely when the house is or becomes painted, and the resultative adds a property of the culmination, namely that it is part of the event of the house being red. On the assumption that there is only one resultative rule, then even in (58) the resultative will only be able to give a property of the culmination and not itself add the culmination. So the grammar must allow us to "add" a culmination to the activity verbs in (58), thus making the resultative possible.

I hypothesize that the resultative predication operation triggers a type-shifting operation which adds a culmination to an activity. I assume, following Krifka (1992, 1998) and others, that processes are not inherently telic or atelic, but telic or atelic under a particular description, and that we can modify our descriptions of them. Thus the same event can be described as a running (atelic) or a running to the store (telic).

Let us assume a culmination modifier of the form in (59):

$$(59) \quad \lambda E \lambda e. E(e) \wedge \exists e' [Cul(e)=e' \wedge Arg(e')=Th(e)]$$

It has the following properties:

- it is of type $\langle\langle e, t \rangle, \langle e, t \rangle\rangle$;
- it is like a thematic role/function, which assigns a location, manner or time to an event;
- its domain is restricted to the set of activity eventualities, and it denotes a function from sets of activities onto their culminations;
- it specifies that the argument of $\text{Cul}(e)$ is the incremental theme of e .

Resultative predication forces the $\text{Cul}(e)$ modifier to be added if the matrix event lacks a culmination. Thus in (58a), resultative predication forces a shift from the activity verb meaning of *hammer* to an accomplishment reading:

- (60) $\text{SHIFT}(\lambda y \lambda e. \text{HAMMER}(e) \wedge \text{Ag}(e)=x \wedge \text{Th}(e)=y)$
 $= \lambda y \lambda e. \text{HAMMER}(e) \wedge \text{Ag}(e)=x \wedge \text{Th}(e)=y \wedge \exists e' [\text{Cul}(e)=e' \wedge \text{Arg}(e')=\text{Th}(e)]$

The interpretation of (58a) is then as in (61):

(58)a. Mary hammered the metal flat

- (61) $\exists e \exists e_1 \exists e_2 [e =^S (e_1 \sqcup e_2) \wedge \text{HAMMER}(e_1) \wedge \text{Ag}(e_1)=\text{MARY} \wedge \text{Th}(e_1)=\text{THE METAL}$
 $\wedge \exists e_1' [\text{Cul}(e_1)=e_1' \wedge \text{Arg}(e_1')=\text{Th}(e_1) \wedge \text{FLAT}(e_2)$
 $\wedge \text{Arg}(e_2)=\text{THE METAL} \wedge \text{TPCONNECT}(\text{Cul}(e_1), e_2, \text{THE METAL})]]$

“There was an event which was the sum of a hammering event and an event of the metal being flat, and the culmination of the hammering event was time-participant-connected to the event of the metal being flat.”

Since $\text{TPCONNECT}(\text{Cul}(e_1), e_2, y)$ forces $\text{Cul}(e_1)$ and e_2 to share an argument, the culmination of the hammering event must have THE METAL as its argument.

When the verb is intransitive, the culmination modifier introduced by the shifting process effectively adds an argument:

- (62) $\text{SHIFT}(\lambda e. \text{SING}(e) \wedge \text{Ag}(e)=x)$
 $= \lambda y \lambda e. \text{SING}(e) \wedge \text{Ag}(e)=x \wedge \exists e' [\text{Cul}(e)=e' \wedge \text{Arg}(e')=\text{Th}(e)]$

(58)b. John sang the baby asleep.

- (63) $\exists e \exists e_1 \exists e_2 [e =^S (e_1 \sqcup e_2) \wedge \text{SING}(e_1) \wedge \text{Ag}(e_1)=\text{JOHN}$
 $\wedge \exists e_1' [\text{Cul}(e_1)=e_1' \wedge \text{Arg}(e_1')=\text{Th}(e_1)$
 $\wedge \text{ASLEEP}(e_2) \wedge \text{Arg}(e_2)=\text{THE BABY}$
 $\wedge \text{TPCONNECT}(\text{Cul}(e_1), e_2, \text{THE BABY})]]$

(63) says:

- The singing event e_1 was assigned a telic point e_1' and the telic point of the singing event was time-participant connected to the event e_2 of the baby being asleep.

- The semantics of TPCONNECT tells us that if $\text{Cul}(e_1)$ is TPCONNECTed to e_2 , then they share a thematic argument. The argument of $\text{Cul}(e_1)$ must be the argument of e_2 , the baby.
- The resultative tells us that at $\text{Cul}(e_1)$ the baby is asleep.

Note that in each case, SHIFT preserves the structure and meaning of the original predicate, as was the case with the aspectual-shifting operation introduced in chapter 2.

The crucial question is in what sense is the argument *the baby* the incremental theme of the verb. Intuitively, if the telic point is determined by what happens to the baby, then in some sense the event of singing is “measured” by what happens to the baby. How this works is the topic of chapter 4, and I will not elaborate on it here. However, there is some straightforward linguistic evidence that the added argument in (58b) indeed is the theme of the verb. It is well known (Verkuyl 1972, Tenny 1987, 1994, Krifka 1992, 1998, and others) that the properties of the (incremental) theme determine whether the VP is telic when the verb is an accomplishment. In (58b) the telicity of the VP is determined by the properties of the DP *the baby*, indicating that this argument is operating as a normal incremental theme:

- (64)a. John sang babies asleep for hours/*in an hour last night.
 b. John sang 3 babies asleep *for hours/in an hour last night.

However, note that this theme has a different “thematic status” from other arguments, as we see from the contrasts in (65), noted originally in Rothstein (1992):

- (65)a. Which table_i did you ask whether John wiped t_i clean?
 b. ??Which baby_i did you ask whether John sang t_i asleep?

While extraction over a wh-island is normally possible from a theta-governed position as in (65a) (Chomsky 1986a), extraction from the argument position introduced by (62) is much less good, as (65b) shows. This suggests that this argument position is not theta-governed. Difference in status with respect to theta-government is a plausible way to represent the distinction between an argument introduced by a type-shifting process, and an argument which is determined by the lexical structure of a verb.

To sum up then, resultative predication triggers a type-shifting operation on activities, in which activities shift to an accomplishment reading through the imposition of a culmination modifier. I give the general operations in (66), replacing DO(P) by the expression $\text{ACTIVITY}_{\langle X \rangle}$, meaning the activity predicate whose lexical content is expressed in X:

- (66)a. Shifted transitive activity ($\langle d, \langle e, t \rangle \rangle \rightarrow \langle d, \langle e, t \rangle \rangle$):
 $\lambda y \lambda e. \text{ACTIVITY}_{\langle X \rangle}(e) \wedge \text{Ag}(e)=x \wedge \text{Th}(e)=y \rightarrow$
 $\lambda y \lambda e. \text{ACTIVITY}_{\langle X \rangle}(e) \wedge \text{Ag}(e)=x \wedge \text{Th}(e)=y \wedge \exists e'[\text{Cul}(e)=e' \wedge$
 $\text{Arg}(e')=\text{Th}(e)]$

- b. Shifted intransitive activity ($\langle e, t \rangle \rightarrow \langle d, \langle e, t \rangle \rangle$):
 $\lambda e. \text{ACTIVITY}_{\langle x \rangle}(e) \wedge \text{Ag}(e)=x \rightarrow$
 $\lambda y \lambda e. \text{ACTIVITY}_{\langle x \rangle}(e) \wedge \text{Ag}(e)=x \wedge \text{Th}(e)=y \wedge \exists e' [\text{Cul}(e)=e' \wedge$
 $\text{Arg}(e')=\text{Th}(e)]$

3.6 The Rest of the Questions

3.6.1 Dethematicized resultatives

If the resultative predicate is predicated of the theme of the matrix verb, then how can we derive sentences such as (67), where the matrix verb *drink* has a theme (the liquid consumed), and yet *John* is the subject of the secondary predicate?

(67) Mary drank John under the table.

I assume that here two processes have taken place. First, the transitive verb *drink* is intransitivized and the internal argument is existentially quantified over. At that point, it is no longer available as the incremental argument, and we will call it “patient” to distinguish it from the incremental theme. We thus have $\lambda e. \exists z [\text{DRINK}(e) \wedge \text{Ag}(e)=x \wedge \text{Patient}(e)=z]$ as its meaning. The resultative predication forces a shift which adds a new incremental argument, as in (68a), with (68b) giving the meaning of (67):

- (68)a. $\lambda y \lambda e. \exists z [\text{DRINK}(e) \wedge \text{Ag}(e)=x \wedge \text{Patient}(e)=z] \wedge \exists e' [\text{Cul}(e)=e' \wedge$
 $\text{Arg}(e')=\text{Th}(e)]$
 b. $\exists e \exists e_1 \exists e_2 \exists z [e = {}^s(e_1 \sqcup e_2) \wedge \text{DRANK}(e_1) \wedge \text{Agent}(e_1)=\text{MARY} \wedge$
 $\text{Patient}(e_1)=z \wedge \text{UNDER-THE-TABLE}(e_2) \wedge \text{Arg}(e_2)=\text{JOHN} \wedge$
 $\text{TPCONNECT}(\text{Cul}(e_1), e_2, \text{JOHN})]$

3.6.2 Why don't resultatives occur with achievements or states?

The type-shifting operations in (66) are designated to apply to activities, which means that resultative predicates can occur only with accomplishments, which naturally have culminations, or with activities, which are shifted into this form via (66). And indeed we want this restriction, since the examples in (69) – where the matrix predicates are stative and achievement predicates respectively – do not have grammatical resultative readings, and instead only have depictive readings:

- (69)a. John_i was happy drunk_i.
 b. John_i arrived late_i.

The restriction of (66) to activities does not have to be stipulated, but follows from the properties of the aspectual classes. For an event to have a culmination requires that it be non-static, since culmination is inherently connected to the notion of development. Adding a culmination to an activity, as we do via (66), involves imposing a developmental structure on the activity. Since states are static, no such developmental structure can be imposed on them. An achievement, on the other hand, is a minimal change of state, and can be understood as consisting only of a culmination. Predicating a property of the culmination of an achievement is normally equivalent to predicating it of the achievement itself, hence resultative reading is equivalent to the depictive reading in (69b). The only cases where we seem to get a resultative reading with achievements are with explicit causatives such as (70):

(70) John broke the glass to pieces.

Here the meaning of the predicate is “cause *y* to break.” Since the verb meaning can be decomposed into a causative and result element, the resultative can be predicated of the culmination and understood as giving a property of *y* in the result state. In this case the resultative meaning is not equivalent to the depictive.

3.6.3 Fake reflexives

The example in (58c), repeated here as (71a) with some analogous cases, involves a so-called “fake reflexive.” Intuitively, the fake reflexive allows a resultative to be indirectly predicated of a non-theme subject via a direct object argument. We can show now exactly how this works and why the examples in (72) are ungrammatical.

- (71)a. John sang himself asleep.
 b. Bill laughed himself sick.
 c. Mary wrote herself into a corner.

- (72)a. *John laughed sick.
 b. *John sang asleep.
 c. *Mary wrote into a corner.

(72) is ruled out by the theta-criterion. I am being unspecific about which version, not because I want to be imprecise but because a central generalization that all formulations of the theta-criterion want to capture, though they express it in different ways, is that a verb has as many syntactic arguments as it has thematic arguments – or in other words, that two thematic roles cannot be assigned to the same argument by the same lexical head. The resultative rule requires the secondary predicate to share the theme argument of the main predicate. In (71) the matrix verbs do not have a theme argument, but only an

agent. Agents are crucially non-incremental, as we saw in the discussion of (57) above, and so the agents in (71) cannot be the arguments of $\text{Cul}(e_i)$, the culmination event of the matrix verb. The examples in (72) are ungrammatical in the same way that *John saw* is ungrammatical on the meaning “John saw himself.” However, in the same way that we use a reflexive in *John saw himself* to allow the same real-world entity to be both agent and theme participant in the event through the mediation of two grammatical arguments, we use a reflexive to allow the same entity to be both agent and incremental argument of an intransitive verb in an intransitive resultative construction.

Note also that the “uniqueness” part of the theta-criterion, the claim that there can be only one incremental theme per verb, rules out pseudothematic resultatives with unaccusatives in (73). Since the verb already assigns a theme role to its subject argument, as we saw in (57b,c), repeated here, there is no available theme role to be assigned to the reflexive.

(73) *The river_i froze itself_i solid.

(57)b. The river_i froze solid_i.

(57)c. Mary_i grew up smart_i.

3.7 Subject-oriented Resultatives

A number of recent papers have argued that the direct object restriction, whether it is phrased in terms of direct objects or incremental themes, is not correct, and that there exists a class of subject-oriented resultatives which are not predicated of incremental themes. Most prominent among these works are Wechsler (1997), who offers (74a–c) as evidence, Verspoor (1997) who offers examples (74d,e) and Rappaport Hovav and Levin (2001).

- (74)a. The wise men followed the star out of Bethlehem.
- b. The sailors caught a breeze and rode it clear of the rocks.
- c. He followed Lassie free of his captors.
- d. The children played leapfrog across the park.
- e. John walked the dog to the store.
- f. John danced mazurkas across the room.

Hoekstra (1988) and Levin and Rappaport Hovav (1995) argue also that verbs of manner of motion and verbs of sound emission occur both in intransitive, object-oriented resultatives and as apparent subject-oriented intransitives. The examples in (75) are taken from Rappaport Hovav and Levin (2001):

- (75)a. Dan ran/hopped/jogged/danced to the station.
- b. She started to run the hangover out of her system.
- c. The elevator creaked to the ground floor.
- d. The alarm clock buzzed them awake.

They point out that sometimes minimal pairs are possible, as in (76), although not always, as (77) shows:

- (76)a. One of the race cars wiggled loose inside the transporter.
 b. The snake wiggled itself loose . . .
 c. She danced across the room.
 d. She danced herself across the room.
- (77)a. She wiggled herself comfortable in the chair.
 b. *She wiggled comfortable in the chair.
 c. She danced herself dizzy.
 d. *She danced dizzy.

Rappaport Hovav and Levin (2001) and Wechsler (1997) give competing analyses of how to explain when and why subject-oriented resultatives are possible. Wechsler (1997) also argues that the apparent direct object restriction is, in fact, a restriction that resultatives are predicated of affected themes (although he doesn't explain why), and thus to the degree that affected themes appear in direct object position, resultatives are predicated of direct objects. This explains the direct object restriction in thematic transitives. With intransitives such as those in the examples above, Wechsler makes the following argument. He distinguishes between "control resultatives," where the resultative is predicated of a lexically determined thematic argument of the head, and "raising resultatives," where the predicate is predicated of an argument which is not theta-marked by the head – in our terms a pseudo-thematic or dethematicized resultative. He argues that in control resultatives, the resultative predicate must represent a canonical or normal result state of an action of the type denoted by the verb. Since *dizzy* is not a canonical result of dancing, it cannot be predicated of thematic argument of *dance*. Intuitively, we can see why this solution is attractive. Control resultatives are those in which the relation of the argument to the verb is determined by the meaning of the verb, and it is plausible that if this relation is lexically determined, there are also lexical constraints on the result state. These lexical constraints may well allow us to distinguish canonical from non-canonical results, and to claim that non-canonical results are simply results which are not compatible with the lexically determined way in which the action of the verb affects the theme. Non-canonical results are thus available only when the meaning of the verb does not determine the relation between the event and the participant introduced by the argument which is the subject of the resultative. This makes a lot of sense, and it is an intuition which is explained by the account of incremental themes which we will introduce in chapter 4. However, it is not an account which is going to explain the distribution of subject-resultatives in the examples given above. To start with, we will see that the issue is not one of distinguishing between canonical and non-canonical results, but rather in determining which result predicates give plausible as opposed to non-plausible criteria for

measuring the progress or development of an activity. While the constraints on thematic resultatives are tighter than those on non-thematic resultatives, the issue is one of degree, and non-thematic resultatives too are subject to a plausibility constraint. Secondly, the notion of “canonical result” is not sufficiently well defined to allow us to make predictions. If it is a semantic notion, then we need a precise theoretical account of canonicity. If it is a pragmatic account, then it is difficult to see how it works. While dance events may not canonically result in dizziness, other events may, and yet be equally impossible with a bare resultative. Take a verb like *whirl* or *spin*, which very plausibly results in dizziness, and in certain circumstances may canonically do so – think of whirling dervishes and funfair whirligigs, both of which whirl in order to induce dizziness. Yet (78) shows that the distribution of resultatives is the same as with *dance*.

- (78)a. *The whirling dervish whirled/spun dizzy.
- b. The whirling dervish whirled/spun himself dizzy.
- c. The whirling dervish whirled/spun across the room.

The generalization that we can make about the subject-oriented resultatives is not that the bare result predicates are related to the matrix verb by a lexically determined relation of canonicity, determined by the idiosyncratic properties of the matrix verb, but that they are all locative expressions. We will return below to this observation, which is also made by Rappaport Hovav and Levin.

Rappaport Hovav and Levin (2001) take a different tack in explaining the data in (74)–(77). They argue that in subject-oriented “bare XP” resultatives, the temporal progress of the event denoted by the verb is necessarily dependent on the temporal progress toward the achievement of the result state, but that this is not necessarily the case in the object-oriented fake reflexive examples. They argue further that “the result XP must be predicated of an NP which denotes the argument which is the recipient of transmitted force if there is one.” The cases where there is a recipient of transmitted force are more or less the cases where there is an affected theme. Thus, if there is an affected theme, which must be generated in direct object position at least at D-structure, it must be the subject of the resultative. However, if there is no NP denoting an entity which is the recipient of transmitted force, the result XP is free to be predicated of the subject, provided the condition on dependent temporal progress is met. Two events which are temporally dependent “unfold” at the same rate. Such temporally dependent events can be conflated and can share a single syntactic argument, while temporally independent events cannot be conflated and must have independent arguments. The crucial examples are repeated here:

- (76)c. She danced across the room.
- (77)c. She danced herself dizzy.
- (77)d. *She danced dizzy.

In (76c), the dancing event and the moving across the room event unfold at the same rate. The two events can be conflated and can share an argument, thus a subject-oriented bare resultative is possible. Since developing dizziness is not seen as temporally dependent on the dancing event, (77d) is unacceptable. The dancing event and the becoming dizzy event must be temporally distinguished, and must thus appear with independent arguments, thus a fake reflexive argument is necessary, as in (77c).

Again, it is unclear from Rappaport Hovav and Levin's account why some verb-resultatives pairs have the option of being interpreted as denoting temporally dependent or temporally conflated events, and others do not. It is not that some verb-predicate pairs are obligatorily dependent, while others are not. *Dance* and *across the room* in (76c) do not denote obligatorily conflated events, as we can see from the fact that the non-thematic, reflexive version of the sentence is also possible, as in (76d). However, even in the case of whirling dervishes, who spin or whirl in order to get dizzy and continue until they do, the temporally dependent version is much worse than the reflexive version, as we saw in (78), and similarly, in an event of wriggling to get comfortable, the achievement of comfort cannot be interpreted as temporally dependent on the wriggling event, as we see from (77b):

(76)d. She danced herself across the room.

(77)b. *She wriggled comfortable in the chair.

(78)a. *The whirling dervish whirled/spun dizzy.

The question is why? Whereas Wechsler's explanation requires a semantic account of canonical result, this account needs a semantic explanation of why some expressions are potentially temporally dependent for interpretation on the matrix verb and others are not. Rappaport Hovav and Levin (2001) point out that subject-oriented resultatives involve a predicate denoting a result "location" and not a result state, and it seems to me that this is the observation on which the explanation depends.

The XPs which are possible as bare subject-oriented resultatives are restricted to expressions of location, and more precisely of direction. The PPs which occur include *across the room*, *out of Bethlehem*, and *to the store*, and the APs too are expressions which can express a direction with respect to a fixed point such as *clear of the rocks*, *free of his captors*, and *loose*. Crucially, a non-directional expression such as *comfortable* or *dizzy* cannot be a subject-oriented resultative. Thus we have the minimal pairs with (76c) and (77d), where *dance* allows a subject-oriented directional expression *across the room*, but disallows the non-directional *dizzy* in the same position. But it is not just the properties of the predicate which are involved here. The bare XP locative predicates are acceptable only with verbs which allow a motional interpretation, and which therefore allow a path argument giving the location of movement. I suggest then that apparently subject-oriented result predicates are not resultative predicates

at all, but are internal path arguments of the verb, in the sense of Krifka (1998). Krifka shows that what defines path arguments is precisely that as the matrix event grows temporally, the portion of the path which is the argument of the event grows too, and that the path argument thus determines the incremental structure of the event. In an example like *John danced across the room*, the verb *dance* is supplied with an incremental path argument *across the room*. The effect is analogous to a resultative predicate because the event denoted by *dance across the room* reaches its telic point when the path is “used up” and that will be when John is across the room. This is the same situation as the one that occurs at the telic point of *John danced himself across the room*, which asserts that there is an event of dancing, the culmination point of which is coincidental with the event of John being across the room.

There are various questions that are answered by this account which make it convincing. First, we explain Rappaport Hovav and Levin’s observation that (so-called) subject-oriented resultatives denote result locations and not other kinds of states. Since they are in fact path arguments, the telic point of the event will be when the subject is at the location designated by the end of the path – and this will be a “result location.” Secondly, we explain why subject-oriented resultatives are temporally dependent on the matrix event. If the locational expression denotes a path argument, and which is “used up” gradually as the event unfolds, then progress along this path and the progress of the main event will be temporally interdependent. Thirdly, although there are minimal pairs such as (76c,d), we see that when the PP is directional but determines a non-bounded path, the object-oriented version is not as good, as in (79a,b):

- (79)a. John danced about the house.
- b. ?John danced himself about the house.

This is because the object-oriented versions are true resultatives, and non-bounded directional phrases do not easily denote result states. Fourthly, Wechsler (1997) observes that PPs can have a “metaphorical” reading when they are object-oriented, as in (80a), but not when they are subject-oriented, as in (80b).

- (80)a. She danced herself over the edge.
- b. She danced over the edge.

This is because in the subject-oriented constructions, the PP is lexically constrained to be a locational expression, denoting a spatial path, and must thus be interpreted spatially, whereas in the object-oriented constructions, the resultative is not constrained to have a spatial interpretation.

3.8 Conclusions and the Next Set of Questions

I have argued that secondary predication involves a summing operation which sums eventualities which are closely related to each other temporally

and which share a participant. Depictive readings occur when the secondary predicate eventuality is cotemporal with the event introduced by the matrix predicate, whereas resultative predication occurs when the culmination of the matrix predicate is cotemporal with the eventuality introduced by the secondary predicate. This chapter has focused on structural issues: what are the formal syntactic structures which are interpreted, what are the rules which interpret them, and how does this explain a number of facts about secondary predication, especially the central fact that a resultative interpretation is possible only when the predicate is predicated of an incremental theme, whereas there is no such restriction on depictive predication. I have not discussed a number of additional issues about depictive predication, in particular what is the basis of the intuition that depictive predicates are preferably non-inherent and transitory. I assume that this question can be discussed within the framework developed, but it is not immediately relevant to our concerns here. I have concentrated instead on the question of how resultative predication interacts with the aspectual properties of matrix predicates. When the matrix predicate denotes an accomplishment eventuality, adding a resultative predicate which gives information about the culmination of the accomplishment is straightforward. When the matrix predicate denotes an activity predicate, adding a resultative requires imposing an accomplishment structure on that activity. The issues we address in the next chapter are precisely what it means to impose an accomplishment structure on an activity, and how this is done.

As an analysis of resultatives (rather than accomplishments), this chapter leaves a number of questions unanswered. The most obvious one is what exactly does it mean for a nominal such as *the baby* to be the incremental theme of *John sang the baby asleep*. A related question is to do with “taking away” rather than “adding” an incremental theme, and is raised by the analysis I have given of *Mary drank John under the table*. The analysis implies, and in fact requires, that when the theme argument of *drink* is existentially quantified over, it loses the property of being the incremental argument. I think this is correct, since *Mary drank* – which has the interpretation given in (81a) – is atelic, as (81b) shows (see also the discussion in Mittwoch 1982):

- (81)a. $\exists e \exists z [\text{DRINK}(e) \wedge \text{Ag}(e) = \text{MARY} \wedge \text{Th}/\text{Patient}(e) = z]$
 b. Mary drank for hours/*in an hour.

But this means that the incremental argument is not necessarily the argument/participant directly affected by the activity determined by the verb. Discussing these questions involves a much closer look at what an incremental argument is, and we will examine this in the next chapter.

The other obvious question which is so far unanswered is the question as to where the “result” meaning of resultatives comes from. The analysis I have given of, for example, *John sang the baby asleep* requires that the baby be asleep at the culmination of John’s singing, but does not require John’s singing to cause the baby to be asleep. But informants often feel strongly that the causative

element is part of the meaning of the sentence and, further, it has always been assumed that the resultative or causal element in the meaning is what is responsible for making examples such as (82) unacceptable on the resultative reading.

(82) #John painted the house dirty.

However, there are a number of cases where there is no necessary causal element in the meaning of resultatives:

- (83)a. The crowd cheered the gates open.
- b. Every night the neighbour's dog barks me asleep.
- c. On May 5, 1945, the people of Amsterdam danced the Canadians to Dam Square.
- d. Mary drank John under the table/sick/dizzy.

I shall return to this issue in the next chapter and argue that the resultative/causative component is not semantic, but is fall-out from the meaning of the accomplishment. As we shall see, the structure of an accomplishment involves structuring an activity in terms of the progress of an extended change-of-state event, which culminates when the change-of-state is reached. Constraints on how the activity and change-of-state events are matched make it frequently the case that the change-of-state is caused by the activity, but this is not necessarily the case. We will see that the result aspect of the resultative derives from this causal relation, and when it is absent the result meaning in resultatives is absent too.

Chapter 4

The Structure of Accomplishments

4.1 Incremental Themes and the Notion of "Extent"

4.1.1 Introduction

In the previous two chapters, I argued that there must be (at least) two different aspectual shift operations which derive accomplishments. The first one is triggered by the progressive operator, and derives an accomplishment from a lexical achievement predicate by associating an activity event with a telic point, where the properties of the telic point are given by the achievement. The second shifting operation is triggered by the operation of resultative predication, and derives an accomplishment from a lexical activity predicate by associating a culmination or telic point with the event denoted by the lexical activity. In both cases, although the structural shift operation provided for a compositional interpretation of the structures, it left open questions about when it was contextually appropriate to use the mechanism. In particular, we raised two questions:

- (i) How "far" from the point at which an "achievement event" is scheduled to take place is it appropriate to make an assertion using the progressive. For example, how far from the top of a mountain can Jane be for (1) to be reasonably asserted:

(1) Jane is reaching the top of the mountain.

- (ii) What constraints are there on the relation between verb and resultative predicate in a resultative construction? Where does the causal implication come from? For example, why is (2a) more acceptable than (2b), and why, if (2b) is acceptable, do we get an implication that the house getting dirty was a result of the painting:

- (2a) Mary painted the house red.
- b. ??Mary painted the house dirty.

I claimed that in both cases, the answers to these questions could come only from an understanding of what incrementality in accomplishments is, and this chapter is devoted to exploring this issue. Explaining incrementality in accomplishments is tied up with the investigation of another notion – the notion of *culmination*. Culmination is often associated with telicity, as a predicate is usually said to be telic if an event in its denotation has a lexically specified endpoint, and a culmination is naturally identified as such an endpoint, and called the “telic point.” However, I shall show that incrementality and telicity are to be distinguished, and I will leave the discussion of telicity to chapter 5.

This chapter begins by reviewing the claim that an accomplishment is incremental because it has an incremental thematic relation with its theme argument (alternatively, that an event is an accomplishment if and only if it has an incremental relation with its theme), and by exploring the strengths and limitations of Krifka’s account of how incrementality works (Krifka 1986, 1989, 1992, 1998). I go on to discuss some other accounts of incrementality in terms of movement toward a culmination, and I develop a broader account of incrementality which subsumes Krifka’s, and which accounts for the “incremental effects” which we have seen both with progressive achievements and derived resultatives.

4.1.2 “Measuring out” and incrementality

Incremental themes surfaced in linguistic discussion notably in the work of Verkuyl (1972, 1993), Krifka (1986, 1989, 1992, 1998), Tenny (1987, 1994), and Dowty (1991). Linguistic evidence that the direct object plays a role in incrementality comes from the contrast between (3) and (4), noted first by Verkuyl (1972) and Dowty (1979). Accomplishment predicates which normally head telic VPs behave as activity predicates (i.e. head atelic predicates) when the direct object is a bare plural or a mass NP, whereas activity predicates always behave as activity predicates no matter what direct object they have.

- (3)a. Mary built the house #for a year/in a year.
- b. Mary built houses for a year/#in a year.
- (4)a. John pushed the cart for an hour/#in an hour.
- b. John pushed carts for an hour/#in an hour.

These examples show that the relation between verb and direct object is central in determining what accomplishments are, and, given the centrality of incrementality in characterizing accomplishments, it is plausible to expect that the relation between verb and direct object can be used to explain how the incrementality works. The basic idea common to the works cited above is that the direct object argument of the verbs, such as *eat* and *mow* and *build* in (5), is used up “bit by bit” as the event denoted by the verb progresses.

- (5)a. Mary ate the sandwich.
- b. Jane mowed the lawn.
- c. Dafna built a house.

One can plot the progress of the event of Mary eating the sandwich by looking at changes in the sandwich, and similarly the progress of the event of Jane mowing the lawn can be plotted by watching changes in the lawn. As Dowty (1991) puts it:

if I tell my son to mow the lawn (right now) and then look at the lawn an hour later, I will be able to conclude something about the “aspect” of the event of his mowing the lawn from the state of the lawn, viz., that the event is either not yet begun, partly done but not finished, or completed, according to whether the grass on the lawn is all tall, partly short or all short. On the other hand I will not necessarily be able to inspect the state of my son and conclude anything at all about his completion of his mowing the lawn. In this event, my son is the Agent and the lawn is the Theme, in fact the Incremental Theme.

Not only the progress of the event, but also the extent of the event can be determined by looking at what happens to the theme. An eating event can go on only as long as there is something to eat, and so the events in the denotation of *eat a sandwich* can continue only as long as there is some sandwich to be eaten. For any particular event in the denotation of *eat a sandwich*, the culmination of that event is determined by the point at which the relevant sandwich is fully eaten. Similarly, the extent of the events in *build a house* are determined by the properties of the particular houses which are participants in the respective events. These accomplishments contrast with verbs such as *run*, which denote activities, but which may easily head telic VPs as in (6b), where the length of the running event is delimited by means of an explicit measure phrase, and (6c), where the event is delimited by a directional or path phrase, but not by an argument.

- (6)a. John ran for an hour.
- b. John ran a mile in an hour.
- c. John ran to the store in ten minutes.

The contrast between (3) and (4) is the basis for arguing that accomplishments and activities are linguistically distinguishable. Accomplishments may head atelic predicates, and activities may head telic ones, but the telicity of the VPs headed by accomplishments is dependent on the properties of their direct object, whereas the telicity of VPs headed by what we call activities is unaffected by the properties of the direct object.

Krifka (1986, 1989, 1992, 1998) has focused on making precise how the telicity of accomplishment-headed VPs is dependent on the direct object. He argues that the contrasts in (4) and (5) are explained on the basis of two linguistic

notions, incrementality and quantization. The direct object of an accomplishment is the position in which the theme argument is canonically realized. If a verbal predicate is incremental, then there is a homomorphism from the denotation of the theme to the extent of the event in which the theme is a participant. If a VP predicate is quantized, then it is telic, and if it is non-quantized it is atelic. These two notions are related in the following way. If a predicate P is quantized, then no x in the denotation of P has a proper part which is also in the denotation of P (see the definitions given in chapter 1). Nominals, or DPs, are quantized or non-quantized. If a verb is incremental, its relation with its theme is such that the properties of the direct object percolate up to the VP in such a way that the quantized or non-quantized status of the direct object DP determines the quantized or non-quantized status of the VP, and thus its telicity. If the verb is an activity verb (or an achievement verb for that matter) and thus non-incremental, the quantized status of the direct object cannot affect the VP. Krifka's account gives precise semantic content to the notion of "measuring out" or incremental theme, and in his 1998 paper he extends his account of incrementality via thematic roles to paths and other measure functions. In the next section I present his theory in detail.

Note that although Krifka's examples come from direct objects, he claims that it is the thematic relation which is relevant rather than the grammatical relation. Accomplishments, which are normally transitive, have themes in direct object position, but subjects of passives determine the telicity of the VP just as they can be subjects of resultative predicates. Neither an agent nor an experiencer can have an incremental relation with a verb/event. Dowty (1991) suggests that there are some subjects of transitive verbs which have what he calls "proto-patient" properties, and he gives as examples *John slowly entered the freezing water* and *The turtle crossed the finishing line*. However, it is not clear that these are counterexamples to the claim that it is the object of a transitive verb which measures out the extent of the verb. While you can clearly watch the progress of the event by looking at John or the turtle, it is context that determines "how much" of either of them must be affected in order for the sentence to be true, and it is thus not the case that the extent of these arguments determines the extent of the event.

4.1.3 Krifka's theory of quantization

Krifka (1992, 1998) argues that predicates can be characterized as cumulative or quantized. He defines cumulativity and quantization as follows:

- (7) If X is **cumulative** then:

$$\exists x \exists y [X(x) \wedge X(y) \wedge \neg x \sqsubseteq y \wedge \forall x \forall y [X(x) \wedge X(y) \rightarrow X(x \sqcup y)]]$$

"If a predicate X is cumulative, and X does not denote a singleton set, then for any two elements in X , their sum is also in X ."

(8) If X is **quantized** then:

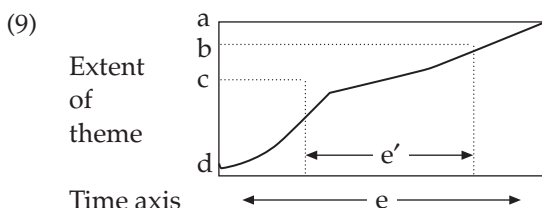
$$\forall x \forall y [X(x) \wedge X(y) \rightarrow \neg y < x]$$

“If X is quantized, then if x and y are in the denotation of X , y cannot be a proper part of x .

Examples of nominal cumulative predicates are *water* or *apples*: if x and y fall under *apples*, then the sum of x and y also falls in the denotation of *apples*. If x and y are non-overlapping and each is in the denotation of (*exactly*) *three apples*, then the sum of x and y cannot also be in the denotation of (*exactly*) *three apples* since there will be at least six apples. Thus (*exactly*) *three apples* is non-cumulative. But (*exactly*) *three apples* is a quantized nominal predicate since, if x falls under (*exactly*) *three apples*, it cannot have a proper part which is also in the denotation of (*exactly*) *three apples*. In contrast, a part of an object in the denotation of the non-quantized predicate *apples* may also be in the denotation of *apples*.

Examples of cumulative event predicates are *run* and *push a cart*; two running events can in the right context form a single event in the denotation of singular *run* and similarly for *push a cart*. However, the sum of two non-overlapping events in the denotation of *build a house* or *eat a sandwich* will not be in the denotation of the singular predicate but only in the denotation of a plural predicate such as *build houses*. On the other hand, *eat (exactly) three apples* and *build a house* are quantized since a part of an event of eating exactly three apples is not itself an event of eating three apples, and a part of an event of building a house is not an event of building a house, but only of building part of one. Atelic predicates are cumulative verbal predicates and telic predicates are quantized verbal predicates. Quantization and cumulativity are then notions which are not specific to the theory of aspectual classes, but are relevant in the classification of nominal predicates as well. In fact, as we pointed out in chapter 1, a single definition of cumulativity cannot separate mass predicates from count predicates in the nominal domain, and atelic count predicates from telic count predicates in the verbal domain, and so the analogy between the structure of the theme argument and the structure of the VP predicate is not as complete as Krifka would wish. We will come back to this in chapter 6. Krifka (1986, 1989, 1992, 1998) shows that if and only if a verb has the appropriate relation with its theme, then the quantized or cumulative status of the theme determines whether the VP is quantized (telic) or non-quantized (atelic). Whether or not the thematic relation has the right properties is what differentiates the two classes of predicates: those we call accomplishments and those we call activities.

The “appropriate thematic relation” is determined in the following way. Thematic roles are functions from events to their participants (Parsons 1990, Landman 2000), and the feature $[\pm\text{quantized}]$ percolates from the theme DP to the VP if the function expressed by the thematic role “theme” is a homomorphism from the event to its theme/patient participant. Krifka represents this graphically in (9), taken from Krifka (1992), with a – d as the theme of the event e , and b – c as the theme of the event e' :



Krifka (1998) shows that a thematic role θ is a homomorphism from the event to the object if it has the following properties (under the assumption that each thematic role has a unique value):

- θ shows mapping to subevents:

$$\forall x, y, \forall e [\theta(e, x) \wedge y \sqsubseteq x \wedge \neg y = x \rightarrow \exists e' [e' \sqsubseteq e \wedge \neg e = e' \wedge \theta(e', y)]]$$

"If x is the theme of e and y is a proper part of x , then there is some unique proper part of e which has y as its theme."

- θ shows uniqueness of events:

$$\forall x, y, \forall e [\theta(e, x) \wedge y \sqsubseteq x \rightarrow \exists! e' [e' \sqsubseteq e \wedge \theta(e', y)]]$$

"If x is the theme of e and y is part of x , then there is exactly one event e' which is part of e such that y is the theme of e' ."

- θ shows mapping to sub-objects:

$$\forall x \forall e, e' [\theta(e, x) \wedge e' \sqsubseteq e \wedge \neg e = e' \rightarrow \exists y [y \sqsubseteq x \wedge \neg y = x \wedge \theta(e', y)]]$$

"If x is the theme of e and e' is a proper part of e , then there is some (unique) proper part of x which is the theme of e' ." (Here, note that uniqueness follows from the general properties of θ .)

- θ shows uniqueness of objects:

$$\forall x \forall e, e' [\theta(e, x) \wedge e' \sqsubseteq e \rightarrow \exists! y [y \sqsubseteq x \wedge \theta(e', y)]]$$

"If x is the theme of e and e' is a part of e , then there is exactly one element y , which is part of x , which is the theme of e' ."

Together these properties constitute what he calls "strict incrementality" (in Krifka 1992 this is called "graduality"). Krifka then explains how quantized DPs lead to telic events: incrementality/graduality means that if each subevent of e has a different unique part of x as its theme and each part of x is the theme of a unique part of e , and if each part of x can be the theme of no more than one event, then at some point the object will be used up; this is the culmination point, the point at which the event is over. An event-description is telic if the linguistic expression of the theme of e gives enough information to determine the size of the object which is the theme, and thus the point at which it will be used up. So graduality is a necessary condition for telicity, and graduality plus a quantized theme is sufficient for telicity. In (10a) and (10b), the thematic role "theme" is gradual:

- (10)a. John ate apples last night.
 b. John ate three apples last night.

(10a) is non-telic although the thematic role “theme” is gradual, because the direct object cannot be used to identify a telic point; put differently, the description of the event does not include information about when the culmination occurs. (10b), on the other hand, does give such information; the event under discussion is over when the eating of three apples was completed. And because there is such a difference between (10a,b), the verb *eat* is classified as an accomplishment. In contrast, *push* does not have a gradual theme, and thus both (11a) and (11b) are non-telic, independent of the quantized or non-quantized status of the theme argument. So, *push* is classified as an activity:

- (11)a. John pushed carts last night.
 b. John pushed three carts last night.

Despite the obvious attractions of the theory, there are a number of problems. Krifka himself brings up several and suggests solutions to them, but the accumulation of questions indicates that the difficulty is more fundamental. There are two issues here: the definition of incrementality, and the relation between telicity and quantization. We will discuss the relation between telicity and quantization in chapter 6, and we will concentrate on incrementality in this chapter. Krifka raises several problems for his theory of incrementality. First, there are VPs such as *peel an apple* where what determines the extent of the event is not the extent of the whole theme of the V (the apple), but only the extent of an aspect of it, namely its outside surface which determines the extent of the peeling event. Second, there are cases where events have parts which do not directly affect a part of the theme: thus in an event of building a house there is the stage at which you put up the scaffolding and the stage at which you take it down again; in neither case is the extent of the house affected by the event at that stage. For both kinds of events, Krifka proposes a modification of the property “mapping to subobjects” which will allow the thematic relation to remain incremental/gradual. A different problem which Krifka (1998) discusses concerns events such as *read “War and Peace”* which can “affect” the same part of the object more than once, since the reader can go back and read, say, chapter 1, many times in the course of reading the book; although *read “War and Peace”* counts as telic, the property “mapping to subevents” does not hold of the thematic relation “theme.” Krifka suggests that although an event *e* of this type may not be incremental in the strict, non-repetitive sense, there is an “idealised” abstract event, which can be defined in terms of *e*, which is strictly incremental, and in terms of which a general incremental relation can be defined.

Although Krifka shows that it is possible to modify the appropriate definitions to save the homomorphism theory of telicity, I want to discuss three other kinds of problems which indicate that the difficulties are fundamental

and require a reconsideration of the nature of incrementality. First, look at examples like (12a–c), where the identical VP can be interpreted as an activity or an accomplishment predicate:

- (12)a. John wiped glass/polished silver for several hours/*in several hours.
- b. John wiped the table/polished the vase in five minutes.
- c. John wiped the table/polished the vase for five minutes.

(12a) shows that for *wipe* and *polish* a non-quantized direct object forces an atelic reading, but (12b) and (12c) show that a quantized direct object allows but does not force a telic reading. If telicity is determined by the graduality of the theme, then (12b) indicates that the theme of *wipe* and *polish* is gradual, whereas (12c) indicates the contrary. One possibility is to assume that the verb assigns two different theme roles in (12b) and (12c), the first gradual and the second non-gradual. But if this is all there is to it, then whether a theme role is or is not gradual is simply stipulated by the verb: some, like *build*, stipulate yes, others like *push* stipulate no, and others like *wipe* and *polish* leave it open. In order to go beyond stipulation, we need to determine what property of the predicate, or of the event denoted by the predicate, forces graduality of the theme relation, prevents it, or leaves it open. But then again, graduality is a by-product of some other property and not the root of it.

Two other problems which Krifka doesn't bring up indicate that the graduality of the theme relation cannot be the root of incrementality. First, we have verbal predicates which clearly head telic VPs, but in which it makes no sense to see the extent of the event as determined by the extent of the theme. Here are some examples:

- | | | |
|------|--|---|
| (13) | repair the computer
spice the soup
wash the clothes/shirt
dry the clothes
prove the theorem
paint the picture | solve the Rubik's cube
close the suitcase
close the door
lock the door
convince the student of the truth of the
argument |
|------|--|---|

In each case, the event involves what we would intuitively think of as a process with a telic point or inherent stopping point, but the extent of the theme does not determine when this point is. Repairing a computer, for example, does not usually involve affecting the computer gradually or incrementally, but rather fiddling around with it and trying various things until you hit on the cause of the problem and thus its solution. Washing the clothes or the shirt does not affect the extent of the clothes or the shirt bit by bit: the event is not over when the last part of the last item of clothing or the last part of the shirt is washed. All the clothes are put in the machine or the sink together and washed together, and the event is over when the last stage of the process (washing/rinsing/drying) is over. An event of painting a picture, although it

ends when the picture is done, does not have its size determined by its physical extent: one can paint and paint over the same piece of canvas, either because one is painting something out, or because the painting technique involves the image being painted in a “layered” way. An event of closing the door does not affect the dimensions of the door incrementally: what is incremental is the movement of the door over the path or space which it is necessary to cross to get from being open to being closed. Locking the door involves movement of the lock and not of the door; solving a problem involves following an “abstract” path of thought – but not necessarily incrementally and maybe following lots of dead-ends on the way; convincing someone of something involves affecting them, but there is no obvious way in which their “extent” determines the extent of the event, and so on.

The other problem for a homomorphism theory of telicity is an extension of this, and comes directly from our discussion of resultatives derived from activity verbs in chapter 3. We have seen that in derived resultatives, the direct object is predicted to be the theme, and that its quantized or non-quantized status determines the telicity of the VP. The relevant data from chapter 3, example (64), are repeated in (14):

- (14)a. John sang babies asleep for hours/*in an hour last night.
 b. John sang 3 babies asleep *for hours/in an hour last night.

But in what sense could the “extent” of the themes in (15) dictate the extent, or telic point, of the events involved?

- (15)a. John sang the baby asleep.
 b. The audience booed the player off the stage.
 c. The dog scratched the wound open.

If a baby falls asleep gradually it is not a gradualness which affects her extent incrementally. She does not fall asleep feet first and then legs and then torso; put differently, the size of the baby does not affect the extent of the event of singing her to sleep, though other properties of the individual baby may well affect how long the event lasts – such as how determined she is not to sleep, how tired she is and so on. Similar arguments can be made for (15b). In (15c) the extent of the wound does not affect how long the event took at all. (15c) can be true if the dog scratched and scratched at one part of a big wound so that it opened at that point, irrespective of what happened to the rest of it. The data in (12) indicate that graduality of the thematic role is not in itself sufficient to explain the special relation that accomplishments have with their theme arguments. The data in (13)–(15) indicate that a homomorphism between the extent of the event and the extent of theme argument may not be involved at all. So if the culmination point of an accomplishment is not determined by the extent of the incremental theme, what does determine it? And if the incrementality of the accomplishment is not determined by the way in which

the incremental theme is “used up,” then what makes an accomplishment incremental?

One might argue that the problem with Krifka’s theory is that the domain of the homomorphism characterizing the accomplishment is too narrow, and that what is involved is a homomorphism from some aspect of the thematic argument to the extent of the event. For example, in *close the suitcase*, the homomorphism would be from the path traversed by the lid of the suitcase to the extent of the event. This is proposed in Filip (1993/1999). But, while Filip is right in claiming that the domain of Krifka’s homomorphism is too narrowly defined, widening it is not going to solve all these problems. It is not the case that the extent of some aspect of the theme determines the extent of the event, but rather that the extent of some change happening to the theme determines the extent of the event. And so the question is how to characterize the change and the relation between it and the accomplishment of which it is part. As the examples discussed above show, the relation between the event of change and the accomplishment event may be characterizable by a function, but not by a homomorphism.

We can add another problem to the above data. We argued in chapter 2 that progressive achievements involve constructing an accomplishment verb, which has to be incremental. Yet, in examples like (16), there is no incremental theme which has a gradual relation to the verb:

- (16)a. Our pizza is arriving.
- b. Mary is reaching the top of the mountain.
- c. The plane is landing.

So the answer to the puzzle of incrementality has to explain how derived accomplishments, which do not assign a gradual thematic role, are also incremental.

4.2 A Theory of Accomplishments

4.2.1 What are incremental themes?

In chapter 3 I presented an analysis of resultatives which can be used to argue that the incremental theme of an event *e* is the argument of the event which is the culmination of *e*. A resultative predicate which is related to a matrix predicate *V* gives a property of the culmination of the event introduced by *e*. I explained the so-called direct object restriction as deriving from a restriction that the resultative must be predicated of the theme of *V*, which is canonically realized in direct object position. The resultative must be predicated of the theme because the resultative must share an object with the culmination event (because of the TPCONNECT condition), and the culmination event has the theme as its argument, because the theme is the argument which the change of state associated with an accomplishment “happens to.” Although agreement

about what a theme is is far from univocal, we can follow Gruber (1976) or Jackendoff (1972) or assume that the theme is approximately related to Dowty's (1991) "proto-patient" role; in all of these cases the theme is the affected argument of the verb. Activities such as those in (17) have themes or proto-patients or affected objects in their direct object position:

- (17)a. Mary hammered the metal bar.
b. John wiped the table.

If incremental themes are those whose [$\pm$ quantized] status affects the telicity of the VP, then we can see from (18), that the themes in (17a,b) are not incremental, and from (19) that adding a resultative predicate in the VP makes them incremental:

- (18)a. Mary hammered the metal bar for two hours.
b. John wiped the table for two hours.
(19)a. Mary hammered the metal bar flat *for two hours/in two hours.
b. John wiped the table clean *for two hours/in two hours.

So while *hammer* and *wipe* have themes, they do not have incremental themes or culminations; however, in *hammer the metal bar flat* or *wipe the table clean*, the theme is incremental. I argued in chapter 3 that this change comes about because resultative predication forces the addition of the culmination modifier in (20), which denotes a function from activities to accomplishments:

- (20) $\lambda E \lambda e. E(e) \wedge \exists e' [Cul(e)=e' \wedge Arg(e')=Th(e)]$

Applied to the activity verb *wipe*, whose meaning is given in (21a), the culmination modifier gives the verb meaning in (21b).

- (21)a. $\lambda y \lambda e. WIPE(e) \wedge Ag(e)=x \wedge Th(e)=y$
b. $\lambda y \lambda e. WIPE(e) \wedge Ag(e)=x \wedge Th(e)=y \wedge \exists e' [Cul(e)=e' \wedge Arg(e')=Th(e)]$

The V' *wipe the table* is ambiguous between the two meanings given in (22); (22a) is the V meaning used in (17b) whereas (22b) is the meaning used in (19b):

- (22)a. $\lambda e. WIPE(e) \wedge Ag(e)=x \wedge Th(e)=THE\ TABLE$
b. $\lambda e. WIPE(e) \wedge Ag(e)=x \wedge Th(e)=THE\ TABLE \wedge \exists e' [Cul(e)=e' \wedge Arg(e')=Th(e)]$

The culmination modifier assigns a culmination to an event, and selects the theme (or affected argument) of the matrix verb to be the argument of the culmination. When the matrix predicate is an intransitive, the second clause in the culmination modifier, $Arg(e')=Th(e)$, forces the verb meaning to shift from

type $\langle e, t \rangle$ to type $\langle d, \langle e, t \rangle \rangle$, adding an argument to the matrix predicate which is the argument of the culmination event and thus the incremental theme. The shift operation is given in (23), and the result of applying it to *sing* is given in (24):

(23) resultative shift (R-SHIFT):

$$\begin{aligned} & \text{R-SHIFT}(\lambda e.V(e) \wedge \text{Ag}(e)=x) \\ &= \lambda y \lambda e.V(e) \wedge \text{Ag}(e)=x \wedge \exists e'[\text{Cul}(e)=e' \wedge \text{Arg}(e')=\text{Th}(e)=y] \end{aligned}$$

(24) $\lambda y \lambda e.\text{SING}(e) \wedge \text{Ag}(e)=x \wedge \exists e'[\text{Cul}(e)=e' \wedge \text{Arg}(e')=\text{Th}(e)=y]$

John sang the baby asleep has the interpretation in (25):

(25) $\exists e \exists e_1 \exists e_2 (e =^s e_1 \sqcup e_2)$
 $\wedge \text{SING}(e_1) \wedge \text{Ag}(e_2)=\text{JOHN} \wedge \exists e'[\text{Cul}(e_1)=e' \wedge \text{Arg}(e')=\text{Th}(e_2)=\text{THE BABY}]$
 $\wedge \text{ASLEEP}(e_2) \wedge \text{Arg}(e_2)=\text{THE BABY}$
 $\wedge \text{TPCONNECT}(\text{Cul}(e_1), e_2, \text{THE BABY})]$

Thus in the resultative construction, the activity *sing* has shifted into an accomplishment predicate denoting an event which has a culmination of which THE BABY is the argument. And as we saw above in (14), repeated here, the quantization effects indicate that *the baby* is the incremental theme of the V – or more properly, the VP.

- (14)a. John sang babies asleep for hours/*in an hour last night.
 b. John sang 3 babies asleep *for hours/in an hour last night.

This data convinces us of two things: first, if resultatives give properties of and share arguments with culmination events, then the direct objects of both transitive and intransitive activities in resultative constructions are arguments of culmination events. Secondly, if the quantization effects represented in (14) are an indication of an incremental theme, then culminations have incremental themes. So the answers to the questions of what are incremental themes and what are culminations are intertwined. Now we need to know what it means to say that the singing event had a culmination, and that the the baby, as the argument of the culmination, is the incremental theme of the singing event.

4.2.2 Culminations

If incrementality is to be understood via the role “incremental theme,” and if incremental themes are the arguments of culminations, then to get any further we need to answer the question: what are culminations? There are four possible answers:

1 The culmination of an event *e* is determined by the extent of a bounded object of *e*. A culmination occurs when the bounded object of an event is “used up” in the event

This defines a culmination in terms of an incremental theme; accomplishments are associated with incremental themes, and the culmination of the accomplishment is determined by the extent of the incremental theme. This is, of course, the account proposed by Dowty (1991), Tenny (1987, 1994), and most fully by Krifka (1986, 1989, 1992, 1998). But as we saw in section 4.1.3, there are a large number of accomplishment events which have telic points, and thus culminations, but for which homomorphisms from the extent of the theme argument to the extent of the event argument cannot be defined. So while a definition of culmination in terms of incremental themes will do for a proper subset of accomplishments, this set is not representative of the general case.

2 The culmination of *e* is the result state, or the beginnings of result state, brought into being by the action determined by the matrix verb

This is essentially Dowty's (1979) account of accomplishments. In chapter 2 he gives the template for accomplishments which we see in (26a); this is translated into an event-argument framework in (26b). This template incorporates two claims: that accomplishments consist of an activity event and a BECOME event, and that these two events are related via a causal relation:

- (26)a. [ACTIVITY(P) [CAUSE [BECOME (P')]]]
 b. $\lambda e. \exists e_1 \exists e_2 [e = {}^S(e_1 \sqcup e_2) \wedge (\text{ACTIVITY}(P))(e_1) \wedge (\text{BECOME}(P'))(e_2) \wedge \text{CAUSE}(e_1, e_2)]$

(26) thus incorporates the idea that a crucial part of an accomplishment meaning is that a result state is “brought about.” In lexical accomplishments, the content of this result state is determined by the meaning of the verb.

The two parts of the claim in (26) are not inherently related. While I accept that the structure of an accomplishment is complex, consisting of an activity part and a BECOME event as in (26b), I shall argue that the relationship between them is not causal. There are several reasons for arguing this. Beth Levin has argued (2000) against a causative analysis of lexical accomplishments, pointing out that accomplishments are not necessarily causative, while causatives are not necessarily accomplishments. Thus in *John ate the sandwich* there is something very counterintuitive about suggesting that John caused something to happen to the sandwich by eating it; while on the other hand there are achievement verbs, such as *break*, which head VPs such as *break the vase*, which do seem to contain a causative element. In the latter case, we can think of an event of the vase being broken by John as being caused by some independent event, whereas an event of the sandwich being eaten by John is not causally related to some independent event but is only trivially caused

by the event of John eating the sandwich. Thus while (27a) is meaningful, there is no parallel completion for (27b), but only the trivial completion in (27c):

- (27)a. John broke the vase by dropping it on the floor.
- b. John ate the sandwich.
- c. John ate the sandwich by eating it.

Of course, one can use the *by*- phrase to add a manner component, as in *John ate the sandwich by gulping it down*, but that is not analogous to (27a). The point about (27a) is that all true causals invite the simple question "How did it happen?" And while we can meaningfully respond to *John broke the vase* with the non-trivial question "How did it happen?" or "How did he do it?", the same questions are just bizarre as a response to *John ate the sandwich*. We can understand the issue differently by looking at more formal properties of the "cause" relation. Assume that "cause" is a relation between events *e* and *e'*; then it is usually agreed that we are entitled to assume that if *e* causes *e'*, *e* precedes *e'*. Then if John broke the vase, or there was an event *e'* of the vase becoming broken, we can ask what event *e* caused this, and we can expect *e* to precede *e'*, by some time interval no matter how small. If John ate the sandwich, then there was an event of the sandwich becoming eaten, but it is unclear how we can identify an event *e* which preceded and caused it. Of course, all of John's eating activity in some sense caused the sandwich to disappear inside him, but then the sense in which the activity caused the result state to come into being is only in the sense that the final part of an event is necessarily preceded by, and by some definitions caused by the final state. But in this trivial sense, the result state of an achievement is also caused by the event of change which brings it into existence. So to say that a causal element is an inherent part of accomplishments seems to be either false or trivially true, and if trivially true, then it will be part of the meaning of other non-accomplishment verbs too (see also the discussion in Abusch 1985, 1986).

A second argument against the causal analysis of accomplishments comes from accomplishments derived from activities in resultative predication constructions, such as those in (28):

- (28)a. On May 5, 1945, the people of Amsterdam danced the Canadians to Dam Square.
- b. Reluctant to let him go, the audience clapped the singer off the stage.
- c. At the opening of the new Parliament building, the crowd cheered the huge gates open.
- d. Mary drank John under the table/sick/dizzy.
- e. Every night the neighbour's dog barks me asleep.

In these examples, the activity does not cause the result: in (28a) the people of Amsterdam do not cause the Canadians to get to Dam Square by dancing:

the Canadians were going there anyway. In (28b) the audience did not cause the singer to leave the stage by clapping; on the contrary, they would probably have been happy if their clapping had managed to prevent the singer from leaving the stage. The examples in (28c–e) give similar examples with AP resultative predicates instead of PP predicates. Sometimes, intransitive resultatives do imply a causal relation between the activity and the result, but this is a matter of pragmatics, as the minimal contrast between (28b) and (29), which does have a causal implication, shows:

(29) The audience hissed/booed/laughed the singer off the stage.

This brings us to the third possible definition of culmination.

3 The culmination of *e* is an achievement event, or minimal change of state associated with the end point of *e*

If culminations are not result states, or the beginnings of results states which are *caused* by the activity, we are left with the idea that a culmination is some minimal event which indicates the end of the activity. This fits in with the conceptually attractive idea that activities and achievements are the two basic kinds of non-stative events, and that the complex accomplishment is constructed out of a sum of an activity and an achievement. If we take the “CAUSE” relation out of the representation in (26b), we are left with (30):

(30) $\lambda e. \exists e_1 \exists e_2 [e = {}^S(e_1 \sqcup e_2) \wedge (\text{ACTIVITY}(P))(e_1) \wedge (\text{BECOME}(P'))(e_2)]$.

Superficially, this looks very plausible. Further, since Dowty (1979) suggests that achievements are to be represented as having a BECOME component (as we saw at the end of chapter 1), it looks at first sight as if (30) represents the third possibility for analysis culminations, namely that the culmination of an event *e* is an achievement event, or minimal change of state associated with the end point of *e*. This means that we could analyse accomplishments as consisting of an event which is the sum of an activity *e*₁, and an achievement, *e*₂. This would be conceptually very pleasing. It would give us three basic event types: a minimal stative eventuality, two event types in which operators affect that basic eventuality, the activity and the achievement, and one complex event type in which an event is constructed through summing the activity and the achievement. This is essentially the intuition which is represented in the templates for the basic lexical classes which I gave at the end of chapter 1: (63a–c) repeated here;

- | | | |
|--------|--------------|------------------------------------|
| (31)a. | States | $\lambda e. P(e)$ |
| b. | Activities | $\lambda e. (\text{DO}(P))(e)$ |
| c. | Achievements | $\lambda e. (\text{BECOME}(P))(e)$ |

(30) is a sum of two events of the types determined by (31b) and (31c) respectively.

However, to analyse accomplishments in this way would be a misreading of Dowty's claim that accomplishments contain a BECOME component. It would also be unhelpful in understanding what accomplishments are. First, Dowty is explicit about the fact that the BECOME part of an accomplishment differs from an achievement verb, since the BECOME part of an accomplishment takes place over an extended period of time whereas achievement BECOME events are instantaneous. And if the BECOME event in (30) takes place over an extended period of time, then e_2 in (30) cannot be the telic point or culmination event we are looking for.

Secondly, we could interpret (30) by treating the BECOME event as an achievement, as in (32) but we wouldn't gain anything in understanding.

$$(32) \text{ Accomplishments} \quad \lambda e. \exists e_1 \exists e_2 [e =^s (e_1 \sqcup e_2) \wedge (DO(P))(e_1) \wedge Cul(e) = e_2]$$

Analysing an accomplishment as an activity event summed with a minimal change of state or culmination doesn't explain very much unless we say something about the relation between the two eventualities, and (30) and (32) put two events together via conjunction without saying anything about their relation to each other. So we come to the fourth suggestion.

4 The culmination is the final minimal event in an incremental process

Analysing accomplishments as consisting of an activity and an achievement type event as in (32) misses the crucial point: the activity and the culmination must be linked via what we can call an **incremental process** or (in Dowty's terms) a BECOME event. So Dowty's original proposal that accomplishments involve an extended BECOME event is incorporated into the definition of culmination in (33):

- (33) The culmination is the final minimal event in an incremental process. It is the event which is the final part of the BECOME event; the upper bound of the BECOME event. The argument of the culmination event is the argument of the BECOME event (i.e. the affected object or theme).

So now we need to explain what an BECOME event, or incremental process, is.

The hypothesis is as follows: intuitively, an accomplishment includes an activity event and an extended change of state which affects the theme, and the extent of the change of state (how long it takes to happen) is what determines when the accomplishment ends. More precisely, an accomplishment consists of an activity event and an extended BECOME process, which is **incremental** in the way I shall make precise below. The culmination of an accomplishment is defined in terms of this BECOME event as **the final minimal event in the incremental process**, the event which is the final part of the BECOME event,

or, in other words, the upper bound of the BECOME event. The culmination event must share an argument with the BECOME event since it is part of it, and so the argument of the culmination event is the argument of the BECOME event. As Dowty and many others have shown, the argument of the BECOME event is the non-agentive entity affected by the main event. We call this the **incremental argument**, or incremental theme, since it denotes the participant in the incremental process.

To make this analysis of accomplishments precise, we need to do two things: the first is to determine what are the identifying characteristics of a BECOME event, and the second is to characterize the (non-causal) relation that holds between the activity event and the incremental event which are summed together in an accomplishment.

4.2.3 Incremental processes and incremental relations

I suggest then that an accomplishment is analysed as consisting of an activity, e , and a BECOME event which is an incremental event which “accompanies” it; we call this accompanying event the **incremental process**, and the culmination of the accomplishment is the final minimal event in this incremental process. I discuss what BECOME events are in more detail in chapter 8; for the moment I assume that a BECOME event is a “BECOME- ϕ ” event, and that it is an event e such that at the time immediately preceding the beginning of e , $\neg\phi$ is the case and at the time immediately following the end of e , ϕ is the case.

BECOME events in accomplishments are incremental in the sense that their parts are individuable, that each has a distinguishable upper bound, and that these parts have a natural and inherent order. This order is determined by our real-world knowledge of what the BECOME event under discussion actually entails. BECOME events are naturally conceptualized as ordered by an incremental chain as follows:

(34) **Incremental chain:**

Let e be a BECOME event.

An incremental chain $C(e)$ is a set of parts of e such that:

1. the smallest event in $C(e)$ is the initial bound of e
2. for every e_1, e_2 in $C(e)$ $e_1 \sqsubseteq e_2$ or $e_2 \sqsubseteq e_1$
3. $e \in C(e)$

(35) **Culmination:**

Let $C(e)$ be an incremental chain in e .

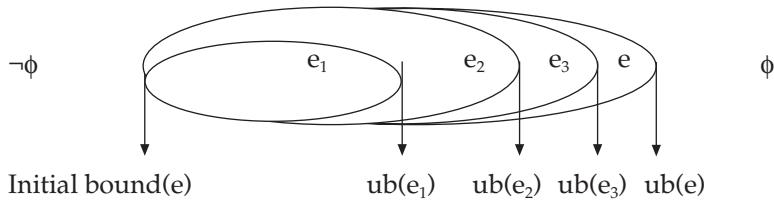
$\text{ub}(C(e)) = \{\text{ub}(e') : e' \in C(e)\}$ (the set of upper bounds)

The **culmination** of e is defined as follows:

$\text{Cul}(e)_{\text{def}} = \text{ub}(e)$

An incremental event can be represented graphically as in (36):

(36) **Incremental event (=BECOME event)**



The function of the incremental BECOME event is to “keep track” of the progress of the activity. This requires imposing a developmental structure, or ordered part structure, on the activity (this includes assigning it a culmination), and we do this by relating it to the developmental structure of the BECOME event via an **incremental relation**:

(37) **Incremental relations**

Let e_1 be an activity, e_2 be a BECOME event, and $C(e_2)$ be an incremental chain defined on e_2 .

$\text{INCR}(e_1, e_2, C(e_2))$ (e_1 is incrementally related to e_2 with respect to the chain $C(e_2)$) iff:

there is a contextually available one-one function μ from $C(e_2)$ onto $\text{PART}(e_1)$ (the set of parts of e_1) such that:
for every $e \in C(e_2)$: $\tau(e) = \tau(\mu(e))$.

We define the set of culminations of the parts of e_1 as the upper bounds of the event parts of e_1 which are the values of the μ function:

$$\text{Cul}_{C(e_2)}(e_1) = \text{ub}(\{\mu(e) : e \in C(e_2)\})$$

INCR is used in the meaning of accomplishments as follows (where $\langle x \rangle$ and $\langle y \rangle$ give the content of the activity and BECOME events):

(38) **Accomplishment template**

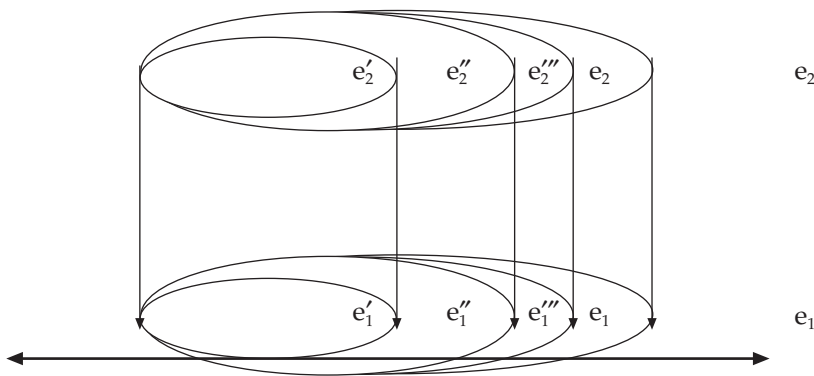
$$\begin{aligned} & \lambda y \lambda e. \exists e_1, e_2 [e =^S (e_1 \sqcup e_2) \\ & \wedge \text{ACTIVITY}_{\langle x \rangle}(e_1) \wedge \text{Ag}(e_1) = x \wedge \text{Th}(e_1) = y \\ & \wedge \text{BECOME}_{\langle y \rangle}(e_2) \wedge \text{Arg}(e_2) = \text{Th}(e_1) \\ & \wedge \text{INCR}(e_1, e_2, C(e_2))] \end{aligned}$$

Since the accomplishment inherits the properties of the activity, $\text{Cul}(e) = \text{Cul}(e_1) = \text{Cul}(e_2)$. The content of the BECOME event is derived from the structure of the Incremental Relation. The BECOME event is constrained to be (i) a change of state, (ii) which happens to the theme participant in the activity event,

(iii) while the activity event is going on. The only information that there is about the argument of the activity is precisely that it is the argument of the activity, and thus the only content which can be supplied for the content of the BECOME event is that it is a change of state in which the participant “undergoes” the activity event. In other words, the BECOME event associated with *build a house* will be $\text{BECOME-BUILT}(e_2) \wedge \text{Arg}(e_2)=\text{Th}(e_1)$, the BECOME event associated with *read “War and Peace”* will be $\text{BECOME-READ}(e_2) \wedge \text{Arg}(e_2)=\text{Th}(e_1)$, and so on.

An event structure following the template in (38) can be pictorially represented as in (39):

(39) **Accomplishment event structure**



The intuition that this reflects is the following. Activities are inherently non-structured. They are, following Dowty, homogeneous down to contextually determined minimal intervals. In an accomplishment, an incremental structure is imposed on an unstructured activity by relating it to a BECOME event. The activity part of an accomplishment can be a simple activity, which consists of a string of repeated “minimal” activity events, as in *read*, or it can be a process consisting of a string of associated tasks or events, as is the case with *build*, where the activity event consists of the multitude of different kind of activities which compose a building event. Let us look more closely at how *read* works. An event of reading involves a reading activity which consists of a string of appropriately defined “minimal reading activity events,” where a minimal reading event is an event of associating a perceived symbol, be it a word or a morpheme, with a meaning. This activity does not have any internal structure or inherent order. If a child is practising reading she can do it by picking out words at random from a book, and, indeed, lots of children’s “word books” are designed to allow them to practice the activity in just such an unstructured way. It doesn’t matter whether the child reads the words in the book in any order or not; the minimal events of reading of which the activity consists can in principle be strung together in a number of ways, not just in the way they

were in the actual event. We might well describe an event of a child engaged in such an activity as in (40a) and describe the end of such an event as in (40b), both indicating that *read* is being treated as an activity verb.

- (40)a. The child read for an hour.
b. The child stopped reading.

Of course, an activity of reading may involve some kind of order for pragmatic reasons, just in the same way that an activity of running or walking normally involves walking in a linear way. But this is different from an accomplishment eventuality which we identify as having parts which are inherently ordered as part of its description. In contrast to the activity, an accomplishment event of reading a book is one which we identify as having an inherent order which is (normally) determined by the order of the given text. An event described by *read the story of Rapunzel* does not just consist of a number of minimal reading activities; these minimal activities have to be strung together in a particular way in order for the reading activity to be an event of reading the particular story. The order of the parts of the event *read the story of Rapunzel* is determined by what is necessary for there to be an event which is in the denotation of the predicate $\lambda e.\text{BECOME READ}(e) \wedge \text{Th}(e)=\text{THE STORY OF RAPUNZEL}$. The words have to be read in a particular order, the beginning has to be read before the middle, and the middle before the end and so forth. The demands of this event are imposed on the reading activity which must perforce accompany it. The activity involved in this accomplishment is over when the event determined by the incremental process is over, i.e. when the story of Rapunzel is read. *The story of Rapunzel* is the incremental argument of the accomplishment because it is the argument of the incremental process: as the theme of the activity event and argument of the incremental process event, it is the **incremental theme**. Given the template in (38), the meaning of the accomplishment *read* will be the VP interpretation in (41), and the interpretation of *read the story of Rapunzel* will be as in (43). The direct object is the incremental theme because of the clause $\text{Arg}(e_2)=\text{Th}(e_1)$:

- (41) $\lambda y \lambda e. \exists e_1, e_2 [e =^S (e_1 \sqcup e_2) \wedge \text{READ}(e_1) \wedge \text{Ag}(e_1)=x \wedge \text{Th}(e_1)=y$
 $\wedge \text{BECOME-READ}(e_2) \wedge \text{Arg}(e_2)=\text{Th}(e_1) \wedge \text{INCR}(e_1, e_2, C(e_2))]$
- (42) *read the story of Rapunzel*
 $\lambda e. \exists e_1, e_2 [e =^S (e_1 \sqcup e_2) \wedge \text{READ}(e_1) \wedge \text{Ag}(e_1)=x \wedge \text{Th}(e_1)=\text{THE STORY OF RAPUNZEL} \wedge \text{BECOME-READ}(e_2) \wedge \text{Arg}(e_2)=\text{Th}(e_1) \wedge \text{INCR}(e_1, e_2, C(e_2))]$

The activity use of *read* used in the examples in (40) uses the intransitive activity meaning in (43), which is simply the intransitivized activity “part” of (41):

- (43) *read*
 $\lambda e. \exists y [\text{READ}(e) \wedge \text{Ag}(e)=x \wedge \text{Th}(e)=y]$

The incremental relation INCR uses the contextually determined one-one function μ which maps from the parts of the incremental chain $C(e_2)$ into $PART(e_1)$, the parts of the activity e_1 . Context plays a role here in two ways. First, the incremental chain $C(e_2)$ consists of a set of events which are part of e_2 which are arranged in a partial order. Context plays a role in the choice of which event-parts of e_2 are in the chain $C(e_2)$, in other words which event parts of e_2 are in the domain of μ . If the event is *read a book* then the relevant parts will be different depending on whether the agent is my five-year-old daughter and the book is *A Kiss for Little Bear*, or whether I am the agent and the book is *War and Peace*. In the first place the contextually relevant parts of the incremental event determined by *A Kiss for Little Bear* becoming read may be the event of reading a page of the book, or even a word of it, while in the second, the contextually relevant part events of the event of *War and Peace* becoming read are likely to be much bigger, for example the events of reading at least a chapter.

Secondly, the existence of a relevant μ function depends on there being some contextually available “connection” between the incremental event and the activity which makes it plausible to impose the developmental structure of one upon the other. When the accomplishment is a lexical one such as *read*, the nature of the event itself guarantees a relation between the activity and a BECOME event which leaves little, if anything, for context to determine. Thus, when *read* assigns a theme role as part of its meaning – which is to say, when it involves the object being read as a participant in the eventuality – it also, as part of its meaning, determines that the relevant incremental process is progress through the book or magazine, or whatever. And the culmination of the incremental process, and thus of the whole eventuality, is the point at which the object is read or used up. But, as we will see below, the role of context in establishing a plausible incremental relation is crucial in determining the acceptability of derived, rather than lexical accomplishments, especially those used in resultative constructions. We’ll come back to those in depth in section 4.3, but the point is made clearly by contrasting the examples (44a) and (44b):

- (44)a. Mary sang the baby asleep.
 b. #Mary ate the baby asleep.

(44a) is considered acceptable by most native speakers because the contextual relation between singing and a baby becoming asleep is easily recognized, and it is thus easy to “measure” or “structure” the progress of a singing activity in terms of an incremental process of a baby falling asleep. In contrast, (44b) is generally considered infelicitous, because such a contextual relation is not available. However, suppose I provide one. Suppose that Mary’s child is a very bad sleeper, and Mary, who is thoroughly exhausted, has to sit with the child for hours in the middle of the night to get her to sleep. The only way Mary can manage to keep going is by sitting by the baby’s bed with a large

box of cookies, and by eating and eating. Under such circumstances, she might say “I ate the baby asleep again tonight.” Now, most of my informants find the sentence much improved.

The above discussion focuses on *read* where the meaning of the accomplishment determines that the activity part is a simple activity consisting of repeated instances of events of a single event type. The same analysis works for *build* where the activity consists of a series of different tasks all associated with and involved in an activity of building. The relation between the activity and the incremental event are the same, with the change of state structuring the set of associated tasks which comprise the building activity.

To sum up then, an **incremental process** is a BECOME event with an inherent internal progression expressed by the fact that it has distinguishable parts which stand in a linear order and which form an **incremental chain**. The **incremental relation** between an activity and an incremental process (with respect to an incremental chain) relates parts of the incremental process to parts of the activity, using the developmental structure of the process to assign a developmental structure, and thus a culmination, to the activity. The **incremental argument** is the argument of the incremental process. What structures the accomplishment event is not (necessarily) the gradualness with which the parts of the theme are affected, but the fact that the process affecting the theme is a gradual process with recognizable stages ordered in a particular way determined by the process. The process may affect the theme gradually, and this is the case with verbs of consumption and creation; but these are special cases of the more general incremental process.

4.2.4 Answering some questions about accomplishments

4.2.4.1 Aspectual ambiguity with *wipe* and *read*

The above account explains some of the properties of accomplishments noted in section 4.1. First, it explains the basis of the contrast between verbs such as *wipe* and *polish* which seem to have both an activity and an accomplishment use, as in (12b,c) repeated here:

- (12)b. John wiped the table/polished the vase in five minutes.
- c. John wiped the table/polished the vase for five minutes.

The verb *wipe* (and similarly *polish*) is ambiguous between an activity reading, in which it denotes a set of simple activity events as in (45a), and an accomplishment reading, in which it denotes a set of complex accomplishment eventualities each of which consists of an activity eventuality incrementally related to a BECOME event via the INCR relation, as in (45b), giving the two meanings in (46) used in (12b) and (12c) respectively:

- (45)a. *wipe*_{ACCOMPLISHMENT}:
 $\lambda y \lambda e. \exists e_1 \exists e_2 [e = {}^S(e_1 \sqcup e_2) \wedge \text{ACTIVITY}_{\langle \text{WIPE} \rangle}(e_1) \wedge \text{Ag}(e_1) = x \wedge \text{Th}(e_1) = y$
 $\wedge \text{BECOME}_{\langle \text{WIPE} \rangle}(e_2) \wedge \text{Arg}(e_2) = \text{Th}(e_1)$
 $\wedge \text{INCR}(e_1, e_2, C(e_2))]$
- b. *wipe*_{ACTIVITY}:
 $\lambda y \lambda e. \text{ACTIVITY}_{\langle \text{WIPE} \rangle}(e) \wedge \text{Ag}(e) = x \wedge \text{Th}(e) = y$
- (46)a. $\exists e \exists e_1 \exists e_2 [e = {}^S(e_1 \sqcup e_2) \wedge \text{WIPE}(e_1) \wedge \text{Ag}(e_1) = \text{JOHN} \wedge \text{Th}(e_1) = \text{THE TABLE}$
 $\wedge \text{BECOME-WIPE}(e_2) \wedge \text{Arg}(e_2) = \text{Th}(e_1)$
 $\wedge \text{INCR}(e_1, e_2, C(e_2))]$
- b. $\exists e [\text{WIPE}(e) \wedge \text{Ag}(e) = \text{JOHN} \wedge \text{Th}(e) = \text{THE TABLE}]$

The relation between activity and accomplishment *wipe* is like the relation between activity and accomplishment *read*, except that in the *wipe* cases both forms are transitive. We noted above that the two cases of *wipe* are apparently distinguishable only by whether the direct object/theme is incremental or not. This derives from difference between the accomplishment and activity meanings. If the theme of the activity is also the argument of the BECOME relation, then it is incremental; if there is no BECOME relation, then the direct object is filled by the patient or theme or affected object, whichever term we choose, but this is not an incremental role. As we predicted, only (45a) can be used in the resultative *wipe the table clean*. We can think of *wipe* as lexically ambiguous, with the activity and accomplishment meanings listed parallel in the lexicon, or we can think of them as related by a lexical redundancy rule deriving the accomplishment reading from the activity via the same aspectual shift operation that is used in the resultative cases which we will discuss in section 4.3 below. The second seems more plausible, since it explains why such a shifting operation is in principle readily available in both cases.

The relation between activity and accomplishment *read* is more complex. There is an intransitive activity verb *read* used in *John read for hours* and I assume, following Fodor and Fodor (1980) and Dowty (1982), that intransitive *read*, *eat* and so on are derived from their transitive counterparts by an operation which removes a syntactic argument slot and existentially quantifies over the corresponding variable. Thus, if transitive *read* denotes a verb like (47a), the corresponding intransitive is in (47b):

- (47)a. $\lambda y \lambda e. \text{READ}(e) \wedge \text{Ag}(e) = x \wedge \text{Th}(e) = y$
 b. $\lambda e. \exists y [\text{READ}(e) \wedge \text{Ag}(e) = x \wedge \text{Th}(e) = y]$

But as Mittwoch (1982) points out in her response to Fodor and Fodor, this cannot be all that there is to intransitivization, as the transitive is (usually) an accomplishment whereas the intransitive is an activity. We saw that in contrast to transitive *read*, the intransitive examples in (40) are activities, and Mittwoch shows that minimal pairs such as those in (48) differ in the same

way. Despite the fact that (48a) and (48b) entail each other, the first is an accomplishment whereas the second is an activity. (This is argued extensively in Mittwoch (1982), using the same kind of tests that we have used up till now, so I won't go through them again here.)

- (48)a. John ate something.
b. John ate.

We can see that what is missing from both Fodor and Fodor's and Dowty's account is that the intransitivization operation is necessarily associated with an operation of aspectual shift, in which the activity part of the transitive accomplishment is detached from the whole meaning.

While intransitivization necessarily involves aspectual shift, the converse is not the case, since some cases of transitive *read* and *eat* can have an activity reading. This is shown in (49), which, as an activity, does not entail that we finished reading *Mary Poppins*.

- (49) Before Dafna went to bed, we read *Mary Poppins* for about half an hour.

Note that imperatives of accomplishments have an easy activity reading. There is a clear contrast between (50a) and (50b):

- (50)a. Eat your soup!
b. Eat your soup up!

(50a) is an instruction to get on with a particular activity, namely soup eating, while (50b) is an instruction to finish all the soup in the plate. I assume that these verbs are derived by a shift from the accomplishment to the activity reading, as formalized in (51):

- (51) $\text{SHIFT}_{\text{accomplishment} \rightarrow \text{activity}}(\lambda y \lambda e. \exists e_1, e_2 [e =^s (e_1 \sqcup e_2)$
 $\wedge \text{ACTIVITY}_{\langle X \rangle}(e_1) \wedge \text{Ag}(e_1) = x \wedge \text{Th}(e_1) = y$
 $\wedge \text{BECOME}_{\langle Y \rangle}(e_2) \wedge \text{Arg}(e_2) = \text{Th}(e_1)$
 $\wedge \text{INCR}(e_1, e_2, C(e_2))])$
 $= \lambda y \lambda e. [\text{ACTIVITY}_{\langle X \rangle}(e) \wedge \text{Ag}(e) = x \wedge \text{Th}(e) = y]$

However, this shift operation cannot be freely available, since (52a) is more acceptable than (52b):

- (52)a. Dafna read *Mary Poppins* for hours.
b. ??John built a house for hours.

I hypothesize that (52a) is more acceptable than (52b) because the activity part of *read*, as we noted above, consists of the repetition of a single kind of event, whereas the activity part of *build* consists of a series of associated different

events. In general, I hypothesize that it will be easier to derive activities derived from accomplishments when the activity part of the accomplishment is a simple repetition of a single event type, rather than a complex activity. We will come back to these activity readings of accomplishments in chapter 8.

4.2.4.2 *The incremental role of the incremental theme*

We saw in section 4.1.3 that there are many verbs which have incremental themes but where we cannot define a homomorphism from the extent of the theme to the extent of the event. There were a number of different subcases of this: cases where the notion “extent of the theme” takes only an aspect of the theme into account and not its whole extent such as *peel an apple*; cases where we have a function from the extent of the theme *into* the event but not *onto* it, leaving parts of the event unrelated to parts of the theme, such as *build a house*; cases where the relation between the theme and the event is not a function, as in *read a book*, where one chapter may be read more than once; and cases where there is simply no relation between the extent of the theme and the duration of the event, such as the examples listed in (13) including *close the suitcase*, *lock the door*, *repair the computer*, *wash the clothes*, *paint the picture*. When it comes down to it, the homomorphism account can explain the incrementality of even straightforward events like *eat the sandwich* only by postulating an idealized event in which, say, there are no pauses to drink, no coughing, and so on. The account of incrementality that I have presented shows clearly why all the problems with the homomorphism account do actually occur, and why the homomorphism account can only be used to posit an idealized BECOME event and then only for a limited set of cases. Incrementality is in fact determined by an independent incremental process charting the ordered stages in which some event affecting some participant occurs, and this event may or may not “use up” its participant gradually. The semantic constraint is that the argument of the incremental process must be the theme or affected argument of the lexical verb, so that in a sentence like *John ate the sandwich* the incremental process which determines the extent of the event must be an event which has the sandwich as participant and not John.

The incremental argument of an accomplishment is thus the argument of the incremental process. It is the participant that something happens to, stage by stage. In some kinds of events, such as those listed in (13), the extent of the incremental argument is not affected gradually. All of it is involved in the different stages of the process. In other events, most notably events of consumption like *eat the sandwich* and *drink the beer*, and events of creation like *build the house*, *paint the picture* and *write the letter*, the incremental process does affect the extent of its participant gradually, because this is what an eating event or a writing event naturally involves. But the gradual involvement is not absolute even in these cases, because eating events involve more than just biting, chewing and swallowing, while building events involve much more than putting bricks on top of one another and putting the cement in the right

places – for example, it can involve putting up scaffolding and taking it down, standing in line to get building permits, and so on. So while the extent of the affected theme which is actually affected by the event may grow as the event progresses, as in the case of these verbs of consumption and creation, there is no homomorphism between extent of the affected argument and the extent of the event. There will be cases where the extent of the object is not affected incrementally, but will be affected in a way which produces a zigzag graph. Assume that when I write a letter, I usually tear up a number of attempts before I write something which satisfies me. Then if you see me at any given time with a piece of paper in front of me, you can't tell how far I am in the process. If it is a blank piece of paper, you don't know how many attempts I have so far made, and even if it looks as if the letter is finished, you still don't know whether I am about to tear this draft up and start all over again. And at any given point, even if you know what has happened up till now, you don't know how much longer, or how many more attempts will be necessary before the letter is written. So we naturally get all the problems with defining a homomorphism between extent of the object and duration of the event which Krifka brings up and which we discussed above.

What this account does not explain as yet is the role of the incremental theme in determining telicity. I have identified the telic point of the event as the culmination point of the incremental event, or BECOME event, but I have said nothing about the role that the properties of the incremental argument, or of the incremental DP, plays in fixing that point. As we saw, the homomorphism account gives an explanation for the role of the incremental theme in determining the telicity of the VP, and it should also explain the theory I have presented here I shall show how telicity and incrementality are related in chapter 7.

4.3 Kennedy and Levin: Telicity in Terms of Degree Measurements

Before we go on to look at the interpretation of the aspectual shift operations which I argued for in chapters 2 and 3, I want to compare the analysis given above with recent work on the semantics of accomplishments in Hay, Kennedy and Levin (1999) and especially Kennedy and Levin (2002). Kennedy and Levin argue that the criterion for being an accomplishment verb cannot be the existence of a homomorphism from the extent of the theme argument to the extent of the event. Instead, what characterizes accomplishments is that they have a difference variable as part of their lexical argument structure, and that the extent of an accomplishment event is measured by the extent of the difference. Kennedy and Levin distinguish three kinds of accomplishments: verbs of creation and consumption (where the theme is involved in determining the extent of the event); verbs of motion (where the extent of the event is determined by movement along a path argument); and verbs of change of state (where the extent of the event of change is determined by the degree of change in a

gradable property whose nature is determined by the verb). In each case, the telicity of the event is determined by whether the difference variable is bounded or unbounded. The examples in (51) illustrate the three types:

- (53)a. Mary ate two bowls of rice.
 b. Bill walked to the store.
 c. The tailor lengthened my skirt.

(53a) can be paraphrased as “Mary consumed rice and lessened its quantity by two bowls,” and (53b) can be paraphrased as “Bill walked and the difference between where he began and where he finished was the distance which was between him and the store.” (53c) doesn’t need to be paraphrased to show up its degree meaning because the verb is an explicit “degree” predicate, derived from the degree adjective *long* which is analysed by Kennedy (1999) as denoting a function from individuals to values on a scale. (53c) means something like “the tailor made my skirt longer by a certain degree.” Hay, Kennedy and Levin analyse (53c) as expressing the meaning represented in (54a), where *d* is a variable over degrees. (54c) gives the meaning of the parallel sentence in (54b), where the difference variable is explicit:

- (54)a. $\exists e \exists d [\text{INCREASE}(\text{long}(\text{my skirt})) (d) (e) (\text{the tailor})]$
 b. The tailor lengthened my skirt by 5 centimetres,
 c. $\exists e [\text{INCREASE}(\text{long}(\text{my skirt})) (5 \text{ centimetres}) (e) (\text{the tailor})]$

Kennedy and Levin assume that degree achievements such as (54) reveal the basic structure of accomplishments; if (53a,b) have the same fundamental structure, then they can be assigned meanings approximately as in (55). (Note, however, that in (55b) we must ensure that *to the store* is not just a measure phrase but denotes an actual path since (51b) requires an actual path to the store to be walked and not just a distance equal to it.)

- (55)a. $\exists e [\text{CONSUME}(\text{by eating}(\text{rice})) (2 \text{ bowls}) (e) (\text{Mary})]$
 b. $\exists e [\text{MOVE}(\text{by walking}) (\text{the path to the store}) (e) (\text{Bill})]$

Kennedy, Hay, and Levin (1999) and Kennedy and Levin (2002) argue that it is the boundedness of the difference variable which makes the predicate telic or atelic. Kennedy and Levin argue that there is homomorphism from the difference argument to the event, and that if the difference variable is bounded, either explicitly or contextually, then VP is telic and if it is unbounded then it is atelic. Thus we have the contrasts in (56):

- (56)a. The council widened the road three metres in a month/*for a month.
 b. The council widened the road for two months.

(56b) can also be modified by *in a month* because of the possibility of a specific difference variable being supplied contextually.

Thus, while Krifka argues that the extent of an accomplishment event is determined by a homomorphism from the extent of the theme (or internal direct object) to the event, and I argue that the accomplishment is measured by an incremental event related to the activity by an incremental function (but not a homomorphism), Kennedy and Levin introduce a new possibility, which is that all accomplishments are to be analyzed as causing a quantifiable change of state and that the measure lies in the “size” of the change, or the difference between the start state and the end state.

The analysis explains some of the same things as my analysis. A BECOME event by definition introduces a change of state in an argument *x*; I argue that the extent of the BECOME event is the measure, whereas Kennedy and Levin (2002) propose mapping the extent of the change of state affecting *x* onto a degree on a scale, and introduce that degree as an argument of the verb. For example, I analyze *eat* as a verb assigning two arguments, an agent and a theme, and denoting an complex event with two participants, and with two subevents, an activity and a BECOME event, which are incrementally related. Kennedy and Levin, however, analyse *eat* as a non-complex event assigning three thematic roles, an agent, a theme and a difference variable, with the difference variable derived from information contained in the direct object. It would seem that the truth conditions of a sentence *S* under the two analyses should be the same, since the measure of difference in the theme which Kennedy and Levin use is determined by the BECOME event. But there are a number of problems with Kennedy and Levin’s account.

First, Kennedy and Levin claim that “quantization/telicity follows completely from the structure of the degree of change argument” (Kennedy and Levin 2002: 2), and thus, like Krifka’s, their theory is not just a theory of the structure of accomplishments but is also a theory of telicity. But their claim is not true. When the degree variable is explicitly quantized, a VP like *lengthen the skirt 5 centimetres* is clearly telic. But even in these cases, the direct object plays the same role in determining telicity that other theories claim it does; mass or bare plural direct objects lead to an atelic reading, as in (57):

- (57)a. The tailor lengthened the skirt 5 centimetres in half an hour.
- b. The tailor lengthened skirts 5 centimetres for three months, until the fashion changed.
- c. John pushed the cart full of sand to the end of the street in 5 minutes.
- d. John pushed carts full of sand to the end of the street for hours.
- e. John pushed sand to the end of the street for hours/*in an hour.

Thus it cannot be that the quantized or non-quantized status of the degree of change fully determines the telic or atelic status of the VP. (57) shows that Kennedy and Levin’s theory does not make an account of the role of the direct object redundant. This means that their account is not a theory of telicity, but a theory about the meaning of accomplishments which needs to be supplemented by an independent theory of the role played by the direct object in

determining telicity/quantization too. The “degree variable” account thus competes with other theories not as an account of telicity, but as a theory of accomplishment meanings which must interact with a theory of telicity. But if the degree of change does not play the role they claim for it, we must ask whether there is enough evidence to warrant positing an explicit degree variable in the argument structure of verbs of motion and verbs of creation, as in (55).

Looking more closely, we see that the Kennedy and Levin account has essentially the same problem as Krifka’s theory. Both take the relation between the event and an argument as the defining property of the accomplishment, rather than looking at the structure of the process or event itself. It is this focus on the internal composition of the event which distinguishes the “BECOME” theory from both of them. The difference is made clear in examples such as (54b), and parallel cases with *shorten* and so on. Suppose my mother-in-law shortens the sleeves of my jacket by five centimetres and it takes her only half an hour. I can say:

- (58) My mother-in-law shortened the sleeves of my jacket 5 centimetres in only half an hour.

(58) asserts that the extent of this event was shorter than half a hour. But the extent of this event is not determined by the degree to which the sleeves become shorter, which actually happens when she takes the scissors and cuts, but by what is involved in making the change: the event is not over when the unpicked sleeves have been shortened, but when the lining has been reset and the sleeves refolded, and restitched into the lining (which is why I was so grateful that she did the job, instead of me). There is a canonical incremental process which determines the extent of a sleeve-shortening event, and the culmination of the particular event described in (58) is determined by the canonical endpoint of that process, not the extent of the difference variable. Shortening sleeves three centimetres or five centimetres is likely to take exactly the same amount of time, unless a change in the difference variable makes the related *process* more complex. And if a smaller difference variable leads to a trickier job, then the extent of the event may be bigger because the extent of the difference variable is smaller. Kennedy and Levin argue that the incremental paradox occurs with examples like (58) because the difference variable is quantized. They also argue that the examples in (59) are telic, because a quantized difference variable is always inferable from context. *My mother-in-law was shortening the sleeves of my jacket* does not entail (59a) and *The tailor was lengthening the trousers* does not entail (59b):

- (59)a. My mother-in-law shortened the sleeves of my jacket.
 b. The tailor lengthened the trousers.

They contrast this with examples where there is no explicitly quantized difference variable, and where one cannot be inferred from context, as in (60). Here,

according to Kennedy and Levin, the imperfective in (60a) entails (60a'), and (60b) entails (60b'):

- (60)a. The sailors were lengthening the rope.
- a'. The sailors lengthened the rope.
- b. The council was widening the road.
- b'. The council widened the road.

However, a closer look at these examples just strengthens the point that what is relevant is the nature of the process involved and not the quantized or non-quantized status of the difference variable. If the entailments in (60) go through, it is not because of the non-quantized degree variable, but because of specific assumptions about the nature of the process involved. (Compare related observations in Abusch (1986) about the status of the verb *change*.) If you assume that all (60a) involves is a gradual letting out of the rope by, say, a repeated "hand-over-hand" movement, then it is true that as soon as the sailors have started the process, they have already somewhat lengthened the rope. But if you assume that lengthening the rope involves, say, unwinding the long length of "loose end" which is coiled around a metal post (as is the case on a barge), then if the sailors are in the process of uncoiling the rope, we might well want to assert *They are lengthening the rope* even though the rope is not yet lengthened at all, in which case (60a) does not entail (60a'), even though there is no quantized direct object available. A similar story can be told for (60b). If the council is digging up the road and demolishing the sidewalk then (60b) is true, but not (60b'), independent of the degree of widening (which may not even be decided on). So what matters here is the nature of the event involved and not the nature of the degree variable. Intuitively, the "hand-over-hand" scenario makes the lengthening event described in (60a) look like an activity: it involves repeated performance of a minimal event, where the number of "repeats" is not specified. And if *lengthen* events have the properties of activities, then the imperfective paradox should not hold. The cases where the imperfective paradox does hold are cases where the event looks more like an accomplishment, consisting of a single instance of an event type which can't be repeated (although it may have some repeatable subparts). We will discuss the question of when an event is repeatable in chapter 8. It is clear that when *lengthen* has an explicit difference argument, the verb behaves as an accomplishment, and is potentially telic. This is because the measure phrase means that an event in the denotation of *lengthen x a metre* cannot be constructed from an indefinitely repeated minimal event. An explicit measure on an event always makes the predicate non-cumulative, and *lengthen x a metre* is non-cumulative and potentially telic just in the same way that *eat x* or *build x* is. In each case, the properties of the direct object determine whether the V heads a telic or atelic VP.

One might argue that verbs in (60) are non-quantized, and that the lack of entailments are because any non-telic event has a "minimal initial event" during which the imperfective paradox holds. As we saw in chapter 1 (and also

shown in Dowty 1979), in the very initial stages of a running event, *John was running* will not entail *John ran*. In the same way, if the examples in (60) just involve the minimal initial event of a widening event or a shortening event, the imperfective paradox should hold. But this doesn't detract from the main point, that the nature of the process determines the semantic properties of the event, including its telic/atelic status and its susceptibility to the imperfective paradox, and not the quantized nature of the difference variable.

A second argument against Kennedy and Levin's theory of accomplishments concerns the analysis that it forces for derived accomplishments. For them, an accomplishment verb must have a difference variable as a lexical argument. I argued in chapter 3 that resultative predication with activity verbs triggers an operation of aspectual shift as part of the process of compositional interpretation, which builds an accomplishment reading out of an activity predicate, preserving the meaning of the activity and embedding it in a more complex accomplishment template. (Even when, as in the case of intransitive activities, a theme argument must be added, this does not require reanalyzing the meaning of the intransitive activity itself.) In the next chapter we will look in detail at how the aspectual shift operation described in chapter 3 can be reformulated in the framework of the analysis of accomplishments presented in this chapter. Kennedy and Levin's theory forces the shifting process to be lexical, since it would have to change meaning and argument structure of the verb to incorporate the INCREASE meaning, and difference variable, rather than using its original meaning in a more complex structure. Thus, in *Mary hammered the metal flat* Kennedy and Levin would have to argue that a lexical rule constructs a new accomplishment *hammer-flat*, which takes an agent, a theme and a difference, and in which the difference is a value on a scale of flatness. The sentence would be interpreted as asserting that there was an event of hammering in which Mary and the metal were participants, and in which Mary caused a change of state in the metal to be measured in a degree of flatness (sufficient to entail that the metal was flat). This in itself is no problem. However, problems arise with examples such as (61), repeated from examples in (28) above:

- (61)a. On May 5, 1945, the people of Amsterdam danced the Canadians to Dam Square.
- b. At the opening of the new Parliament building, the crowd cheered the huge gates open.

A lexical rule would have to derive a verb *dance* with an agent, a theme and a path argument denoted by *to Dam Square*, with the last allowing a difference measure to be understood. By analogy with (56b) it should mean something like:

- (62) $\exists e[\text{MOVE}(\text{by dancing}) (\text{to Dam Square}) (e) (\text{The people of Amsterdam}) (\text{The Canadians})]$

The problem is that it is not clear what this verb would mean, or how DANCE would relate these three participants in the dancing event. According to the semantics which Kennedy and Levin propose for accomplishments, (61a) ought to associate *dance* with a scale which directly measures the dancing event in which the people of Amsterdam and the Canadians were participants, and *to Dam Square* should denote a measure on that scale. But it is extremely difficult to give a plausible lexical meaning for a predicate DANCE of this kind. It is not a dancing activity in which the participants take part, since (61a) doesn't require the Canadians to dance. It is not a causal meaning in which the dancing causes a change of state in the Canadians since, as we have seen, the Dutch did not cause the Canadians to get to Dam Square. It is also not a meaning in which the measure directly measures how much dancing there is, since (61a) doesn't require the dancers to get to Dam Square, only the Canadians. So, it is not clear what lexical rule could determine productively how such a verb could be interpreted. The analysis I have presented avoids this problem by maintaining the original meaning of *dance* embedded in an accomplishment template and thus associated with an independent BECOME event. In this way *the people of Amsterdam* remains the single thematic argument of *dance* and the added argument receives its interpretation via its relation with the independent but associated event.

Chapter 5

The Interpretation of Derived Accomplishments

5.1 Aspectual Shift in Resultatives

5.1.1 Transitive accomplishments

The previous chapter looked at the semantics of lexical accomplishments where the association between activity and incremental process is lexically determined. In this chapter we look at the interpretation of accomplishment predicates derived through type-shifting operations triggered in particular constructions. We begin with the accomplishments derived in resultative constructions.

Accomplishment VPs such as *build a house* and *read "War and Peace,"* are headed by lexical accomplishments, where the meaning of the V stipulates what the activity is and what incremental process is associated with it. We saw that context has an important role to play in the construction of the incremental chains (for example, in the minimal pair *read "War and Peace"* and *read "A Kiss for Little Bear"*). Nonetheless, the basic information about the activity and the incremental process it is structured by are given by the lexical semantics, and there is no choice which incremental activity is chosen to "measure out," or developmentally structure, the activity. It is part of the meaning of *read* that it denotes an event with a theme participant and that its incremental process involves progression through this participant. Context determines how the event is divided into parts to give the domain of the incremental relation, and what activities which are not strictly reading activities may be part of the incremental process (discussing the book with a friend, going to a book-club meeting, etc.), what pauses (in the sense of Landman 1992) are allowed in the incremental process, and so on. Verbs such as *wipe*, which are lexically ambiguous between an activity and an accomplishment reading, are also lexically associated with an incremental process, but the association is optional, captured either through dual lexical entries or through a redundancy rule. As Dowty (1979) says, the BECOME event associated with an event predicate P is the event in which the theme "has P happen to it" or in which the theme is affected by the activity. This means that, while the particulars of the BECOME event depend on the nature of the activity involved (different themes are

affected by different kinds of activities in different ways), there is sufficient generality to formulate a redundancy rule which will predict for each accomplishment meaning the structure of the relation between the incremental process and the activity.

With derived resultative accomplishments such as *hammer the metal flat* or *sing the baby asleep*, there is no lexical information or redundancy rule which determines the nature of the BECOME relation. The type-shifting operation in chapter 3 derived these constructions by adding a culmination to the activity, and the analysis in chapter 4 shows this is done through associating the activity with an incremental process via an incremental chain. Since the association is created by a type-shifting operation and is not lexical, the relation between the activity and the incremental process is not determined by the meaning of the verb. As a result, this relation is much less constrained. We will first reformulate the aspectual shift operation triggered by resultative predication to take account of the analysis in chapter 4, and then examine the formal and the contextual issues involved in building up meanings for the derived accomplishments.

The simplest cases are where aspectual shift is applied to transitive lexical activities, such as *hammer*. *Hammer*, roughly speaking, denotes a set of activity events in which an agent brings a heavy instrument in contact with a surface or object. I leave aside all the subtle points of the meaning of *hammer*, such as whether it has to be done with a hammer or whether some other instrument will do, and whether the action has to be done with force or not. What is important is that in its simple use such as in (1), there is no lexical entailment that a change of state, or incremental process, happened to the metal.

- (1) Mary hammered the metal.

The resultative in (2) requires the verb to introduce an event with a culmination:

- (2) Mary hammered the metal flat.

The hammering event can have a culmination only if it is associated with an incremental process or BECOME event. According to the definition in chapter 4:(37), the culmination is the upper bound of this event. We define an operation on transitive activities, given in (3) (which we call **accomplishment shift**, or $\text{SHIFT}_{\text{acc}}$ for short), which builds the accomplishment from the activity.

- (3) **Accomplishment shift (for transitive activities)**

$$\begin{aligned} & \text{SHIFT}(\lambda y \lambda e. \text{ACTIVITY}_{\langle x \rangle}(e) \wedge \text{Ag}(e)=x \wedge \text{Th}(e)=y) \\ &= \lambda y \lambda e. \exists e_1 e_2 [e = {}^s(e_1 \sqcup e_2) \wedge \text{ACTIVITY}_{\langle x \rangle}(e_1) \wedge \text{Ag}(e_1)=x \wedge \text{Th}(e_1)=y \\ & \wedge \text{BECOME}_{\langle y \rangle}(e_2) \wedge \text{Arg}(e_2)=y \\ & \wedge \text{INCR}(e_1, e_2, C(e_2))] \end{aligned}$$

An explicit statement of the SHIFT operation is given by:

- (4) $\text{SHIFT}_{\text{activity} \rightarrow \text{acc}}(\alpha_{\langle d, \langle e, t \rangle \rangle})$:
 $= \lambda y \lambda e. \exists e_1, e_2 [e =^S(e_1 \sqcup e_2) \wedge \alpha(e_1, y)$
 $\wedge \text{BECOME}_{\langle Y \rangle}(e_2) \wedge \text{Arg}(e_2) = y$
 $\wedge \text{INCR}(e_1, e_2, C(e_2))]$

This gives (5) as the output of the shift (HAMMER).

- (5) $\lambda y \lambda e. \exists e_1, e_2 [e =^S(e_1 \sqcup e_2) \wedge \text{HAMMER}(e_1) \wedge \text{Ag}(e_1) = x \wedge \text{Th}(e_1) = y$
 $\wedge \text{BECOME}_{\langle Y \rangle}(e_2) \wedge \text{Arg}(e_2) = y$
 $\wedge \text{INCR}(e_1, e_2, C(e_2))]$

The content of the BECOME event is derived in the normal way: the BECOME event is a change of state which happens to the theme of the activity while the activity is going on. However, *hammer* does not have an simple accomplishment reading, because the meaning associated with the activity *hammer* simply does not give enough information to construct a plausible BECOME event associated with it. Hammering does not necessarily bring with it any change of state in the object being hammered: if the hammering is not strong enough or the object hammered is hard enough, the hammering can leave no mark at all. Neither does a hammering event necessarily imply progress through an object. While an event in the denotation of *read the book* normally by its nature involves some progression through the book, and an event in the denotation of *build a house* involves some progression or development in the coming-into-existence of the house, *hammer the metal* does not necessarily involve anything like that. One can hammer the metal for half an hour, continuously hitting the metal at the same spot, and not make any change in the metal at all. (Imagine a scenario which would support the assertion *The baby hammered the metal with her plastic hammer*.) So a BECOME event cannot be constructed just on the basis of the information that the activity event of hammering is incrementally related to a BECOME event which has the theme of the hammering as its argument.

However, what is possible is to use the accomplishment structure for *hammer* in a resultative as in *Mary hammered the metal flat*. The resultative predicate *flat* gives us information about the state of the theme of the activity at the end of the activity, namely that it is flat. This information allows us to give content to the BECOME event and interpret it as an event of becoming flat which is has the metal as its participant, to which the activity event is incrementally related via an incremental chain. If ϕ denotes the proposition *the metal is flat*, the BECOME event is interpreted as a change of state from $\neg\phi$, a state in which *the metal is flat* fails to hold, to ϕ , a state in which *the metal is flat* holds, and the incremental chain orders the stages of the BECOME-FLAT event, which may be a succession of stages in which all the metal moves from one stage of flatness to a greater one, or stages at which the different parts of the pieces of metal reach the appropriate degree of flatness, depending on the event itself.

Thus the meaning in (5) can be used in a resultative construction as in (6), with the meaning represented diagrammatically as in (7):

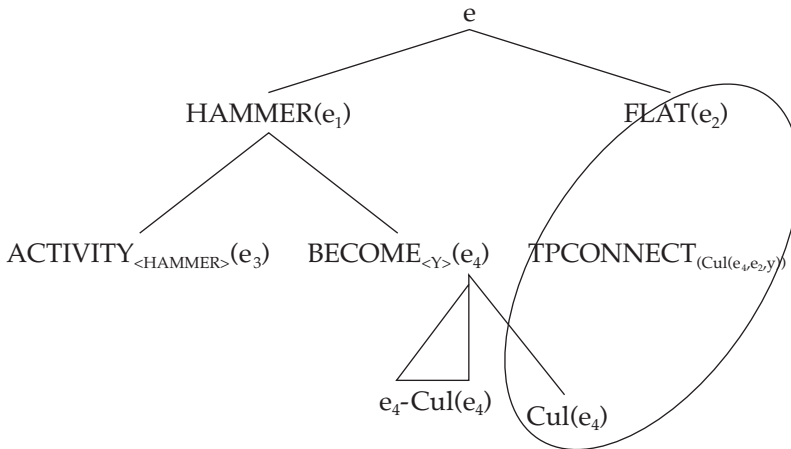
(6) Mary hammered the metal flat:

$$\begin{aligned} & \exists e, e_1, e_2, e_3, e_4 [e =^S (e_1 \sqcup e_2) \wedge e_1 =^S (e_3 \sqcup e_4) \\ & \wedge \text{ACTIVITY}_{\langle \text{HAMMER} \rangle}(e_3) \wedge \text{Ag}(e_3) = \text{MARY} \wedge \text{Th}(e_3) = \text{THE METAL} \\ & \wedge \text{BECOME}_{\langle Y \rangle}(e_4) \wedge \text{Arg}(e_4) = \text{THE METAL} \\ & \wedge \text{INCR}(e_3, e_4, C(e_4)) \\ & \wedge \text{FLAT}(e_2) \wedge \text{Arg}(e_2) = \text{THE METAL} \\ & \wedge \text{TPCONNECT}(\text{Cul}(e_1), e_2, \text{THE METAL})] \end{aligned}$$

“There was an event e which was the sum of the accomplishment event e_1 and an event e_2 of being flat where:

- the accomplishment e_1 is the sum of a hammering activity event e_3 , with Mary as agent and the metal as theme, and a BECOME event e_4 ,
- e_3 is incrementally related to e_4 ,
- the culmination of e_1 (=culmination of e_4) is time-participant connected to the event of being flat with respect to the metal.”

(7)



The representation we gave in chapter 3, repeated in (8) for the meaning of *Mary hammered the metal flat* is still adequate if it is not necessary to represent the decomposition of the accomplishment meaning:

(8) $\exists e, e_1, e_2 [e =^S (e_1 \sqcup e_2) \wedge \text{HAMMER}(e_1) \wedge \text{Ag}(e_1) = \text{MARY} \wedge \text{Th}(e_2) = \text{THE METAL} \wedge \text{FLAT}(e_2) \wedge \text{Arg}(e_2) = \text{THE METAL}]$
 $\wedge \text{TPCONNECT}(\text{Cul}(e_1), e_2, \text{THE METAL})]$

“There was an event which was the sum of a hammering event with Mary as agent and the metal as theme, and an event of the metal being flat, and the culmination of the hammering event was time-participant connected to the event of the metal being flat.”

The SHIFT operation in (4) allows at the level of sentence interpretation the same aspectual shift from activity to accomplishment reading which is available for

verbs such as *wipe* and *polish* at the lexical level. *Wipe* has both an activity reading and an accomplishment reading equally lexically available, as can be seen from the possibility of minimal pairs such as *wipe the table in five minutes/wipe the table for five minutes*. Verbs such as *hammer* have an accomplishment reading only when they occur in a sentence together with a resultative predicate which forces the shift. I therefore assume that (4) is available in the lexicon as a lexical redundancy rule relating pairs such as *wipe_{activity}* and *wipe_{accomplishment}*. In languages such as Dutch and German there is evidence that resultative predication is derived via a lexical operation (see, for example, Neeleman 1994). I hypothesize that in these cases the operation, which in English is a lexical redundancy rule, can apply freely in the lexicon as a word-formation rule, and that resultative predicate constructions can thus be derived in the lexicon.

5.1.2 Intransitive resultatives

With intransitive resultatives, the shifting operation is more complicated since it must add an argument to the original activity verb. The appropriate operation is represented in (9), and more formally in (10):

(9) **Accomplishment shift (for intransitive activities):**

$$\begin{aligned} & \text{SHIFT}(\lambda e. \text{ACTIVITY}_{\langle X \rangle}(e) \wedge \text{Ag}(e)=x) = \\ & \lambda y \lambda e. \exists e_1, e_2 [e = {}^S(e_1 \sqcup e_2) \wedge \text{ACTIVITY}_{\langle X \rangle}(e_1) \wedge \text{Ag}(e_1)=x \wedge \text{Th}(e)=y \\ & \wedge \text{BECOME}_{\langle Y \rangle}(e_2) \wedge \text{Arg}(e_2)=\text{Th}(e_1) \\ & \wedge \text{INCR}(e_1, e_2, C(e_2))] \end{aligned}$$

(10) $\text{SHIFT}^*_{\text{activity} \rightarrow \text{acc}}(\alpha_{\langle e, t \rangle})$:

$$\begin{aligned} & \lambda y \lambda e. \exists e_1, e_2 [e = {}^S(e_1 \sqcup e_2) \wedge \alpha(e_1) \wedge \text{Arg}(e_1)=y \\ & \wedge \text{BECOME}_{\langle Y \rangle}(e_2) \wedge \text{Arg}(e_2)=\text{Th}(e_1) \\ & \wedge \text{INCR}(e_1, e_2, C(e_2))] \end{aligned}$$

The operation in (10) adds an argument to the activity; the equation $\text{Arg}(e_2)=\text{Th}(e_1)$ forces the argument of the BECOME event to be the theme argument of e_1 , which by default is the new argument. In *John sang the baby asleep*, we add *the baby* as the additional argument of the verb *sing* via $\text{SHIFT}^*_{\text{activity} \rightarrow \text{acc}}$ as in (11), and this is the argument which is also the argument of the BECOME event.

(11) $\text{SHIFT}^*(\lambda e. \text{SING}(e) \wedge \text{Ag}(e)=x) =$

$$\begin{aligned} & \lambda y \lambda e. \exists e_1, e_2 [e = {}^S(e_1 \sqcup e_2) \wedge \text{SING}(e_1) \wedge \text{Ag}(e_1)=x \wedge \text{Th}(e_1)=y \\ & \wedge \text{BECOME}_{\langle Y \rangle}(e_2) \wedge \text{Arg}(e_2)=\text{Th}(e_1) \wedge \text{INCR}(e_1, e_2, C(e_2))] \end{aligned}$$

There is no lexical information about how the new argument is involved in the singing activity – in fact, this new argument has no explicit thematic relation to the activity at all, as it is introduced by the SHIFT rule and not lexically.

This means that we cannot construct a BECOME event, and the verb meaning in (11) cannot be used as an independent accomplishment, although it can be used in a resultative predication structure. The predicate *asleep* tells us what the state of the baby was at the culmination of the singing event, and this allows us to construct a BECOME event whose parts are the stages of a change of state process at the end of which the baby is asleep. In chapter 3, we gave (12) as the interpretation for *John sang the baby asleep*: given the verb meaning in (11), we can now give the more detailed representation in (13a), diagrammatically represented as in (13b):

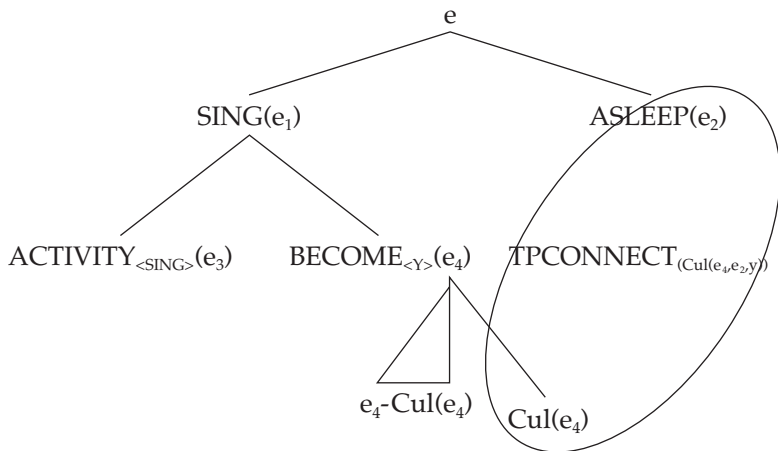
- (12) John sang the baby asleep
 $\exists e, e_1, e_2 [e =^S (e_1 \sqcup e_2) \wedge \text{SING}(e_1) \wedge \text{Ag}(e_1) = \text{JOHN}$
 $\wedge \text{ASLEEP}(e_2) \wedge \text{Arg}(e_2) = \text{THE BABY}$
 $\wedge \text{TPCONNECT}(\text{Cul}(e_1), e_2, \text{THE BABY})]$

- (13)a. $\exists e, e_1, e_2, e_3, e_4 [e =^S (e_1 \sqcup e_2) \wedge e_1 =^S (e_3 \sqcup e_4)$
 $\wedge \text{ACTIVITY}_{\langle \text{SING} \rangle}(e_3) \wedge \text{Ag}(e_3) = \text{JOHN} \wedge \text{Th}(e_3) = \text{THE BABY}$
 $\wedge \text{BECOME}_{\langle Y \rangle}(e_4) \wedge \text{Arg}(e_4) = \text{Th}(e_3)$
 $\wedge \text{INCR}(e_3, e_4, C(e_4))$
 $\wedge \text{ASLEEP}(e_2) \wedge \text{Arg}(e_2) = \text{THE BABY}$
 $\wedge \text{TPCONNECT}(\text{Cul}(e_1), e_2, \text{THE BABY})]$

"There was an event e which was the sum of the accomplishment event e_1 and an event e_2 of being flat where:

- the accomplishment e_1 is the sum of a singing activity event e_3 , with John as agent and the baby as theme, and a BECOME event e_4 ,
- e_3 is incrementally related to e_4 ,
- the culmination of e_1 (=culmination of e_4) is time-participant connected to the event of being asleep with respect to the baby."

b.



The meanings in (12) and (13) indicate that the new argument is the theme of the verb *sing*. What exactly does this mean? There is no recognizable change in the meaning of *sing*, which allows it to take an internal thematic argument in any familiar sense. But by interpreting *the baby* as an argument of *sing*, we assert that it is a participant in the singing event, and by ascribing it the theme role we claim that it is affected by the event. This is minimal, and it should be, because the important generalization seems to be that the argument of the BECOME event can be neither agent/experiencer nor goal nor benefactive in relation to the activity verb, even if these (latter) are expressed as grammatical or non-prepositional arguments of the verb. We saw in chapter 3 that an agent is never the subject of a resultative, and the examples in (14) show that while the resultative can be predicated of the theme whether or not it is the direct object immediately adjacent to the verb, the goal can never be the argument of the resultative:

- (14)a. John sent Mary the parcel_i squashed_i.
 b. John sent the parcel_i to Mary squashed_i.
 c. *John sent Mary_i the parcel happy.

The crucial property of the theme is thus that it is “affected” by the activity, and it does not have any other role in the event; we can think of “theme” as the term for the unmarked argument of the verb, the participant which is “involved” in the event but the nature of whose involvement depends on the properties of the event itself, rather than being specified by either agent or goal roles. It is this argument which is available as the incremental argument of the BECOME event. In theories which recognize a “patient” argument, the patient is identified with the theme, but then the patient is precisely a participant which is “involved” in the event, with the nature of the participation determined by the properties of the event itself. As Dowty (1991) argues, it is extraordinarily difficult to characterize the properties that are shared by patients of different verbs – consider the patients of such verbs as *drink the glass of wine*, *hammer the metal*, *address the envelope*, *push the cart*, *hear the speech* and so on.

In examples such as (15) the patient has been “demoted” from theme status, and a new theme is introduced, which is the argument of the incremental BECOME event:

- (15)a. Mary drank John under the table.
 b. I read Dafna asleep

As we argued in chapter 4, sentences like those in (15) make use of an intransitive verb which has been derived from the transitive verb by a process which simultaneously existentially quantifies over the internal thematic argument and shifts its meaning from an accomplishment to an activity. I assume following, for example, Dowty, that this is a lexical rule (and not a type-shifting operation) and that it looks something like (16).

(16) **Intransitivization:**

$$\begin{aligned}
& \lambda y \lambda e. \exists e_1, e_2 [e =^S (e_1 \sqcup e_2) \wedge \text{ACTIVITY}_{\langle X \rangle} (e_1) \wedge \text{Ag}(e_1) = x \wedge \text{Pat}(e_1) = y \\
& \wedge \text{BECOME}_{\langle Y \rangle} (e_2) \wedge \text{Arg}(e_2) = y \\
& \wedge \text{INCR}(e_1, e_2, C(e_2))] \\
& \rightarrow \\
& \lambda e. \exists z [\text{ACTIVITY}_{\langle X \rangle} (e) \wedge \text{Ag}(e) = x \wedge \text{Pa}(e) = z]
\end{aligned}$$

But while a lexically realized patient argument is the default incremental theme, an existentially bound argument is not available as an incremental theme. Thus, intransitivized *drink* can be the input to the SHIFT* operation, and can appear with a resultative as in (15a). To preserve the distinction between the argument introduced by the SHIFT operation and the original direct object, I will assume also that there is a general lexical redundancy rule which tells us that a patient argument is the default theme argument.

(16) applies to the accomplishment meaning of *drink* given in (17a), and results in the activity meaning in (17b):

- (17)a. $\lambda y \lambda e. \exists e_1, e_2 [e =^S (e_1 \sqcup e_2) \wedge \text{DRINK}(e_1) \wedge \text{Ag}(e_1) = x \wedge \text{Pa}(e_1) = y$
 $\wedge \text{BECOME}_{\langle Y \rangle} (e_2) \wedge \text{Arg}(e_2) = \text{Th}(e_1)$
 $\wedge \text{INCR}(e_1, e_2, C(e_2))]$
- b. $\lambda e. \exists z [\text{DRINK}(e) \wedge \text{Ag}(e) = x \wedge \text{Pa}(e) = z]$

If activity *drink* is used in a resultative VP as in (15a), then the SHIFT* operation given in (10) applies to intransitivized *drink* in (17) to give the verb meaning in (18):

- (18) $\lambda y \lambda e. \exists z \exists e_1 \exists e_2 [e =^S (e_1 \sqcup e_2) \wedge \text{DRINK}(e_1) \wedge \text{Ag}(e_1) = x \wedge \text{Pa}(e_1) = z \wedge \text{Th}(e_1) = y$
 $\wedge \text{BECOME}_{\langle Y \rangle} (e_2) \wedge \text{Arg}(e_2) = \text{Th}(e_1)$
 $\wedge \text{INCR}(e_1, e_2, C(e_2))]$

This verb is then summed with the resultative predicate and applied to the new direct object argument, in (15a) *John*, to give (19) as the interpretation:

- (19) Mary drank John under the table
 $\exists e, e_1, e_2, e_3, e_4 \exists z [e =^S (e_1 \sqcup e_2) \wedge e_1 =^S (e_3 \sqcup e_4)$
 $\wedge \text{DRINK}(e_3) \wedge \text{Ag}(e_3) = \text{MARY} \wedge \text{Pa}(e_3) = z \wedge \text{Th}(e_3) = \text{JOHN}$
 $\wedge \text{BECOME}_{\langle Y \rangle} (e_4) \wedge \text{Arg}(e_4) = \text{Th}(e_3)$
 $\wedge \text{INCR}(e_3, e_4, C(e_4))$
 $\wedge \text{UNDER THE TABLE}(e_2) \wedge \text{Arg}(e_2) = \text{JOHN}$
 $\wedge \text{TPCONNECT}(\text{Cul}(e_1), e_2, \text{JOHN})]$

“There was an event *e* which was the sum of the accomplishment event *e*₁ and a being under the table event *e*₂ where:

- the accomplishment e_1 is the sum of a drinking activity event e_3 , with Mary as agent and John as theme, and a BECOME event e_4 ,
- e_3 is incrementally related to e_4 ,
- the culmination of e_1 (=culmination of e_4) is time-participant connected to the event of being under the table with respect to John."

5.1.3 Why do resultatives have a "result" meaning?

I have argued in the first two parts of this section that the resultative predication operation, because it makes reference to the culmination of the matrix event, triggers an operation of aspectual shifting which allows what is inherently an activity predicate to be assigned an accomplishment interpretation. The shift operation introduces an incremental relation INCR which associates the activity e_1 with an incremental BECOME event e_2 through a function μ which maps each element in a linearly ordered set of parts of e_2 onto that part of e_1 which has the same run time. (The two versions of this operation, for transitive and intransitive activities, are given in (3) and (9) above.) The content of the BECOME event and the function μ are constructed on the basis of contextually available information. When no such contextually available information is available, the μ function cannot be constructed and the accomplishment meaning cannot be derived from the activity. This means that the shift operation cannot be freely applied, but can be used only when the appropriate contextual information is present. Resultative predication triggers the shift operation and simultaneously provides the contextual information which allows an appropriate BECOME event and μ function to be constructed. Several questions about resultative predication remain open, in particular the following.

First, what restrictions are there on the choice of resultative predicate and where does the "result" meaning in resultatives come from? In (12), repeated here, there is a strong implication that the baby is asleep as a result of John's singing, but the semantics gives as the assertion only that the baby was asleep at the culmination of the singing event, and not that the one caused the other. So where does this implication come from?

(12) John sang the baby asleep.

The examples in chapter 4:(28), repeated here, show that the causal implication cannot be part of the semantics:

- (20)a. On May 5, 1945, the people of Amsterdam danced the Canadians to Dam Square.
- Reluctant to let him go, the audience clapped the singer off the stage.
 - At the opening of the new Parliament building, the crowd cheered the huge gates open.
 - Mary drank John under the table/sick/dizzy.
 - Every night the neighbour's dog barks me asleep.

In these examples the activity clearly does not cause the state indicated by the result predicate. The causal implication must thus be derived contextually as a pragmatic effect and cannot be part of the semantics.

Secondly, if the semantics forces only that the culmination of the BECOME event and the event introduced by the resultative happen at the same time to the same entity, why are there restrictions on what pairs of verbs and adjectival predicates can go together. If (12) asserts only that John sang and at the end of his singing the baby was asleep, then why should we not use (21a) to assert that John sang and at the end of his singing the baby was dirty, or any of the other examples in (21) to make analogous assertions.

- (21)a. John sang the baby dirty.
- b. Mary ate the baby asleep.
- c. John washed the floor dirty.
- d. Mary drank the water blue.

And thirdly, Rappaport and Levin (2001) have argued that (22) shows that the result state may be temporally independent of the activity, while the semantics that I have proposed makes the result state the property of the culmination of the activity:

- (22) Last night I sang for hours, and this morning I woke up hoarse. So I guess last night I sang myself hoarse.

To answer these questions we need to understand more about how the BECOME event is constructed and how the μ function works in constructing an incremental relation between the BECOME event and the activity.

The important factor in resultative predication is that, while triggering the operation which shifts an activity e_1 into an accomplishment e , it provides information about the culmination of e , namely that $\text{Cul}(e)$ is TPCONNECTED with the event denoted by the resultative, in other words that $\text{Cul}(e)$ and the “result” event are cotemporaneous and share a participant. This information is enough to allow a BECOME event to be constructed; in *John sang the baby asleep*, the incremental process is a process at the end of which the baby is asleep; it is a BECOME-ASLEEP event. This BECOME event provides the domain of the μ function which relates the BECOME event to the activity. The μ function maps the elements of a linearly ordered set of parts of the BECOME event (the chain built on it) onto the cotemporaneous parts of the activity. Crucially, the μ function is not just a “formal” mapping which can relate any two arbitrary events providing they have the same running time. It is a contextually available function which takes two events e_1 and e_2 which stand in a relation which is contextually determined as appropriate, and maps from $C(e_2)$ into the set of parts of e_1 , such that for every $e \in C(e_2)$: $\tau(e) = \tau(\mu(e))$. In other words, $\text{INCR}(e_1, e_2, C(e_2))$ cannot relate two arbitrary events, but only two events which are connected in some appropriate way. With lexical accomplishments

such as *eat* and *read*, this is of course met, since the two events related by the incremental relation are determined lexically. With derived accomplishments in resultative predication structures, the relation between the two events is not determined lexically but is constructed contextually. Thus, the choice of resultative predicate has to be one which allows the construction of a BECOME event which reasonably stands in an incremental relation with the activity.

What counts as “reasonable”? This has to do with the function of resultative predication in VPs headed by activity verbs. A resultative predicate forces an atelic, and necessarily non-quantized VP, into a format which is potentially quantized. In other words, resultative predication provides the wherewithal to measure quantities of an activity. While *sing* denotes a set of singing events of indeterminate length, *sing x asleep* essentially provides a measure with which to isolate singing events of a certain size, namely singing events at the end of which the theme participant is asleep. In *John sung the baby asleep*, the singing event that we are interested in is individuated by the fact that it is related incrementally to the event of the baby falling asleep; in other words, an event of the baby falling asleep is used to mark the endpoint of, or measures out, or individuate, an event of John singing. The resultative thus allows us to distinguish a particular event e_i of John singing from all the other singing events that the cumulative predicate *sing* makes available, and it does this by constraining e_i to be part of a restricted and (potentially telic) event type determined by *sing . . . asleep*.

The constraint on the incremental relation between the BECOME event and the activity in an accomplishment is that the decision to use the BECOME event to measure out or individuate “chunks” of the activity is not arbitrary. Causation is one of the possible relations which makes it appropriate to use one event to measure another. If John’s singing is the cause of the baby falling asleep, then it is clearly appropriate to use the incremental process of the baby falling asleep to impose a unit structure on a chunk of singing. But causation is not the only relevant relation. In (20a), causation doesn’t play a role: the people of Amsterdam didn’t cause the Canadians liberating the city to get to Dam Square. But the dancing accompanied the progress of the Canadians, and their arrival at Dam Square provides a measure for the dancing event. Similarly, in (20c), where the resultative is an AP and not a PP, the cheering doesn’t cause the gates to become open, but the gates becoming open provide a measure for an individuable event of the crowd cheering. Resultatives may provide answers to explicit queries about the size of events. For example, in Amsterdam, metro no. 51 runs from the Central Station to the South Station as a train, but at the South Station it turns into a tram: its overhead pulley is attached to overhead electric wires, and it runs on those instead of electric rails. (It also automatically lowers a step to enable people to get on at tram-style platforms instead of station-type platforms.) I can answer the question “How far did you ride the 51” with the resultative “I rode it into a tram,” which is clearly noncausal, and which uses the resultative to give

an explicit measure of the activity. Similarly, we can ask “How long did John sing for?” “How far did the people dance” and so on, and answer with a resultative.

This gives us the answer to the first question about where the “causative” implication in a resultative comes from. The result is, strictly speaking, only the end state of the activity, but constructing a meaning for an accomplishment involves identifying the contextually relevant function which licenses the association with the BECOME event, and a causal relation between the two events is an obvious choice. If a causal relation is what μ relies on, there will be a causal implication that the result is caused by the activity.

If the μ function is available only if the incremental event and the activity event are plausibly associated, there is a pragmatic constraint on what resultative predicates can occur with which verbs. The resultative predicate must allow the construction of a BECOME event which can plausibly measure the activity. Thus we get minimal contrasts such as:

- (23)a. John wiped the table clean.
 b. ?John wiped the table dirty/red.

It is straightforward to see how an event of x’s becoming clean can measure out an event of someone’s wiping x. It is less easy to see, out of context, how an event of x’s becoming dirty or red could measure out a unit of the same activity. But given the right context, we can see how such a measure function could work, and the resultative improves:

- (24) “John, put away that dirty paint rag and wipe the table with something clean. You’re wiping the table dirty/red.”

Similarly, *I sang the baby asleep* is a natural resultative, but *I ate the baby asleep* is not. But suppose I provide the context that I did in chapter 3. I have a baby who doesn’t like going to sleep, and it takes hours to get her to sleep at night. Since I am exhausted at the end of the day, the only way I can keep up my energy level enough to function in this situation is to eat a lot while putting her to bed. You say to me after a while “I see you are putting on weight” and I reply:

- (25) Yes, every night I eat my baby asleep.

In this context my informants all find (25) much more appropriate than the almost identical (21b) offered without a context. Or suppose you know that (as was indeed the case) my daughter used to ask me to sit by her bed and count quietly to myself while she fell asleep. You might say “Do you still have to count Dafna asleep?” Again, this is a great improvement over “I counted the baby asleep” out of context.

One might still raise problems about the contrast between (26a) and (26b):

- (26)a. Mary painted the house red.
 b. ?Mary painted the house dirty/into pieces.

In these examples, the verb is a transitive accomplishment, and therefore comes with its own lexically determined BECOME event – presumably in this case the event of the house becoming painted. So the resultative does not determine the BECOME event, and it should be possible to choose a resultative independent of the contextual requirement that it determine an appropriate incremental process, and (26b) should be as acceptable as (26a), which it isn't. But suppose that specifying culminations, or properties of culminations, is inherently associated with a measuring process, for reasons that we will discuss in chapter 6. Then we expect what I will later propose as a general constraint: that is, that atomic events can be measured in only one way. Then the constraints on the resultatives with accomplishments will be even tighter than in shifted resultatives. Since the content of the BECOME event e_2 is lexically determined, the incremental process and the culmination by which the event is structured will be lexically determined. The resultative can then only give more information about the lexically determined culmination. (26a) is fine, since a process of becoming red is a normal property of the culmination of a painting process. However, without special contextual information linking them, this is not the case for a state of being dirty or being "into pieces."

The third question was about temporal dependency between the culmination and the activity in examples such as *sing oneself hoarse*. The semantics I have proposed requires the culmination of the BECOME event to be culmination of the activity event also. But, in the example brought by Rappaport and Levin (2001), cited in (22) and repeated here, it looks as if the result state, or culmination of the BECOME event, occurs long after the activity has ended:

- (22) Last night I sang for hours, and this morning I woke up hoarse. So I guess last night I sang myself hoarse.

However, this apparent temporal independence is illusory. Examples with a parallel structure do not allow the temporal independence apparently illustrated in (22). The examples in (27) are contradictory:

- (27)a. I sung the baby asleep, but when I stopped singing she was still awake.
 b. We clapped the singer off the stage, although when we stopped clapping she was still on the stage.

What makes the apparent temporal independency possible in (22) is the fact that too much singing can create the physical conditions for hoarseness, even though this doesn't show itself immediately. So in the circumstances in which (22) is true, the singer can assert at the end of the singing "I think I have probably sung myself hoarse" even though the hoarseness has not yet showed itself.

5.1.4 PPs as paths and PPs as results

Finally, our theory makes a prediction about a contrast between the examples in (28):

- (28)a. The people of Amsterdam danced the Canadians to Dam Square.
(See 20a)
b. The Canadians drove to Dam Square.

We have analyzed the VP in (28a) as a derived accomplishment containing a BECOME event, but the VP in (28b) is an activity with a modifier introducing a bounded path argument, which imposes telicity. (28a) has to be an accomplishment since there is a non-thematic DP *the Canadians* which is theta-marked only as part of the accomplishment. (28b) is not an accomplishment since we have argued at length that the subject is not the theme of the verb, and thus *to Dam Square* is not a resultative but a path argument. There is nothing wrong with this prediction but, nonetheless, it would be nice to have some independent evidence to support the claim that in accomplishments a PP such as *to Dam Square* is a result predicate, while as a modifier of an activity it is a path modifier. There is one piece of evidence which does support this. In derived accomplishment constructions such as (28a), the PP must itself be a measure – in other words, it must introduce a path with a determined endpoint. In constructions such as (28b), there is no such constraint. Thus (29a) is not as acceptable as (28a), and to the degree that it is, it requires *along the streets of Amsterdam* to be interpreted as defining a fixed distance. There is no such constraint on modifiers of activity verbs, as (29b–d) indicates.

- (29)a. ?The people of Amsterdam danced the Canadians along the streets of Amsterdam.
b. The Canadians drove along the streets of Amsterdam.
c. He pushed the cart to the end of the street.
d. He pushed the cart along the street.

5.2 Aspectual Shift in Progressive Achievements

5.2.1 The structure of the shift operation

In chapter 2, I argued that progressive achievements made use of an operation of aspectual shift which operated on an achievement to form an accomplishment. The operation was formulated as in (30) (=chapter 2:(33)):

- (30) $\text{SHIFT}(\text{VP}_{\text{punctual}}): \lambda e.(\text{BECOME})(e) \rightarrow$
 $\lambda e.\exists e_1\exists e_2[e=\text{S}(e_1\sqcup e_2) \wedge (\text{DO}(\alpha))(e_1) \wedge (\text{BECOME}(\text{VP}))(e_2) \wedge \text{Cul}(e)=e_2]$

The template for accomplishments in chapter 4:(38), repeated here as (31), requires us to reformulate the shifting operation which lifts an achievement reading into an accomplishment. I will show how this is done, and then use the result to explain the problems left over at the end of chapter 2.

(31) **Accomplishment template:**

$$\begin{aligned} & \lambda y \lambda e. \exists e_1, e_2 [e =^S (e_1 \sqcup e_2) \\ & \wedge \text{ACTIVITY}_{\langle x \rangle} (e_1) \wedge \text{Ag}(e_1) = x \wedge \text{Th}(e_1) = y \\ & \wedge \text{BECOME}_{\langle y \rangle} (e_2) \wedge \text{Arg}(e_2) = \text{Th}(e_1) \\ & \wedge \text{INCR}(e_1, e_2, C(e_2))] \end{aligned}$$

Intuitively it is clear what should happen. The $\text{SHIFT}_{\text{achievement} \rightarrow \text{accomplishment}}$ rule should take an achievement like *arrive at the station*, which denotes the set of arriving at the station events, and shift it into a meaning represented as in (32b):

$$\begin{aligned} (32) \quad & \lambda e. \exists e_1, e_2, [e =^S (e_1 \sqcup e_2) \\ & \wedge \text{ACTIVITY}_{\langle x \rangle} (e_1) \wedge \text{Th}(e_1) = x \\ & \wedge \text{BECOME}_{\langle y \rangle} (e_2) \wedge \text{Arg}(e_2) = \text{Th}(e_1) \\ & \wedge \text{INCR}(e_1, e_2, C(e_2)) \\ & \wedge \text{Cul}(e_2) \in \{e' : e' \in \text{ARRIVE AT THE STATION} \wedge \text{Th}(e') = x\}] \end{aligned}$$

In other words, the complement of PROG in a sentence like *John is arriving at the station*, the output of the shift operation, is the expression denoting a set of events which have the structure of an accomplishment, and where the culmination of the BECOME event is given by the denotation of the VP headed by the original lexical achievement. Predication will lambda abstract over the expression in (32), binding the free x variable to give a predicate of type $\langle d, \langle e, t \rangle \rangle$, and the resulting expression will be applied to the subject, *John*. The interpretation for *John is arriving at the station* is as in (33b):

$$\begin{aligned} (33)\text{a.} \quad & \text{John is arriving at the station} \\ \text{b.} \quad & \exists e [\text{PROG}(e, \lambda e'. \exists e_1, e_2, [e' =^S (e_1 \sqcup e_2) \wedge \text{ACTIVITY}_{\langle x \rangle} (e_1) \wedge \text{Th}(e_1) = \text{JOHN} \\ & \wedge \text{BECOME}_{\langle y \rangle} (e_2) \wedge \text{Arg}(e_2) = \text{Th}(e_1) \wedge \text{INCR}(e_1, e_2, C(e_2)) \\ & \wedge \text{Cul}(e_2) \in \{e'' : e'' \in \text{ARRIVE AT THE STATION} \wedge \text{Th}(e'') = \text{JOHN}\}]] \end{aligned}$$

This will be true in w if e is a stage of an event e' in world w' , such that $\langle e', w' \rangle$ is on the continuation branch of e in w , and such that e' is an event in the denotation of $\text{SHIFT}(\text{ARRIVE AT THE STATION})$, i.e. an event in the set given by (32). Put differently, (33) is true if there is an e such that (34) holds:

$$\begin{aligned} (34) \quad & \exists e' \exists w' : \langle e', w' \rangle \in \text{CON}(g(e), w) \wedge \\ & \parallel \lambda e. \exists e_1 \exists e_2 [e =^S (e_1 \sqcup e_2) \wedge \text{ACTIVITY}_{\langle x \rangle} (e_1) \wedge \text{Th}(e_1) = \text{JOHN} \\ & \wedge \text{BECOME}_{\langle y \rangle} (e_2) \wedge \text{Arg}(e_2) = \text{Th}(e_1) \wedge \text{INCR}(e_1, e_2, C(e_2)) \\ & \wedge \text{Cul}(e_2) \in \{e'' : e'' \in \text{ARRIVE AT THE STATION} \wedge \text{Th}(e'') = \text{JOHN}\}] \parallel_{w', g} (e') = 1 \end{aligned}$$

Instead of (30), then, we need the operation in (35):

- (35) $\text{SHIFT}_{\text{achievement} \rightarrow \text{accomplishment}}$ (VP):
 $\lambda e. \text{VP}_{\text{punctual}}(e) \rightarrow$
 $\lambda e. \exists e_1 \exists e_2 [e =^S(e_1 \sqcup e_2) \wedge \text{ACTIVITY}_{\langle X \rangle}(e_1) \wedge \text{Th}(e_1) = x$
 $\wedge \text{BECOME}_{\langle Y \rangle}(e_2) \wedge \text{Arg}(e_2) = \text{Th}(e_1) \wedge \text{INCR}(e_1, e_2, C(e_2))$
 $\wedge \text{Cul}(e_2) \in \{e'' : e'' \in \text{VP}\}]$

When the achievement is an transitive verb, such as *reach* in (36), things are a bit more complicated:

- (36) Mary is reaching the summit.

The shift rule predicts that the external argument of the achievement is the theme of the activity. $\text{SHIFT}_{\text{ach} \rightarrow \text{acc}}$ applies to a VP which has one free variable in it. This variable, which indicates the place in which the subject argument is to go, has to be abstracted over by the same operation which abstracts over the variable which is the value of the function $\text{Th}(e_1)$. Thus $\text{SHIFT}_{\text{ach} \rightarrow \text{acc}}$ applies to *reach the summit* to give the VP in (37):

- (37) $\lambda e. \exists e_1, e_2 [e =^S(e_1 \sqcup e_2) \wedge \text{ACTIVITY}_{\langle X \rangle}(e_1) \wedge \text{Th}(e_1) = x$
 $\wedge \text{BECOME}_{\langle Y \rangle}(e_2) \wedge \text{Arg}(e_2) = \text{Th}(e_1) \wedge \text{INCR}(e_1, e_2, C(e_2))$
 $\wedge \text{Cul}(e_2) \in \{e'' : e'' \in \text{REACH} \wedge \text{Arg}_1(e'') = x \wedge \text{Arg}_2(e'') = \text{THE SUMMIT}\}]$

According to the accomplishment template, the argument of the BECOME event is the theme of the activity – that is the participant affected by the activity; however, the compositional semantics requires the theme of the activity event to be the external argument of the achievement. Thus in (36), Mary is the external argument of the achievement, but the theme of the activity. Since I have been assuming that transitive verbs assign themes to their object position, this looks like a problem, but there are two reasons not to think that it is. First, we require the external argument of *reach* to be the theme only of the derived accomplishment and not of any lexical predicate. So the subject of the achievement can be the theme of the derived accomplishment (the activity event and the BECOME event) without being the theme of the achievement itself. Secondly, there is no evidence that the external argument of the achievement isn't its theme: it has no agentive properties which conflict with being a theme. Although Mary can be agentive in relation to the *reach the summit* event in (36), she is not obliged to be so, nor need the subject of *reach* necessarily denote an agentive participant, as we can see in (38a) and (38b) respectively, and in this the subject of *reach* differs from genuine agent positions:

- (38)a. Mary reached the summit of the mountain unconscious and on a stretcher.
 b. The supplies reached the summit of the mountain by helicopter.

Thus it could be the case that while the canonical position for realizing the theme with accomplishments is the direct object position, it is subject position with achievements.

The theoretical claim made by (37) matches our intuitions that in *Mary is reaching summit*, whatever activity is going on involves and affects Mary rather than the direct object of *reach*. Whatever the activity which leads up to Mary reaching the summit is, it is an activity which seems to involve Mary, but not the summit. Furthermore, unlike in lexical accomplishments, the direct object of *reach* cannot be used directly in measuring the progress of the progressive achievement. We see this by contrasting the examples in (39):

- (39)a. Mary was climbing the mountain when she had to stop and go home.
- b. Mary was reaching the summit of the mountain when she had to stop and go home.

Although the accomplishment event in (39a) was interrupted, the mountain was nonetheless “involved” in the event. We can evaluate the progress of the *climb the mountain* event by measuring the mountain itself and seeing how much of it was climbed. But in (39b), where the progressive achievement is interrupted, the summit itself is not yet involved in the event; it will be involved only at the telic point of the accomplishment. We evaluate the progress of the event by measuring the distance from the summit, and not by measuring the summit directly. I will thus assume that the $\text{SHIFT}_{\text{ach} \rightarrow \text{acc}}$ is indeed as in (35), and that the external argument of the achievement is the theme of the activity and BECOME subevents of the derived accomplishment, and I will make no claims about how the thematic arguments of lexical achievements are labelled (which is why in (37) they are labelled simply Arg_1 and Arg_2).

5.2.2 The content of the activity and BECOME events

What is the content of the activity and BECOME events introduced as subevents of the accomplishment derived by (35)? Remember that the BECOME event is an incremental change of state whose argument is the argument affected by the activity, i.e. its theme. In lexical accomplishments, the meaning of the lexical verb determines both the activity and the basic structure of the BECOME event: the BECOME event is constrained to be an event in which the theme of the activity is affected gradually by the activity in a contextually appropriate way. In transitive resultative constructions, the lexical verb determines the nature of the activity event, the theme and the involvement of the theme in the activity, whereas the resultative provides information about a change of state on the basis of which a BECOME event can be constructed. In intransitive resultatives, there is less lexical information available; the lexical verb

determines the activity, but gives no information about how a theme is related to it; we add a theme to the verb and, on the basis of the resultative, we construct a contextually relevant BECOME event which has the new theme as its argument, and this is used to keep track of the progress of the activity via the incremental relation. However, with progressive achievements, there is even less lexical information to go on. (35) requires only that there is an activity event, and a BECOME event and that the culmination of the BECOME event is in the denotation of the achievement, but puts no constraints on the characteristics of these events. How can we use a verb meaning with so little lexical content?

Progressives generally assert that a process stage of an event of type P is going on (to use Landman's 1992 terminology). We call an event which warrants an assertion of a progressive sentence S a witness event for S. A lexical progressive such as *Mary was climbing a mountain* asserts that there is an event going on which looks as if it will turn into an event in the denotation of MARY CLIMB A MOUNTAIN. The witness event for this sentence must have Mary and the mountain as participants; this witness event must have an activity subevent with Mary as agent, and this activity must have the characteristics normally associated with part of a climbing process. The witness event must also have a subevent which looks like part of an appropriate BECOME event, to which the activity is incrementally related. The crucial point is that lexical accomplishments have what we call a "characteristic activity" associated with them; when we learn the meaning of a verb like *climb NP* we learn what kind of activity usually goes on when an event in its denotation takes place. If there is evidence that this activity is going on, and that it is being structured by (part of) a BECOME event, we feel entitled to assert that an accomplishment of the appropriate kind is in progress. This is why we can make an assertion like (42a) from chapter 2, repeated here as (40):

- (40) Mary is building a house, but I don't know HOW she is going to finish it with the workmen on strike.

(40) asserts that there is an event *e* going on which displays the properties of the characteristic activity associated with BUILD A HOUSE, and which is incrementally related to part of a BECOME event; if there is an event *e* with such properties, then *e* is a witness event for the assertion in (40). This is because, on the basis of the internal properties of *e*, it is reasonable to suppose that *e* will develop into an event in the denotation of BUILD A HOUSE, even though for reasons external to the event we can see that it is going to be interrupted (see Landman 1992 and the discussion in chapter 2 for the distinction between "internal" and "external" which makes an assertion like (40) possible). In a progressive achievement like (33a) or (36), repeated here, we have no lexically given information about characteristics of the witness event, or about the incremental event which structures it. So, on what basis are these progressive assertions made?

(33)a. John is arriving at the station.

(36) Mary is reaching the summit.

For verbs of motion, such as *reach the top of the mountain*, *arrive at the station* and so on, the witness event must include an activity event whose characteristics are not specified, and a BECOME event which is an event of moving toward the physical location at which the culmination can take place. For (33a), it must be an event of moving toward the location of the station, and for (36) an event of moving toward the top of the mountain. In progressive achievements which do not involve events of physical movement, such as *is dying* or *is finding the reference*, the BECOME event is an event of approaching the culmination, even if this doesn't involve physical movement – for example by going through a process which may well lead to death, or by going through the actions which may lead to finding something.

In order to construct such a BECOME event, the speaker must have contextually available evidence as to how the witness event *e* is going to develop into an (abstract) accomplishment *e'* of the right kind, in other words, how the culmination will be reached. In a lexical accomplishment like *is building a house*, the speaker can rely on a typical picture or “blueprint” of how a house develops in a building event to check whether the witness event is a stage of (more properly, part of a stage of) an event of house-building. If the witness event displays enough of the characteristics to show that the blueprint has been followed up till now, then we are entitled to assume that it will carry on in the same way, unless there is good reason not to. But in *is arriving at the station* the speaker cannot rely on a general picture or blueprint of how “events of this kind” develop, since the abstract accomplishment is such that “events of this kind” is not a recognizable category. So the speaker has to be able to construct a specific incremental process or movement event for the individual event in order for the abstract accomplishment to have the appropriate content and be usable. If we look at a movement event *e*, and ask if it is a stage in an accomplishment culminating in MARY ARRIVE AT THE STATION, we can answer this only by explicitly relating *e* to the supposed culmination point, and seeing whether *e* is an event of moving toward the culmination point and whether it seems probable that the culmination point will be reached. This is why the progressive achievement in (41), parallel to (40) is infelicitous: it asserts on the one hand that there is an event stage of the right kind going on, but on the other hand denies that it is possible to construct a BECOME event which will take the event to its culmination:

(41) #Mary is arriving at the station, but I don't know HOW she is going to get there with all the roads closed. (Chapter 2: 42b)

We can express the difference between progressive accomplishments and lexical accomplishments (including those derived via resultative predication) in the following way. If an event *e* is part of a lexical accomplishment *P* (but is

a part which does not include the culmination), we can assess on the basis of what we see internal to the event *e* itself whether it provides sufficient evidence to assert that an event in the denotation of *P* is going on. (Note the distinction between whether the assertion is felicitous and whether it is actually true.) This is because by looking at *e* itself we can see whether (a) it has an activity subevent with the right characteristics, and (b) whether the theme is affected by the agent performing the activity in such a way as to provide evidence that a BECOME event of the right type is going on. So, given a non-final subevent *e* of an event in the denotation of MARY CLIMB THE MOUNTAIN, we recognize it as being such an event because (a) there is a climbing activity going on with Mary as its agent and the mountain being climbed, and (b) the mountain is climbed to a sufficient degree within *e* for us to assume that *e* is part of a BECOME event culminating in an event in which the mountain gets into the “climbed by Mary” state. Similarly, we can identify an event *e* as a non-final part of the stage of a MARY HAMMER THE METAL FLAT event if we see that there is a hammering activity going on involving Mary and the metal, and that the metal is becoming a degree flatter. Crucially we can do this without having any specific endpoint in mind – we don’t even have to commit ourselves to how much flatter the metal has to be before it can be considered “flat.” Even a part of a JOHN SANG THE BABY ASLEEP event can be recognized as such, although, as we saw, babies do not necessarily fall asleep in degrees, because we know what a characteristic singing activity looks like, and we can see at once on the basis of real world knowledge whether a particular singing event is a likely candidate for being incrementally related to an event of the baby becoming asleep: if the room is dark and the baby is in bed, then it is a plausible candidate, but if the baby is playing on the floor and the television is simultaneously blaring, then however hard John is singing, it is not a plausible candidate. In the absence of other contextual information, we would be unlikely to assert *John is singing the baby asleep*, let alone assent to it.

In contrast, an event which is going to lead up to a culmination in the denotation MARY REACH THE SUMMIT does not directly involve the summit: it only involves Mary moving towards the summit. Suppose Mary is only a third of the way up the mountain, the activity event (which is Mary moving in the right direction) involves only Mary directly as a participant. This intuition is grounded in the semantic representation. As we saw, only the syntactically external argument of the achievement is accessible as an argument of the activity and BECOME events, and thus denotation of this argument is the only semantically designated participant in either the activity or the BECOME event. Since *the summit* is an internal argument of the achievement, it is not accessible as an argument of the activity event or the BECOME event. But then the semantics of the construction does not require the sentence to provide enough information to determine whether or not an event *e* is a witness event for a progressive achievement, and this is exactly where the problem lies. In order to determine whether *e* contains a BECOME event, we have to be able to evaluate whether it is a movement toward the location of the culmination

point, and whether it is likely to result in the culmination being reached. And the only way to do this is to postulate a specific potential culmination event e' as the end point of the accomplishment and then to evaluate whether e is likely to result in the event e' . This means that unlike other, lexical, accomplishments, progressive achievements can be used only if there is a plausible potential endpoint which is contextually available, and which can be used to construct a BECOME event. This does not guarantee that the potential endpoint will actually be reached, as we saw in chapter 2 in the discussion of the imperfective paradox. There are progressive achievements where the endpoint is not reached in the actual world, as in *Mary was arriving at the station when she fell and broke her leg and had to be taken to the hospital*. However, to be assertable, there must be evidence that it is very likely that the endpoint will be reached in the actual world. In Gricean terms, the maxim of Quality requires assertions to contain information that you have good reason to assume to be true. Unless there is a way to construct a specific BECOME event for e , which shows how it is related to a specific culmination in this world, there is no good reason to assume that a progressive achievement is true. While all process events of lexical accomplishments like *is building a house* or *is reading a book* have characteristics in common, process events in the denotation of *is reaching the summit* or *is understanding a problem* are all different. An event in the denotation of *is reaching the summit* is identified only by its relation to a particular hypothesized culmination. Similarly, each event in the denotation of *is understanding the problem* can be recognized as such only if we have contextual evidence about the point at which the problem is understood and can see that the process event under discussion is related to this endpoint in the appropriate way.

We can postulate a pragmatic constraint on using progressive achievements which captures this as follows:

- (42) If an event e in w supports a progressive assertion of the form x is *VP-ing*, where *VP* denotes a set of achievement events, then there is a good possibility that there is an event-world pair $\langle e', w \rangle$ on the continuation branch of e such that e' is in the denotation of *VP*.

In other words, if an event e supports a felicitous assertion of *Mary is reaching the summit of the mountain* in w , then it must be the case that on the basis of what we see in e , there is a good possibility (in the sense of Kratzer 1981) that Mary actually reaches the summit in w . And this means that we can make this assertion only if we can actually hypothesize exactly how e develops into a event of the appropriate kind. So the difference between the progressives of lexical accomplishments and the progressives of achievements, in the language of Landman's 1992 theory of the progressive, can be summed up as follows. The felicity conditions for a progressive assertion about e in w of the form x is *VP-ing* merely require that there is good reason to believe there is a pair $\langle e', w \rangle$ on the continuation branch of e such that e' is in the denotation *VP*. An

additional pragmatic constraint on the use of progressive achievements is that there must be reason to believe that $w'=w$.

Let us see how this constraint explains the puzzles about progressive achievements that were pointed out at the end of chapter 2.

(a) Progressive achievements cannot be used with an explicit doubt as to whether it is possible to reach the culmination

This reiterates the explanation of the contrast between (40) and (41) above:

- (40) Mary is building a house, but I don't know HOW she is going to finish it with the workmen on strike.
- (41) #Mary is arriving at the station, but I don't know HOW she is going to get there with all the roads closed.

(41) expresses an explicit doubt as to whether the culmination point can be reached in this world, and thus the constraint in (42) is violated. In (40), the same kind of explicit doubt is mentioned, and yet the progressive of the accomplishment is acceptable because it is plausible that the culmination will be reached in a close world if not in the actual world.

(b) Progressive achievements cannot be used "too soon"

If Mary has just left the house to walk to the station, then we can immediately use (43a), but we cannot use (43b) felicitously until she is almost at the station.

- (43)a. Mary is walking to the station.
b. Mary is arriving at the station.

Felicitous use of (43a), with the lexical accomplishment *walk to the station*, requires us to check whether the witness event *e* displays the characteristic properties of a WALK TO THE STATION event, and provides us with good reason to assume that the event will be completed in some close world. Felicitous use of (43b) requires us to see that there is a good possibility that the activity going on in the witness event will reach a culmination in the denotation of ARRIVE AT THE STATION in the world in which (43b) is asserted. This requires the speaker to be able to build a hypothetical continuation branch from the witness event *e* to the culmination, and this is itself only possible if the culmination is "in view," i.e. if the witness event is close enough to the culmination to see how the two are connected. This explains the contrast in (44), noted at the beginning of chapter 2:

- (44)a. #Jane is reaching the summit of the mountain.
b. Jane is just reaching the summit.

Out of context, (44b) is more likely to be seen as felicitous than (44a) since it contains the information that Jane is almost at the summit, and thus the witness event is close enough to the envisaged culmination to make available sufficient contextual information to construct a BECOME event which will allow the constraint in (42) to be satisfied.

Obviously, this raises the question of what is “close enough” and this itself brings in the factor of perspective. Intuitively, a speaker makes an assertion about events from a perspective which allows her to “see” a certain amount, and the relation between a witness event *e* and its culmination will be determined in part by the perspective. So assume that I have started physically climbing a mountain, and I have gone, say, a third of the way up. I can normally assert *I am climbing Mt. Hermon* but not *I am reaching the top of Mt. Hermon*, because I am still too far away from the summit to have the evidence to build the appropriate continuation branch. But suppose my perspective is much wider and, although I am still fairly low down the side of Mt. Hermon, I conceive of this actual climbing as the last part of the event. I can felicitously say: “The first time I tried to climb Mt. Hermon I was sick and had to stop; the second time, there was a snow storm and I couldn’t even get to the foot of it; the third time, the army closed the area and I didn’t get past first base; but now, this, the fourth time, I am actually reaching the top.”

One way of capturing the notion of perspective is in terms of the contextually relevant part structure of the BECOME event. Remember that the incremental relation relating the BECOME event to the activity uses a μ function which has as its domain the linearly ordered temporal parts of the BECOME event, but which allows the part structure to be contextually determined. We can assume that, normally, the bigger (or longer) the BECOME event, the larger the contextual parts which are the input to the μ function. Now, suppose that we make precise the constraint that “*e* must be ‘close enough’ to the culmination for a BECOME event to be constructed” using the μ function; *e* will be “close enough” to the culmination event *e'* if the μ function does not distinguish too many parts of a BECOME event between *e* and *e'*. I am not going to try and answer “how many is too many” here, but this should be enough detail to see how the pragmatics can be worked out.

(c) There are no pauses in progressive achievements

Thus, we have the contrasts originally noted in chapter 2 in (43), (44) and (45), repeated here in (45) and (46):

(45) *Context*: Mary is sitting in a field just in front of the station, picking buttercups.

- a. Mary is walking to the station. She is just taking a rest.
- b. #Mary is arriving at the station. She is just taking a rest.

- (46)a. Mary was climbing to the top the mountain when she had to take refuge from an avalanche. Afterwards, she carried on to the top.
 b. Mary was reaching the top of the mountain when she had to take refuge from an avalanche. #Afterwards, she carried on to the top.
 So she didn't make it that time.

Unlike lexical accomplishments, the derived accomplishment used in a progressive achievement sentence does not allow for pauses or breaks in the process stage. (45) shows that we can identify pause stages in lexical accomplishments, but not in accomplishments derived from achievements, whereas (46) shows that if a derived accomplishment event is forcibly interrupted, it is seen as terminated, while an interrupted lexical achievement can be resumed after the interruption is over. Assume, following Landman (1992), that a pause event in an activity is an event which is flanked by events each showing the characteristic properties of that activity. Since there are no characteristics of the activities associated with accomplishments derived from achievements, it is not possible to meet this criterion. A break in the process event of a derived accomplishment of this kind terminates the event.

(d) Progressive achievements are not seen as stages in other events

Thus, we have the contrast in (47):

- (47)a. Mary is running to the Netherlands. In fact she is running to Amsterdam.
 b. Mary is arriving in the Netherlands. In fact she is arriving in Amsterdam.

If Mary is first crossing the border at Maastricht, and then continuing to Amsterdam, (47a) is appropriate, while (47b) cannot be used to describe the situation. (46b) can be used only if the event verifying *Mary arrive in the Netherlands* and *Mary arrive in Amsterdam* are the same event. This is because the event *e* which verifies RUN TO AMSTERDAM will have a part which is RUN TO THE NETHERLANDS: the BECOME event determining the structure of the latter will be part of the BECOME event determining the structure of the former. However, an accomplishment derived from an achievement does not have a lexically constructed BECOME event associated with it, but an idiosyncratic BECOME event constructed according to contextually available information on a case-by-case basis, which relates a witness event to a culmination which is "close enough." Thus it makes no sense to assert that the BECOME event associated with one derived accomplishment is part of the BECOME event associated with a different derived accomplishment.

Finally, let us compare this analysis with a suggestion made in Dowty (1979). As mentioned in chapter 2, Dowty suggests that progressive achievements such as (48) are possible because there is a canonical or well-defined procedure

associated with processes of finding, which allow us to attach an activity to the culmination:

(48) The librarian is finding the book.

This is clearly a special case of the analysis presented here: because we know what finding a book entails, it is particularly easy to construct the appropriate BECOME event, and to use an accomplishment derived from the achievement by an operation of aspectual shift. To the degree to which an example like (48) does not share the properties of other progressive achievements (for example, it is possible to argue that *is finding the book* does allow pauses), I suggest that the procedure associated with *find a book* is so well defined that it is possible to derive a lexical accomplishment *find* by a lexical rule, with the activity constrained to be the well-defined procedure, as opposed to the abstract accomplishment derived by an operation of aspectual shift.

Chapter 6

Quantization, Telicity, and Change

6.1 Quantization

Up till now, we have been concerned with the semantics of accomplishments. In this chapter we look at the interaction between accomplishments and telicity. The criteria for calling a VP telic are usually considered to be: (i) that it occurs with the temporal modifier *in α time*, and (ii) that it induces the imperfective paradox. Intuitively, telic VPs are characterized as those denoting events which have a determined endpoint (or set terminal point, to use Krifka's phrase). *In α time* locates that endpoint and thus cannot co-occur with atelic VPs which don't have a determined endpoint. The imperfective paradox occurs with telic VPs because if *e* is in VP and has a lexically determined endpoint *e'*, then any part of *e* which doesn't also include the endpoint *e'* cannot also be in VP.

Accomplishments interact with telicity because the direct object of an accomplishment determines whether the VP it occurs in is either telic or atelic, as first observed in Verkuyl (1972). This is shown in (1):

- (1)a. Mary ate bread/sandwiches for an hour.
- b. *Mary ate bread/sandwiches in an hour.
- c. Mary ate the/a sandwich in an hour.
- d. *Mary ate the/a sandwich for an hour.
- e. Mary ate three sandwiches in an hour.
- f. *Mary ate three sandwiches for an hour.
- g. Mary pushed a cart/carts/three carts for an hour.

Krifka's theory of accomplishments (Krifka 1986, 1989, 1992, 1998) is at the same time a theory of telicity. He argues that it is the homomorphism from the extent of the incremental argument to the extent of the event which allows the properties of the direct object to determine whether the VP is telic or atelic. The theory of accomplishments presented in chapter 4 does not naturally explain the relation between direct object and VP, and in this chapter and the next I will outline a theory of telicity which does account for it. Since it may be taken

as an inherent weakness of my account that an independent theory of telicity is necessary, I begin by showing the problems with Krifka's theory.

6.2 Krifka's Theory of Quantization

The data in (1a–f) show that the same accomplishment verb can head an atelic or a telic VP, depending on the properties of the direct object. If the direct object is mass or contains a bare plural, then the VP is atelic; however, if it is a singular count noun (either definite or indefinite), or a nominal with a numerical determiner, then it is telic. This does not occur with activity verbs.

Krifka explains the contrast as follows. In an accomplishment, one of the thematic roles (usually the theme role) constitutes a homomorphism from the extent of the theme to the extent of the event. This means that the extent of the incremental argument – usually the direct object – determines the endpoint of the event. DPs are classified as cumulative or quantized. The relevant definitions are repeated in (2) and (3):

- (2) X is **cumulative** iff:

$$\exists x \exists y [X(x) \wedge X(y) \wedge \neg x \sqsubseteq y \wedge \forall x \forall y [X(x) \wedge X(y) \rightarrow X(x \sqcup y)]]$$

- (3) A predicate X is **quantized** iff:

$$\forall x \forall y [X(x) \wedge X(y) \rightarrow [x \sqsubseteq y \rightarrow x = y]]$$

If the direct object is quantized, then the homomorphism will determine a unique event which satisfies the VP predicate and the VP predicate will be telic. However, if the direct object is cumulative, the homomorphism will determine a multiplicity of events such that one is a proper part of another, all of which will satisfy the VP predicate, and the VP will be atelic. (The precise definition of telicity is given in Krifka 1998: essentially it is quantization restricted to temporal parameters. An event predicate P is telic if whenever e is in P and e' a part of e , is also in P , then e and e' start and finish at the same time.) Since only accomplishments, and not activities, are associated with a homomorphism, the properties of the incremental argument will affect the telicity only of accomplishment-headed VPs. Krifka claims that with an accomplishment verb, a cumulative argument will lead to a cumulative and thus atelic VP, whereas a quantized argument will lead to a quantized, and thus telic, VP. If what is particular to accomplishments is the thematic relation with the incremental argument, then we can assume that all bare V predicates are cumulative. The sum of two events in *eat* will also be in *eat*, just as the sum of two events of *run* are in *run*. With an accomplishment, if the incremental argument is cumulative, then the sum of two events in the denotation of $[V DP]_{VP}$ will also be in $[V DP]_{VP}$, while if the incremental argument is quantized then the sum of two events in $[V DP]_{VP}$ will not be in the denotation of the same predicate.

The elegance of this account is marred by the fact that, as we pointed out in chapter 1, nominal and verbal predicates cannot be cumulative in the same way. Cumulativity in the nominal domain distinguishes mass and bare plural predicates from count predicates, while in the verbal domain it distinguishes two different kinds of count predicates – those with a “set terminal point” and those without. But elegance aside, on an empirical level, there are serious problems, since the theory makes the wrong predictions in a large number of cases. When we look more closely, we will see that both the confusion surrounding the definition of cumulativity and the empirical problems stem from the same source.

The central claim of Krifka’s theory is that in accomplishment-headed VPs a cumulative and/or non-quantized incremental argument leads to an atelic VP and that a non-cumulative and/or quantized incremental argument leads to a telic VP. However, there are many cumulative and non-quantized DPs which lead to telic VPs, as was discussed extensively in Zucchi and White (2001). These are of two kinds: those where the determiner is responsible for the cumulativity or non-quantization, and those where the lexical noun-phrase is. (So far I have not come up with any examples in the opposite direction – i.e. where a quantized DP leads to an atelic VP.)

We look first at the determiner cases. Krifka restricts his discussion of quantized direct objects to singular nominals such as *a N* and *the N*, the universal quantifier *exactly N* and plurals such as (*exactly*) *n N* (or *n N* on an implicit “exactly” reading), and he contrasts these with the obviously non-quantized bare plurals and mass nominals. But as soon as we look at a wider range of determiners we see that plural DPs in general are non-quantized and in many cases cumulative, but lead to telic VPs. For example, *some houses* is non-quantized and cumulative, since a proper part of some houses can also be some houses, and the VP *build some houses* is also non-quantized, since an event of building some houses can have a proper part which is also an event of building some houses. Similarly, the VP is cumulative, but as Mittwoch (1982) argues, a VP with *some NPs* as the direct object is also telic. The problem does not stop there. Numerical DPs are quantized only on an “exactly” reading. *At least three apples* is cumulative, since a sum of two groups of at least three apples is clearly in the denotation of at least three apples. It is also non-quantized, since a proper part of at least three apples may also be in the denotation of the predicate. *At most three apples* is non-quantized (and in fact strongly homogeneous) since any proper part of at most three apples is in the denotation of the predicate. It is not cumulative, though, as each of two pluralities of two apples are in the denotation of *at most three apples* but their sum is not. Nonetheless, *eat at least three apples* and *eat at most three apples* are as telic as *eat (exactly) three apples*, as the examples in (4) show:

- (4)a. John ate at least three apples in twenty minutes.
- b. John ate at most three apples in twenty minutes.

Zucchi and White (2001) show that non-universal quantificational DPs cause the same problem. *Most books* is cumulative and non-quantized, since adding something to a plurality of *most N* gives a plurality which will still be in *most N*. *Few books* is non-cumulative and non-quantized since part of a *few N* is still in the denotation of the predicate. *An infinite number of* is cumulative and non-quantized, and so on. In general, upwardly entailing DPs will be cumulative, and downward entailing DPs will be non-quantized. All result in telic VPs. Quantized DPs also result in telic VPs, but there are remarkably few of them: the set of quantized DPs consists of universals, singular DPs such as *the N* and *an N* with an exact reading, and numerals explicitly or implicitly modified by *exactly*. The generalization about telicity then has nothing to do with quantization and cumulativity: bare plural and mass nominals result in atelic accomplishment VPs, and other DP themes result in telic accomplishment headed VPs.

The second set of problematic examples are mentioned by Krifka himself, who credits them to Barbara Partee (see references in Zucchi and White 2001). These are cases where the incremental theme argument is cumulative, despite it being a singular count DP, because of the properties of the nominal head. Examples of nominals which behave in this way are *sequence*, *twig*, *quantity of N*. The examples are taken from Zucchi and White:

- (5)a. John wrote a sequence of numbers in ten minutes/*for ten minutes.
- b. Mary drank a quantity of milk in an hour/*for an hour.
- c. Bill found a twig in ten minutes/*for ten minutes.

The theme is not quantized since a sequence of numbers normally has a proper part which is also a sequence of numbers – a quantity of milk has a proper part which is also a quantity of milk, and a twig may well have a proper part which also counts as a twig. The range of count nouns which are non-quantized is quite big. Mittwoch (1988) points out in a footnote that many mathematical terms are non-quantized, and are in fact strongly homogeneous (parts of a line are also lines), and similarly for other mathematical terms. Rothstein (1999, 2001a,c) discusses a class of predicates such as *hedge*, *wall*, and *lawn*, which are count nouns, but strongly homogeneous and thus not quantized. These are problematic for Krifka because not only are they strongly homogeneous and thus non-quantized, they are in fact cumulative in exactly the same way that verbal predicates are. If your and my houses stand next to each other and I build a wall in front of my house while you build a adjacent wall in front of your house, we may consider them two separate walls or one continuous wall. Similar examples are discussed in Rothstein (1999, 2001a,c). So both *wall* and *a wall* are cumulative in the sense of S-cumulativity defined for count terms in chapter 1:(11), repeated here, meaning that two singular count entities in X can be joined together to form a new singular entity which is still in the denotation of the X:

- (6) X is **S-cumulative** iff:

$$\exists e \exists e' [X(e) \wedge X(e') \wedge \neg e \sqsubseteq e' \wedge \forall e'' \forall e''' [X(e) \wedge X(e') \wedge R(e, e'') \rightarrow X^S(e \sqcup e''')]]$$

But *build a wall* is a telic VP (since we can say *build a wall in two hours*), and that means that even these DPs, which are cumulative in exactly the same way that atelic VPs are cumulative, fail to induce atelicity in the VP which contains them. It really looks as if cumulativity and quantization have nothing to do with atelicity at all.

Zucchi and White (2001) try to save Krifka's theory by arguing that the non-quantized DPs get an exactly (and thus quantized) reading through maximalization effects. They explore two different ways in which this might happen. The first is by postulating that indefinites such as *at least three books* introduce a free variable which is existentially bound by closure rules at the discourse level. If quantization is relative to models and assignment functions, then at the VP level where the DP introduces a free variable it will be quantized. However, as they point out, there are several problems with this solution, including the fact that it cannot be extended to quantificational DPs. So they propose a second solution for quantificational DPs which can be extended to indefinites as well. They propose that all DPs with explicit determiners are quantized because the meanings of these DPs determine sets of maximal participants. For example, *at least three* and *at least three letters* will have the meanings:

- (7)a. [at least 3 [_{NP}α]] ⇒
 $\lambda P \lambda e. \exists y [P(y)(e) \wedge \text{Max}(\lambda z. \exists e' [P(z)(e') \wedge \alpha(z) \wedge \tau(e') \sqsubseteq t_r, y) \wedge |y| \geq 3]$
 a'. [at least 3 letters] ⇒
 $\lambda P \lambda e. \exists y [P(y)(e) \wedge \text{Max}(\lambda z. \exists e' [P(z)(e') \wedge \text{LETTERS}(z) \wedge \tau(e') \sqsubseteq t_r, y) \wedge |y| \geq 3]$

So *at least three* will denote sets of at least three individuals which together constitute the maximal participant in some event, and *at least three letters* will denote sets of at least three letters which are the maximal participant in some event. An event in the denotation of *write at least three letters* is a writing event whose patient/theme is maximal among the plural individuals that are letters written by the agent of *e* at the reference time t_r , as given in (8):

- (8) [write at least three letters] ⇒
 $\lambda e. \exists y [\text{WRITE}(e) \wedge \text{Ag}(e)=x \wedge \text{Th}(e)=y \wedge \text{Max}(\lambda z. \exists e' [\text{WRITE}(e') \wedge \text{Ag}(e)=x \wedge \text{Th}(e)=z \wedge \text{LETTERS}(z) \wedge \tau(e') \sqsubseteq t_r, y) \wedge |y| \geq 3].$

"An *e* in the set characterized by this function is a writing event whose theme is the maximal set of letters written by the agent of *e* at reference time t_r , and the cardinality of this set is greater than or equal to 3."

The maximal set of letters is the sum of all the letters such that during *e* there is an event of writing them. Thus maximalization is not a pragmatic inference, but part of the semantic meaning of the DP.

Zucchi and White (2001) assume that the reference time t_r is fixed, probably bound by the tense operator of the sentence. It is easy to see that if

maximalization relative to a reference time is part of the semantics of the DP, the DPs and the VPs which dominate them are quantized. The maximal sum of letters written by an agent during a specific interval t with cardinality n , has no proper part which has the same cardinality, and an event of writing such a maximal participant has no proper part which is also the writing of the maximal participant (assuming that the extent of the event is determined by the extent of the maximal participant). However, although making maximalization part of the semantics of determiners does make DPs with determiners quantized, and guarantees that all telic accomplishments have a “quantized” DP as incremental argument, the change in the meaning of the DP gives the wrong truth conditions for VPs headed by activity verbs.

Zucchi and White claim that *rule every country* is atelic because it is non-quantized, since if there is an event of a king ruling every country that lasts for twenty years, then there are parts of that event which are also events of his ruling every country. But while activity verbs will generally come out as heading atelic VPs with maximalization as a part of the meaning of determiners, they will be atelic with the wrong meaning. Look at the sentences in (9):

- (9)a. John has owned more than half the houses on this street for the last five years, and he is adding to his property every few months.
- b. I carried at least two children around on this bicycle for ten years.
- c. The emperor has ruled fewer than 5 countries for the last ten years.

Suppose that the meanings for *most NP*, *at least three NP*, *more than half* and so on do include a reference to maximal participants. Then (9a) means something like: “There is an eventuality of owning occurring at time t , which has a duration of five years, whose theme is the maximal set of houses owned by John at reference time t and the cardinality of this set is greater than half the number of houses on our street.” Suppose there are 40 houses on the street. The interpretation that Zucchi and White (2001) give to this means that at all times during the five-year-period, the same maximal set of more than 20 houses must have been owned by John, and this is clearly not true. Suppose John has been buying up the properties on this street for as long as I remember, and his goal is to own the whole street. About five years ago he crossed the half-way mark and he has since been progressing toward his ultimate goal. In 1997, say he owned 25 out of 40 houses, in 1998 he owned 29 houses, in 2000 he owned 33, and now he has just acquired his 36th house. In such circumstances, I can well utter (9a). But if the meaning of *at least half* involves a reference to maximal participants at a particular reference time then (9a) would be false. The same is true for (9b). Suppose I have a bicycle of the type common in Amsterdam, with three bicycle seats for children on it (one at the front and two over the back wheel). Suppose (counterfactually) that I bought the bicycle when I had two kids, and (also counterfactually) I have since had a lot more kids. Looking appreciatively at the bicycle, I say (9b), clearly intending to make the assertion that all relevant times in the last ten years I rode around with at least two kids

on the bike and sometimes I rode around with three kids on the bike. Clearly, they don't have to be same kids, and in fact maybe as many as a dozen kids rode on my bicycle during the last ten years. On the maximal participants account, the theme of *carry* would be the maximal set of children which at some part of the last ten years was carried on my bicycle, and the sentence would assert that there was an event of carrying whose theme was the maximal set of children who were carried on the bicycle over the last ten years. And this is clearly wrong. (9c) gives an example with a downward entailing DP, where the effects are equally troublesome. It is true if there have been fewer than 5 countries ruled by the emperor at all points in the last ten years, but doesn't require the countries to remain the same. If the members of the Empire change regularly, then the maximal set of countries ruled by the emperor over ten years may be more than 5, even if at no time are there more than five countries in the Empire. So the price of making maximalization a semantic property of the DP is to get the wrong truth conditions for activity sentences. (Note that Landman 2000 argues with cumulative readings that maximalization is a semantic phenomenon, but one that operates at the level of event types and not at the DP level.)

I conclude that maximalization cannot be part of the semantics of determiners, and that maximal participants cannot save the claim that it is the quantization of the theme argument which determines the telicity of accomplishment-headed VPs.

And so the generalization is that accomplishment-headed VPs are telic unless the incremental theme is a bare plural or a mass noun. In the next part of the chapter, I will try to explain why.

6.3 Telicity and Change

Leave aside for the moment the question of how the direct object of an accomplishment affects the telicity of the VP it occurs in. There is a question we should ask earlier, and that is the question left over from chapter 1: what makes achievements and accomplishments telic, when states and activities are not. As soon as we look at this question, we see that the properties of the direct object are a side issue for the simple reason that achievements, unlike accomplishments, are telic independent of the properties of the arguments. (10) shows that achievements are telic with a mass or count direct object:

- (10)a. I recognized garbage in a minute/within a minute of beginning to read the paper.
- b. She noticed new pictures and changes in the furniture in an instant.
- c. The message reached listeners in an instant.

It can be argued that the examples in (10) are irrelevant, since it is the subject which is the incremental argument of the achievement. But although a bare

plural theme/subject can induce a non-telic reading as in (11), from Verkuyl (1972), it need not do so, as the examples in (12) show:

- (11) Tourists discovered the village all summer.
- (12)a. When she rang the bell, servants arrived in a minute.
 b. Owls arrived in five minutes, bringing letters and packages.
 c. Help reached me in five minutes.

While the bare plural induces atelicity in (11), for reasons which we will discuss in the next chapter, the examples in (10) and (12) show that the telicity of the VP (or the sentence) is not determined by whether or not the incremental theme is mass or plural, but on some inherent properties of the event denoted by the V itself.

What is common to both achievements and accomplishments (but not to states or activities) which makes them both telic is that they involve events of change, the BECOME events that we have been talking about in previous chapters. Achievements are minimal changes from $\neg\phi$ to ϕ , which therefore take no time. They take no time because, assuming the principle of bivalence, either ϕ or $\neg\phi$ must hold at each instant. An instant which comes between the last instant at which $\neg\phi$ holds and the first instant at which ϕ holds must be an instant at which neither holds, and if we maintain the principle of bivalence, there can be no such instant. So an achievement is the shortest possible change and, as we shall see, the shortest possible non-stative eventuality. (Kamp 1979a,b argues that changes from $\neg\phi$ to ϕ are primitive events; that the change is precisely the instant of change at which neither $\neg\phi$ or ϕ hold, which makes a change of this kind the shortest possible eventuality. But here we will follow, for example, Dowty (1979) and treat a minimal change as consisting of two adjacent instants, and as therefore being near-instantaneous. For discussion of and comparison between different theories of change see Landman 1991.) So achievements are minimal changes and, as ter Meulen (1983) points out, this makes them "atomic" in the sense that they cannot be broken down into any smaller changes. They are clearly non-homogeneous, since any part of a change is going to be either a state in which $\neg\phi$ holds or a stage at which ϕ holds, and neither is the same kind of event as the change itself.

Accomplishments, as we have seen in chapter 4, are changes which take time. Since a change from $\neg\phi$ to ϕ is near-instantaneous, a change which takes time must be a change from ϕ to ϕ , where ϕ is of course a state which entails $\neg\phi$. Accomplishments are not atomic in the sense of ter Meulen (1983), since they can be broken down into a series of smaller changes which gradually get you from ϕ to ϕ . Accomplishments are crucially changes into ϕ , in the sense that it is the ϕ state which is lexically specified. An event in *write a book* is an event which involves a change from a state in which there is no book to a state ϕ in which a book has come into existence through being written. The predicate determines that the end of the event is the point at which the book has

“become written” but doesn’t specify where the beginning point is except that it is some contextually relevant point in the state $\neg\phi$. We can now see what it is about the meaning of accomplishments and achievements that makes them telic, i.e. events with a predetermined endpoint. They are events of change, and the event is over when the change has taken place. As long as a change applies to a singular argument, it is easy to see that the structure of the change determines “how long” the event is. *Mary wrote a book* is an event which is over as soon as the change of “become written” has happened to the book. Similarly, in the atelic *Mary wrote magazine articles* the bare plural does not intuitively allow us to see when the event is over, since it leaves open how many articles were written and thus how many singular BECOME events occurred, and thus how long the plural event took. So, bearing in mind that the telic lexical classes are those which involve change, we come back to the question of what the relation is between the structure of the argument and the telicity of the VP. A telic VP cannot simply be one which allows its endpoint to be determined because, as we have seen above, *eat at least three sandwiches* and *eat no more than three sandwiches* are both telic, and yet they give, respectively, only minimal and maximal criteria for the extent of the events they denote.

What we have seen is that for an accomplishment-headed VP to be telic, its direct object must have a determiner. We want therefore a formal account of telicity which incorporates this structural generalization, and which explains how the semantics of determiners interacts with the generalization that the telic lexical classes denote events of change. We need to then to answer the following questions:

- 1 Why does an accomplishment V head a telic VP when it has an incremental theme with a lexically realized determiner, and head an atelic VP when its incremental theme is a bare plural or a mass noun.
- 2 Why does an achievement head a telic VP even when the argument undergoing the change of state is the denotation of a mass noun or bare plural.

I shall argue that the answer lies in the relation between telicity and atomicity. However, to explain what this relation is we will need to look at how we identify atomic events.

Chapter 7

Telicity and Atomicity

7.1 Telicity and Atomicity

Here is the central hypothesis. Telicity is to do with counting and the identification of atomic events. A VP is telic if it denotes a set of countable events, and a set of entities P is countable if criteria are given for determining what is an atomic entity in P. So a VP is telic if the VP expresses criteria for individuating atomic events, and it is atelic if this is not the case.

The basic contrast shows up in (1):

- (1)a. Mary ran a mile.
- b. Mary ran.
- c. John ate three sandwiches.
- d. John ate.

(1a) asserts that there was an event of Mary running and includes the information that the event is measured by how far Mary ran. (1b) asserts that there was a running event but gives no criteria for determining what “chunk” of running counts as a single running event. (1c) asserts that there was an event of eating at least three sandwiches, while (1d) gives no criteria for determining what counts as a single event of eating. In a sufficiently rich context, both (1b) and (1d) can have telic interpretations; in this case the context provides information as to how big the single event was, as for example in (2):

- (2)a. This morning Mary ran in half an hour.
- b. Today at lunch time I ate in the cafeteria.

Crucially, I am not arguing that the atelic/telic distinction is a mass/count distinction, and in this I differ from several authors, in particular Bach (1986). I have argued (Rothstein 1999, 2001a) that all verbs have their denotation in the count domain, and I will review the evidence below. But within the count domain, we can distinguish between VPs denoting sets of countable entities where the criteria for atomicity is given (even if unexpressed) and those where

no such criterion for individuation is available. I formulate the telicity principle below:

(3) **Telicity principle:**

A VP is telic if it denotes a set of events *X* which is atomic, or which is a pluralization of an atomic set (i.e. if the criterion for individuating an atomic event in *X* are fully recoverable).

The range of telic VPs is determined by the different ways available for determining atomicity. Achievements and accomplishments are telic because of their association with BECOME events which provide criteria for atomicity. Activities and states such as *push the cart*, *run* and *love* are atelic, but can head telic VPs if the criterion for atomicity is indicated via a path argument such as *to the store*, or a measure phrase such as *a mile* or *for α time*. First, though, we review the evidence that events have their denotation in the count domain.

7.2 Events have their Denotation in the Count Domain

A very plausible way of thinking about the telic/atelic distinction is that it parallels the count/mass distinction in the nominal domain. Count predicates such as *cup* and *girl* are quantized, non-homogeneous, and non-cumulative, whereas mass predicates are homogeneous and cumulative. A part of a cup is not a cup and a part of a girl is not a girl, while a sum of two cups or girls does not fall in the denotation of *cup* or *girl*, but in the denotation of the plural predicate *cups* and *girls* respectively. In contrast, a part of a quantity of water is water, and the sum of two quantities of water is in the denotation of *water*. This looks analogous to the distinction between a quantized, non-cumulative VP such as *eat the apple* on the one hand and an atelic predicate such as *run* or *drink water* on the other. Bach (1986) exploits the analogy to argue that telic accomplishments and achievements denote count entities, whereas states and activities, which are atelic, have their denotations in the mass domains. I argued, in chapter 1, that the parallelism is less strong than a first glance shows, as activities and states are cumulative in the sense that two singular events in *P* can be put together to form a new singular event in *P*. This presupposes that atelic predicates also have denotations in the count domain. I argued in Rothstein (1999, 2001a) that this is indeed the case, and that the count/mass distinction in the eventuality domain has its linguistic expression in the verbal/adjectival distinction and not in a distinction among the classes of verbs. I argued that there is a minimal contrast between AP predicates such as *angry* which denote sets of non-countable eventualities in the mass domain, and VP predicates such as *be angry* which denote sets of eventualities in the count domain, and that the contrast shows up when we try modifying these predicates in non-inflected small clauses, in the complements of *make*, perception verbs and so on. *Be* itself denotes a function from the mass domain into the count

domain. I won't discuss the adjective/verb contrast here, but I will briefly review the evidence that verbal predicates denote countable eventualities.

Countable eventualities can be identified as such because they can be counted, temporally located, and distributed over, while this is not the case for minimally contrasting denotations of adjectival phrases. In order to contrast verbal predicates with bare adjectival predicates, we look at them in small clause complements, where bare predication structures need not be marked for tense, and thus need not contain a verb. In the examples (4)–(7), the (a) example has an accomplishment as the small clause predicate, the (b) example an achievement, the (c) example an activity, and the (d) and (e) examples verbally expressed statives. The (f) example is the minimally contrasting adjectival predicate.

(i) **Temporal locatability:** the examples in (4) show that the eventuality denoted by the embedded verbal predicate can have a temporal location which is independent of the temporal location assigned to the matrix event. This is impossible with minimally contrasting AP predicates.

- (4)a. Yesterday the witch made John build a tower last night and destroy it this morning.
- b. Yesterday the witch made John arrive last night and leave this morning.
- c. Yesterday the witch made John run last night and sleep late this morning.
- d. Yesterday the witch made John know the answer last night and forget it this morning.
- e. Yesterday the witch made John be clever last night and be stupid this morning.
- f. *Yesterday the witch made John clever last night and stupid this morning.

(ii) **Counting adverbials:** where the small clause complement is verbal, a modifier such as *three times* modifies either the embedded eventuality or the matrix eventuality. (5a–e) are all ambiguous between a reading where there were three “making” events and a reading where there was an unspecified number of “making” events, but three events in the denotation of the embedded predicate. This latter reading is impossible for (5f) with an embedded AP small clause.

- (5)a. I made Mary build a tower three times. (ambiguous)
- b. I made Mary touch her head three times. (ambiguous)
- c. I made Mary run three times. (ambiguous)
- d. I made Mary know the answer in class three times. (ambiguous)
- e. I made Mary be clever/angry three times. (ambiguous)
- f. I made Mary clever/angry three times. (unambiguous)

(iii) **Adverbial modification by event quantifiers:** adverbial modifiers such as *every time the bell rang* count events in the denotation of the main predicate by matching them one to one with the members of the set denoted by the modifier

(Rothstein 1995a). When the small clause predicate is a VP, the adverbial can modify either the embedded predicate or the matrix predicate, but where the predicate is adjectival, the modifier can only modify the matrix predicate:

- (6)a. I made him send me an email every time the bell rang. (ambiguous)
- b. I made him cry every time the bell rang. (ambiguous)
- c. I made him worry every time the bell rang. (ambiguous)
- d. I made him feel unhappy every time the bell rang. (ambiguous)
- e. I made him be nervous every time the bell rang. (ambiguous)
- f. I made him nervous every time the bell rang. (unambiguous)

(iv) **Distributivity:** *each* distributes count predicates over their subjects, as in (7a–e), but mass predicates cannot distribute, as (7f) shows:

- (7)a. The medicine made Jane and Mary each eat too much.
- b. The medicine made Jane and Mary each arrive late.
- c. The medicine made Jane and Mary each behave badly.
- d. The medicine made Jane and Mary each feel sick.
- e. The medicine made Jane and Mary each be sick.
- f. */??The medicine made Jane and Mary each sick.

The above data show that all verbal predicates have their denotation in the count domain, but that AP predicates do not. One might try and argue that atelic verbal predicates are mass predicates forced into a count denotation by the modifiers, but then we have no explanation why coercion is impossible with minimally contrasting APs. If atelic VPs and APs naturally have denotations in the same domain, we would expect coercion to work the same way with both – but it doesn't. The conclusion is that verbal predicates have their denotations in the count domain, regardless of whether they are atelic or telic.

This is puzzling. Atelic verbal predicates are homogeneous at least down to minimal parts and cumulative. (I will use "cumulative" in the sense of S-cumulative as defined in chapter 1:(11) unless further precision is necessary.) Classifying a predicate as count usually entails the claim that the non-plural predicate denotes a set of atoms, and atomicity entails non-homogeneity. If the atoms of a set *P* are the smallest possible units of *P*, then there should be no parts of elements of *P* which are also in *P*, and this means that an atomic predicate characterizing *P* should be quantized and non-homogeneous. Count predicates also show a singular/plural distinction, which is usually an indication of non-cumulativity. So what does it mean to say that an homogeneous, cumulative predicate has its denotation in the count domain? The data above indicate that "singular count predicate" and "atomic predicate" are not equivalent. But if atomicity in verbal predicates cannot be straightforwardly characterized by non-homogeneity and non-cumulativity, how then can it be characterized? Before answering these questions, I will first show that

non-equivalence of “singular count predicate” and “atomic predicate” occurs in the nominal domain too, although admittedly much less frequently.

7.3 Homogeneity and S-cumulativity in the Domain of Individuals

We have seen that a standard characterization of the mass domain is that mass expressions are homogeneous and cumulative whereas count nouns are not. A quantity of wine is divisible into parts, all of them entities in the denotation of *wine*, whereas a dog is not divisible into parts which are themselves in the denotation of *dog*. Wine + wine is also wine, but the sum of two dogs is not in the denotation of *dog* but in the denotation of the plural predicate *dogs*. Cumulativity in the mass domain is not restricted to contiguous elements, and mass predicates may have scattered entities in their denotation, as the examples in (8) show:

- (8)a. The wine for dinner is in the fridge and on the balcony.
- b. The furniture in my office and your office is broken.

Count predicates are **atomic**, whereas mass expressions are not, and this distinction is naturally associated with the properties of homogeneity and distributivity. The atoms of a set *P* are the elements that we count; if a set has a cardinality of *n*, then it contains *n* atoms. A natural way to identify the atoms of a set *P* is that they are the minimal elements of *P*:

- (9) $\forall x[P(x) \rightarrow \text{ATOM}(x) \leftrightarrow \forall x[P(x) \rightarrow \exists y[P(y) \wedge y \sqsubseteq x \leftrightarrow y=x]]]$

“If a predicate is atomic then the elements of *P* have no proper parts which are also elements of *P*.”

It is easy to see that an atomic predicate is quantized and vice versa, and thus we do not expect atomic count predicates to be homogeneous. Predicates such as *cup*, *dog* and *girl* are naturally atomic since the world tells us what constitutes a unit of cup or a unit of dog or a unit of girl. It is often pointed out that the mass/count is not a reflection of “reality” since plenty of things come in individuable units but are in the denotation of mass predicates, such as *furniture* and *hair*. Furthermore, there are minimal pairs of predicates where if an object is in the denotation of *P*₁ it will normally be in the denotation of *P*₂, and yet *P*₁ is a mass term and *P*₂ is a count term. Chierchia (1998) discusses a number of such items, including the minimal pair *Pavarotti’s hair* / *Pavarotti’s hairs*. But the evidence for *dog* being atomic is that if you divide a dog in two you don’t get two dogs, whereas if you divide some quantity of wine in two, you do get two portions of wine. The fact that dividing a dog into two does not give you two dogs is a real-world fact depending on the natural make up

of dogs – as we see if we look at amoeba which subdivide in the way that dogs don't – and this leads us to ask whether atomicity is a linguistic property, or a property derived from facts about the world.

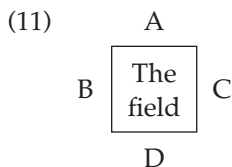
Atomicity is a linguistic property, and we can determine this from the existence of count predicates which are homogeneous. Paradigmatic examples are the non-quantized nominals discussed in chapter 6: *fence*, *wall*, *lawn* and *hedge* (Rothstein 1999, 2001a), *sequence* and *twig* (Zucchi and White 2001), and mathematical terms such as *line* (Mittwoch 1988). (10) shows that these predicates are count predicates by the standard tests for mass vs. count, as detailed in Chierchia (1998):

- (10)a. **they can be pluralized:**
fence/fences, wall/walls, lawn/lawns, hedge/hedges
- b. **they occur with numerical determiners:**
two fences, three walls, four lawns, five hedges
- c. **they occur with quantifiers:**
every fence, few walls, each lawn, several walls.
- d. **they do not occur with non-atomically based expressions of quantity:**
*little wall, *much fence, *plenty of hedge, *a lot of lawn.
- e. **they do not occur naturally with classifiers:**
*two pieces of fence, *three pieces of wall, ?two stretches of wall.

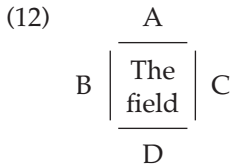
But like mass predicates they are homogeneous, and they are cumulative.

(i) **Homogeneity:** If I have a fence along the side of a road and I take a piece of it and put it around a tree, then I have two fences. *Fence* applies both to the original fence and to each of the "fence parts." So *fence* is strongly homogeneous.

(ii) **Cumulativity:** Imagine a field, with each side bordering on a field belonging to a different farmer, as in (11). We can think of this as a field with a fence around it, or, in the right context, as a field with four fences around it, one on each side. Suppose each farmer, A, B, C, and D, builds a fence, we can think of it as four events, each with a different agent in which four fences were built, or as one event with a collective agent in which one fence was built. But if *fence* can apply to each of the things that A, B, C, and D built, respectively, or the entity that they built together, then *fence* is cumulative:



Note the contrast between the situations illustrated in (11) and (12). In (12), the fences on each side of the field are not contiguous:



If we look at the statements in (13), the following is the case: (a) and (b) apply in situations (11) and (12); (c) and (d) apply only in situation (11) and not (normally) in (12); (e), (f) and (g) do not normally apply in situation (11) but do apply in situation (12).

- (13)a. Four farmers have each built a fence today.
 b. Four fences have been built today.
 c. Today the farmers built a fence around the field.
 d. There now is a fence around the field.
 e. There are four fences around the field.
 f. There are four fences on each side of the field.
 g. The field is fenced in with four fences.

But *fence* is S-cumulative, since the four individual fences in (11) are composed to form a single bigger fence. The restrictions on what single fences can be combined are similar to the restrictions on the S-cumulativity on verbal predicates. The elements to be summed must be contextually related, but while contextual relatedness usually entails temporal adjacency in the verbal domain, it often entails spatial adjacency in the nominal domain, hence the contrasts between (11) and (12) illustrated in (13). This behavior is not particular to *fence*, but characterizes a whole group of predicates – *wall*, *hedge*, *lawn*, *sequence*, *twig*, *bush*, and so on, as well as expressions such as *piece*, *bunch*, *quantity*. If I and my neighbour build adjoining walls, we may announce either “Together we built a wall in front of both our houses” or “we each built a wall in front of our respective houses,” depending on whether the city council is charging a tax for each wall built or paying a reward for each wall built. If I have a twig and a bunch of flowers and I divide them into two and give a part of each to Dafna and her best friend, then Dafna has a twig and a bunch of flowers and Nomi has a twig and a bunch of flowers, and there are two twigs and two bunches of flowers, albeit smaller than the original ones. If I break a piece of bread into two, there will then be two pieces of bread, and so on. The same facts hold for S-cumulativity. If Dafna has a bunch of flowers and I give her some more flowers to hold, then she had a bigger bunch of flowers until she decides to divide them. It is harder to put two pieces of bread together to make a single piece (although it has been done), but this is because of the particular way in which bread does or does not stick together. Two pieces of bread dough can

easily be summed cumulatively into a single piece. In all these cases, what counts as a single unit of P, or an atom of P, is contextually determined.

The predicates discussed above are cumulative and strongly homogeneous, as defined in chapter 1:(13c), meaning that all fences over a reasonable size can be divided into two parts both of which are fences, and so on, and it is true that the number of nominal predicates which are strongly homogeneous is indeed relatively small. But, there are also a huge number of count predicates which are non-quantized and thus very weakly homogeneous (see chapter 1:(13a)), meaning that a P-individual may have a proper part which is also in P. There are jackets which have detachable sleeves, so that a part of the jacket is also a jacket; there are baby-chairs which have detachable parts and contain smaller chairs as parts; there are containers which have smaller containers as parts and so on. These differ from the strongly homogeneous predicates as the part-whole relation depends on the structure of the particular P-entities under discussion, rather than in the general properties of P. These predicates are not usually cumulative, since a P element will usually be joined with a non-P element (and not another P element) to make the new "bigger" P. Nonetheless, the result is a set of count predicates which do not meet the criterion for atomicity in (9).

There are also predicates which fall between the strongly homogeneous and the merely non-quantized. An example is *table*. Suppose there are six tables in a restaurant. A group of twenty people come in for dinner and the restaurant owner rearranges them to make three big tables. The restaurateur may answer at any time that evening "I have three tables here" or "I have six tables here" depending on the context of the question.

What, then, is the criterion for being an atom? Intuitively, an x is an atomic fence (or table or jacket) in a particular context if there is no y which also counts as an atomic fence (or table or jacket) in that context of which x is a proper part. So we can formulate a general, context-dependent, informal statement of what atomicity is as follows:

- (14) x is an atom of P in a context C if there is no y which is an atom of P in C such that x is a proper part of y.

In other words, an atom for P is not the absolutely smallest element which can count as a P, nor is there a context-free definition of what a P-atom is. (14) postulates that what is relevant for the definition of atom-of-P is a context-dependent definition of what counts as a single unit of P. Cumulativity for a count predicate means that two P elements can be put together to make a new singular P entity only if the newly constructed P-entity can be atomic in the relevant context. Crucially, when two instances of P are put together to make an instance of P, the two smaller Ps lose their individual identity. It is this which is the crucial difference between count nouns and mass nouns. If a restaurant owner puts together tables a and b to make a bigger table and tables c and d to make another bigger table, then a, b, c, and d no longer count

as atoms in that context. If she wants to count how many tables there are, then either there are two tables or four tables, but there is no other possibility. In contrast, if I put water together with water to make water, the parts of the sum still fall under the denotation of *water*.

So what is crucial about the count domain is that a choice has to be made as to what counts as an atom of *P* in a particular context. Once that choice is made, the atomic structure is fixed; an entity and its parts cannot count as atoms at the same time. That means that these count predicates are indeed non-homogeneous and non-cumulative; they are non-homogeneous and non-cumulative **relative to a particular context**.

The contrast between predicates like *fence* and predicates like *dog* arises because the structure of the world and the nature of dogs is such that the definition of what counts as an atomic dog happens not to be context-dependent. A dog has an internal structure which determines its atomicity, and context will not affect what counts as a dog (although the same dog atom may have different extents at different times depending on how it grows). These predicates are **naturally atomic**. Fences, on the other hand, have no such internal individuating structure, and thus can have a different unit structure in different contexts, and tables come somewhere in the middle. But this turns out to be a local property of dogs, fences, and tables, and not a formal property of semantic atoms.

So we have the following conclusions:

- (i) atomicity is not derived from either non-homogeneity or non-cumulativity;
- (ii) the atoms of a set *P* need not be “given” in either the nominal or the verbal domain;
- (iii) in a context *C*, the atoms of *P* do not overlap;
- (iv) if *P* is a count predicate, *P* is non-homogeneous and non-cumulative relative to a context;
- (v) some predicates are naturally atomic. If *P* is naturally atomic then what counts as an atom of *P* is not context-dependent. But the contrast between *dog*, *table*, and *fence* shows that natural atomicity may be a matter of degree.

7.4 Defining Sets of Atoms

Atoms are things which are counted. This means, by definition, that they have a cardinality. Landman (2001) argues that atoms simply are the elements of a (plural) set $*P$, which have a cardinality of 1. He argues that the set of atoms is not “given” but must be accessed via a measure function and that we can access the set of atoms in the count domain via the property of having a cardinality of 1.

- (15)a. $ATOM_{COUNT} = \{x \in COUNT: |x|=1\}$
- b. For any plural predicate $*P$, $ATOM_P = \{x \in *P: |x|=1\}$

The question is how do we pick out the elements whose cardinality is 1, if, as in the case of fences, P-entities do not come in inherently well-defined units.

Landman (2001) argues that the atomic measure function applies to a plural set and picks out its atoms. Assume the denotation of a plural predicate *P is a Boolean semi-lattice with a join operation; an element in the denotation of *P set is an ideal defined on that lattice. The bare plural denotes the ideal defined by the supremum, and the atomic measure function picks out the minimal elements of the lattice. This works out well for plural predicates such as *BOY, where *boy* is naturally atomic, and the atoms are constant and not context-dependent, but not for predicates like *FENCE. *FENCE will denote the Boolean semi-lattice representing the structure derived from applying the join operation recursively to the atomic elements. But this assumes a particular set of atoms to start with. What we are interested in is where the particular set of atoms comes from.

What we saw of *fence* above indicates that being an atom, or having a cardinality of 1, is a property which is assigned to individual fences relative to a particular definition of what counts as a fence-unit. A single fence is not necessarily a maximal physically isolable element of *P – we saw with respect to (11) that the same stretch of fencing could be analyzed as either one fence or four fences. Rather, the *fence*-elements which are assigned the cardinality of 1 are assigned it relative to a context-dependent definition of what counts as a unit of fence.

Let us assume that a predicate such as *boy* or *fence* denotes the set of entities which in some context, according to some criterion of individuation, can count as atomic boys or fences. We can call this predicate a **basic predicate**. The general principle is given in (16):

(16) **A basic predicate P denotes the set:**

$\{x: \text{there is some context } C \text{ or other such that } x \in \|P\| \wedge |x|_C=1\}$

The **basic set** denoted by the basic predicate contains all the individuals which at some time or another count as atoms of P, so there will be an overlap between the elements.

A **context** will be a pair consisting of a time index and a criterion of individuation, or a way of assigning the cardinality 1. Different individuals in P may count as atoms according to different standards for measuring units of P at different times. P_C is a subset of P, whose members are the P elements which count as atoms of P relative to a particular context C. The crucial condition on P_C , which makes it a set of atoms, is that none of its elements overlap, and P_C will thus be a non-homogeneous and non-cumulative predicate.

(17) $\forall x, y [x \in P_C \wedge y \in P_C \rightarrow [xOy \rightarrow x=y]]$

“If any x and y are members of the singular set P relative to a context C, then x and y overlap only if they are identical.”

A context then consists of a pair $\langle t, M \rangle$, where t is a time index and M is a measure statement. M is a **measure statement for P** if M is a proposition of the form (18), where Q is a context-dependent variable (but note that we will discuss only extensional contexts here):

$$(18) \quad \forall x [P(x) \wedge Q(x) \rightarrow |x|=1]_t$$

An **atomic function** is a function of type $\langle \langle d, t \rangle \langle d, t \rangle \rangle$ from sets into atomic sets, i.e. sets of individuals in P which count as atomic P s according to a standard of individuation or measure for counting atoms at a particular time. The schema is given in (19):

$$(19) \quad \lambda P \lambda x. P(x) \wedge |x|_{\langle t, \forall x [P(x) \wedge Q(x) \rightarrow |x|=1] \rangle} = 1$$

So counting is picking out individuals according to a particular criterion for individuation. While the definition of atomic functions allows them crucially to be context-dependent, we can pick out a subset of atomic functions which are constant, i.e. no matter what value is picked for Q , the function applied to P will always give the same set of atoms. These are the **natural atomic functions**, and these are the functions which give us the atoms of *dog*, *boy*, etc. Finally, the bare plural will be the pluralization of the basic set P , called $*P$. $*P_C$ is the pluralization of an atomic set P_C .

Lexical items are used in the following way. FENCE denotes the set of singular things which are potentially atomic, which is to say that there is some context in which they count as atoms. In English, this set is not lexically accessible, since bare singulars are not allowed. Determiners which select singular nominals, such as *a* and *each*, denote functions from the denotation of P_C into generalized quantifier meanings, and those which select plural nominals denote functions from the denotations of $*P_C$ into generalized quantifier meanings. So the determiner will trigger an operation which shifts P into P_C . So while FENCE is the set of singular individuals which are potential atoms, the denotation of *fence* in a DP is $FENCE_C$. The meaning of the nominals in *a dog* and *a fence* is dictated by the schema in (20):

$$(20) \quad \{x: x \in DOG \wedge |x|_{\forall x [BOY'(x) \wedge Q(x) \rightarrow |x|=1]} = 1\} \\ \{x: x \in FENCE \wedge |x|_{\forall x [FENCE'(x) \wedge Q(x) \rightarrow |x|=1]} = 1\}$$

For a set such as *DOG*, which is the denotation of a naturally atomic predicate, the value of the Q variable will be fixed by the meaning of the predicate itself, and the denotation of the sets *DOG* and *DOG_C* will be identical, relative to a particular time variable. (The denotations of *DOG* and *DOG_C* will differ at different times, since the particular individuals which meet the individuation criterion will differ over time, but the measure itself will be as good as constant.) With *fence*, this is not the case, and *FENCE_C* will denote different sets depending on the time variable and measure statement chosen.

7.5 Atomic Structure in the Domain of Events

The domain of eventualities works in the same way as the domain of individuals: a bare verbal predicate V denotes a set of events which in some context or another will count as atomic instances of V . So V denotes a set of singular entities, but not a set of atoms. V_C is a subset of V consisting of events of V which are atomic in a particular context, given by the free variable C , in other words, relative to a time and standard of counting or individuating atoms. There are two crucial differences between the nominal and the verbal domain, one grammatical and one to do with the structure of the world. The grammatical difference is that there are no verbal operators paralleling determiners, so there is no grammatical element which forces verb meanings to shift from $\|V\|$ to $\|V_C\|$. The second difference is that while most count nouns are natural atomic predicates like *dog*, in that they denote entities with structural properties which determine what counts as an individual, events frequently do not. There is nothing inherent about running which determines what counts as a unit of running (although there is a minimal size for a running event, as we discussed in chapter 1). So in a particular sentence S , *run* may well denote the set RUN (i.e. the set of all events which count as events of running in some context) and not the set RUN_C (the set of events of running which are atomic relative to a particular context). The contrast between atelic and telic VPs lies exactly here. An atelic (singular) VP such as *run* denotes the set of singular eventualities which are running eventualities in some context or other. A telic VP such as *run to the store* denotes $RUN\ TO\ THE\ STORE_C$, a set of events in the denotation of VP which are atomic relative to a context, in this case what counts as a running to the store at time t (I assume that the start point is contextually determined). A plural atelic VP denotes the plural set derived from the singular (but not atomic) set, while a plural telic VP denotes the result of applying the plural operator to an atomic set.

- (21) A verbal predicate is telic if it denotes a set V_C , i.e. an atomic set contextually restricted by a context $\langle t, M \rangle$, or a pluralization of such a set. Otherwise the predicate is atelic.

So (22a), with the representation in (22b), asserts that there was an event of running which took place yesterday, but gives no information about what the criteria for picking out atomic events of running are (where AT is the temporal location function):

- (22)a. Yesterday John ran.
 b. $\exists e, t [RUN(e) \wedge AT(e, t) \wedge t \leq NOW \wedge Ag(e) = JOHN]$

Unless such criteria are supplied contextually, we do not know what kind of singular running event John was involved in. It could have been a cross-country race with short breaks to allow the cows and the sheep to cross the

road, or a training session, or a short run to catch a bus. In the examples in (23), where the verbal predicate is telic, the question is answered: in (23a), a path phrase has been added, and in (23b) and (23c) measure phrases have been added. (2d) is telic because *run* has been shifted into an accomplishment reading. We will discuss these examples in detail below.

- (23)a. Yesterday John ran to the store.
 b. Yesterday John ran a mile
 c. Yesterday John ran for two minutes.
 d. Yesterday John ran a race.

Modifiers such as *to the store* and measure phrases such as *for two minutes* and *a mile* denote functions from denotations of VPs (by which I mean intransitive verbal predicates) to sets of contextually restricted atomic eventualities. These modifiers denote atomic functions, and are assigned the meanings in (24):

- (24)a. $\lambda P \lambda e.V(e) \wedge |e|_{\langle t, M \rangle} = 1 \wedge \text{PATH}(e) = \text{TO THE STORE}$
 b. $\lambda P \lambda e.V(e) \wedge |e|_{\langle t, M \rangle} = 1 \wedge \text{LENGTH}(\text{PATH}(e)) = 1 \text{ MILE}$
 c. $\lambda P \lambda e.V(e) \wedge |e|_{\langle t, M \rangle} = 1 \wedge \text{DURATION}(e) = 2 \text{ MINUTES}$

Following Krifka (1998), I assume that paths are special cases of adjacency structures and that $\text{PATH}(e) = x$ assigns to an event a path x such that every part of x is related to part of e , and the final part of x is related to the final part of e . (As Krifka discusses, this is not a homomorphism, since we must allow for circular movements and backtracks, etc.) PATH indirectly assigns an atomic measure criterion for e via the measure of the path to which it is related. DURATION is a direct measure function which maps from events to degrees on a temporal scale, and $\text{LENGTH}(\text{PATH})(e)$ measures e by assigning it the direct measure of the path to which it is related. Applying the modifier in (24b) to a predicate P will give the expression $\lambda e.V(e) \wedge |e|_{\langle t, M \rangle} = 1 \wedge \text{LENGTH}(\text{PATH}(e)) = 1 \text{ MILE}$. The restriction on the atomic measure function is still $\langle t, M \rangle$, since the meaning of *a mile* is added via conjunction to the meaning of the VP. However, this modifier must give the content of the measure statement and this is not defeasible. *John ran a mile twice* requires atomic events to be events of running a mile, and the measure statement will be $\forall e[\text{RUN}(e) \wedge \text{LENGTH}(e) = A \text{ MILE} \rightarrow |e| = 1]$. We get this effect by assuming the natural condition (25):

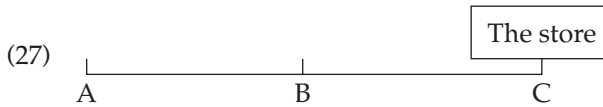
- (25) An atomic element is measured in only one way.

This asserts that atomicity is relative to a single criterion, and ensures that the translations in (26) are representations of the meanings in (23a–c):

- (26)a. Yesterday John ran to the store.
 $\exists e, t[\text{RUN}(e) \wedge |e|_{\langle t, \forall e[\text{RUN}(e) \wedge \text{PATH}(e) = \text{TO THE STORE} \rightarrow |e| = 1] \rangle} = 1 \wedge \text{AT}(e, t)$
 $\wedge \text{PATH}(e) = \text{TO THE STORE} \wedge t \leq \text{NOW} \wedge \text{Ag}(e) = \text{JOHN}]$

- b. Yesterday John ran a mile .
 $\exists e, t [\text{RUN}(e) \wedge |e|_{< t, \forall e [\text{RUN}(e) \wedge \text{LENGTH}(e) = \text{A MILE} \rightarrow |e| = 1]} > = 1 \wedge \text{AT}(e, t) \wedge \text{LENGTH}(\text{PATH})(e) = 1 \text{ MILE} \wedge t \leq \text{NOW} \wedge \text{Ag}(e) = \text{JOHN}]$
- c. Yesterday John ran for two minutes (once).
 $\exists e, t [\text{RUN}(e) \wedge |e|_{< t, \forall e [\text{RUN}(e) \wedge \text{DURATION}(e) = \text{TWO MINUTES} \rightarrow |e| = 1]} > = 1 \wedge \text{AT}(e, t) \wedge \text{DURATION}(e) = 2 \text{ MINUTES} \wedge t \leq \text{NOW} \wedge \text{Ag}(e) = \text{JOHN}]$

The denotations of these atomic VPs are, of course, subject to the criterion of non-overlap in (17), and this is guaranteed by the fact that the measure statement is relativized to times. In (27), a running from A to C and a running from B to C can both count as events of running to the store, but not simultaneously.



Note that verbs do not have to be “verbs of movement” to have path arguments, as (28) shows:

- (28) Dafna slept the whole way to Tel Aviv (several times).

Modifiers such as *along the road* in (29a) don’t introduce atomic functions because they don’t give a criterion for picking out non-overlapping entities, and thus they don’t induce telicity. *Along the road* denotes a function from sets of events to sets of events which have a path argument, but which do not include a cardinality statement, as in (29b). Note that these modifiers can apply to a telic predicate (and the resulting VP is telic) as in (29c,d), whereas the modifiers in (24) cannot:

- (29)a. Dafna ran along the road.
 b. $\lambda P \lambda e. P(e) \wedge \text{PATH}(e) = \text{ALONG THE ROAD}.$
 c. Dafna ran to the store along the road.
 d. $\# \text{Dafna ran to the store for two hours}.$
 e. $\# \text{Dafna ran to the store for a mile}.$

Double measure phrases do seem to appear in (30), which is potentially a problem for the principle in (25):

- (30)a. Dafna ran a mile/two hours to the store.
 b. Dafna ran a race to the store.

I assume that in (30a) *a mile* and *two hours* modify the phrase *to the store*. These phrases appear as constituents, as in (31a), and while the examples in (30) are acceptable, the examples where the modifiers appear in inverse order are not, as shown by (29d) and (29e). In (30b), *to the store* modifies *a race*, and is similarly a constituent, as in (31b):

- (31)a. A mile to the store/Two hours to the store is a long way.
 b. A race to the store is about a kilometer long.

7.6 Atomicity and BECOME Events

Accomplishments and achievements are telic because the BECOME event provides the criterion for individuating atoms. We look first at singular BECOME events with atomic arguments, and we then extend the account to BECOME events with plural or quantified arguments, all of which lead to telic VPs. Finally, we show why bare plural or mass theme arguments necessarily make accomplishments but not achievements atelic. Achievements are naturally atomic predicates because they denote changes from $\neg\phi$ to ϕ , and the principle of bivalence thus determines exactly how big an achievement event is. *Arrive at the station* or *John arrive at the station* denotes a set of near-instantaneous events of John moving from the state of not being at the station to the state of being at the station. It can be neither bigger nor smaller than the event e consisting of the minimal pair $\langle e_1, e_2 \rangle$, where e_1 and e_2 are temporally adjacent, e_1 is a minimal final state of not being at the station, and e_2 is a minimal initial state of being there, and no context can make e either bigger or smaller. Since achievements are naturally atomic predicates, the measure phrase in the relevant atomic function can be constructed independent of context. The meaning of *arrive* is given in (32), with the content of the measure phrase indicating that it is naturally atomic and that any event in the set of singular arrive events will be atomic:

$$(32) \quad \lambda e. \text{ARRIVE}(e) \wedge |e|_{\langle t, \forall e[\text{ARRIVE}(e) \rightarrow |e|=1] \rangle} = 1 \wedge \text{AT}(e, t) \wedge \text{Th}(e) = x$$

The BECOME event in an accomplishment is a change from ϕ to ϕ , where the starting point of the event is a contextually determined point in $\neg\phi$ which is the last point at which ϕ is true, and the endpoint is the first instant at which ϕ is true. I assume that the contextual element in constructing the incremental chain together with contextual constraints on the incremental function μ determine what the content of ϕ is in a given situation. Since the accomplishment event is the sum of an activity event and the BECOME event to which it is incrementally related, and which must thus have the same start and culmination points, the temporal extent of the BECOME event will determine the temporal extent of the accomplishment as a whole. An atomic BECOME event will result in an atomic accomplishment, with the incremental change associated with an accomplishment providing the criterion for atomicity. The contextual element in constructing the incremental chain means that singular BECOME events, and thus accomplishments, are not naturally atomic in the way that achievements are, but in a particular context of use the extent of the BECOME event will be fully determined, and thus provide a criterion of atomicity for the accomplishment as a whole. The generalization is thus that the telic

verbal classes are the classes where the criterion for individuating atoms in the denotation of the predicate is derived from the meaning of the lexical predicate itself.

Of course, a particular context of use involves a particular theme argument, which means that a BECOME event in an accomplishment is atomic relative to a particular argument. With this in mind, we will look at the effect of the theme argument on atomicity and telicity.

Following Landman (2000), I assume that a singular event is an event on which singular thematic roles are defined. I add to this that for a singular BECOME event to be an atomic event, it must be an event which has an atomic argument as the value of its singular thematic role. Again following Landman, plural events are events on which plural thematic roles are defined, roles which have their value in plural sets.

I assume the following principles:

(33)a. **Cardinality principle 1:**

The cardinality of an accomplishment event is the same as the cardinality of the BECOME event which it contains.

b. **Cardinality principle 2:**

A singular BECOME event which is not naturally atomic has a cardinality of 1 if it has an atomic argument.

This means that if an accomplishment event is constructed out of an activity and an atomic BECOME event, it will also have a cardinality of 1, and be atomic. The measure statement in the expression denoting a set of atomic accomplishment events will be of the form in (34). The set denoted by the accomplishment verb *build* is given in (35):

$$(34) \quad \forall e[e \in \|P\| \wedge \exists e', e''[e =^S(e' \sqcup e'') \wedge \text{BECOME } P\text{-ed}(e'') \wedge \text{Arg}(e'') = \text{Th}(e) \\ \wedge \text{INCR}((e', e''), C(e'')) \wedge |e''| = 1 \rightarrow |e| = 1]$$

$$(35) \quad \| \text{BUILD} \|_{\langle t, M \rangle} = \{e: e \in \text{BUILD}' \wedge |e|_{\langle t, \forall e[\text{BUILD}(e) \wedge \exists e', e''[e =^S(e' \sqcup e'') \wedge \text{BECOME-BUILT}(e') \wedge \text{Arg}(e'') \\ = \text{Th}(e) \wedge \text{INCR}(e', e''), C(e'')) \wedge |e'| = 1 \rightarrow |e| = 1] \rangle} = 1\}$$

that is, the set of building events which are atomic according to the criterion that *e* is atomic if *e* is the sum of an activity and an atomic BECOME event which are incrementally related. Unlike achievements, it is not completely naturally atomic, since the criterion provided by the measure phrase is underspecified, leaving certain parameters to be filled in contextually. Nonetheless, we do have an inherent measure criterion which is part of the meaning of the lexical predicate, and *build* and accomplishments in general are telic because they are naturally atomic in the sense that the criterion for individuating atoms is given by the meaning of the predicate.

So, an atomic accomplishment will be atomic because it is the sum of an activity and an atomic BECOME event. The denotation of the telic predicate *build a house* will be (36). (For the sake of conciseness, I won't decompose accomplishment into its sub-elements, and I will refer to the measure statement simply as M whenever possible.)

$$(36) \quad \lambda y \lambda e. \text{BUILD}(e) \wedge |e|_{<t, \forall e[\text{BUILD}(e) \wedge \exists e', e'' [e = s(e' \sqcup e'')] \wedge [\text{BECOME-BUILT}(e') \wedge \text{Arg}(e'') = \text{Th}(e) \wedge \text{INCR}(e', e'', C(e'')) \wedge |e'| = 1 \rightarrow |e| = 1]} > = 1 \wedge \text{Th}(e) = y \wedge \text{Ag}(e) = x$$

To deal with the plural examples, I will use a simplified version of the theory of plurality in Landman (2000). Expressions such as *build three houses* are ambiguous between a plural reading, in which they denote pluralities of singular events in which a house got built, and a singular reading, in which they denote single events with a group of three houses as theme. The first is the distributive reading, and the second the collective reading. (Although Landman discusses group readings separately, we will treat the group or collective reading as a kind of singular; the difference between group roles and singular roles will not be important for us here.) This ambiguity shows up clearly in (37), which asserts either that each house got built in less than three months (but says nothing about how long the building went on for overall), or that all three houses were built within three months.

(37) Mary built three houses in three months.

(37) must thus make available one of two sets of atomic events: a plural set whose atoms are atomic events of building a house, and an atomic set whose atoms are events of building groups of three houses. In Landman's theory, a plural set is derived from a singular set via the summing operation. Plural events are sums of singular events, and are related via plural roles to pluralities of individuals. The plural role *R is defined in such a way that if e is an event and for every atomic part a of e the singular thematic role R maps a onto an individual, then the plural role *R is defined for e and maps e onto the sum of the R-values of the atomic parts of e. The plural set *build three houses* denotes the set characterized by (38):

$$(38) \quad \lambda e'. \exists y [*(\lambda e. \text{BUILD}(e) \wedge |e|_{<t, M> = 1})(e') \wedge * \text{Th}(e') = y \wedge y \in * \text{HOUSE} \wedge |y|_{<t, M> = 3} \wedge * \text{Ag}(e') = x]$$

Plural events are sums of singular events. If the events that they are summed out of are atomic, then they will be sums of atomic events. Since the theme of the accomplishment, and thus of the BECOME event, is the DP *three houses* (which we saw in the previous section is a plural of a set of atomic houses), the predicate will distribute down to atomic accomplishments and thus atomic BECOME events, which will provide a measure for the whole VP. According to the telicity principle in (3), the VP will be telic. So *build three houses* is telic,

since it is a pluralization of an atomic set $BUILD_C$ denoting a set of atomic building events where atomic size is determined by a set of atomic BECOME events related to a set of atomic houses. Crucially, *build exactly three houses*, *build at least three houses*, and *build at most three houses* will all be telic in exactly the same way (although only the first is quantized in Krifka's sense) since they are constructed out of the same set of atomic events.

The second, collective, reading of (37) is straightforward. Following Landman (1989, 2000), we assume that *three houses* denotes an atomic group entity constructed out of a sum of three houses. This individual has a cardinality of 1, and is the argument of the event *build* and of the BECOME event out of which *build* is constructed. So the VP in (37) denotes a set of atomic building events whose atomic themes are collections of at least three houses, and the VP is telic. Although I won't go into details here, it is clear that VPs with quantified theme arguments will also be telic: *build every house in the street* and *build most houses in the street* require accessing a set of atomic houses, and the VP denotes a set of events which is related to a particular quantity of that set of atoms.

In sum, a VP is telic when we can identify an atomic set which makes counting events in the denotation of the VP possible, and not because it is possible to determine the precise extent of the event verifying the sentence. Achievements are naturally atomic, and thus telic. Accomplishments are (potentially) telic because they are associated with an (potentially) atomic BECOME event, which provides the measure content of the atomic function. Activities are inherently unspecified for a criterion of atomicity, but an activity heads a telic VP if an external measure provides a criterion of individuation or atomicity.

Accomplishment VPs with bare plurals and bare mass nouns as themes are atelic because bare plurals and mass nouns are not atomic. This is because the atomicity of accomplishments depends on the atomicity of the associated BECOME events, and the atomicity of these BECOME events depends on the atomicity of their argument, expressed in (33b). We look first at how it works with bare plurals.

We have made a distinction in both the nominal and the verbal domain between sets of singular entities and sets of atoms. In section 2.4, I defined a set of atoms of N as a set $\{x: x \in N \wedge |x|_{\langle t, M \rangle} = 1\}$, while a set of singular entities is the union of all such sets, and thus not itself a set of atoms. The bare nominal *house* denotes the set of singular entities, and when the nominal is the complement of a determiner, the determiner triggers a shift into *house_C* which denotes the set of house entities which count as atoms in the context determined by C . While *three houses* denote sets of entities in plural $*HOUSE_C$, the pluralization of a set of atomic houses, the bare plural *houses* denotes $*HOUSE$, the pluralization of the set of singular houses. As the bare plural is not derived from a set of atoms, the set of BECOME events which has the bare plural as a theme will not be atomic, nor will it be a sum of a set of atoms, and thus the VP is not telic. We need to make a minor adjustment to the theory of plurality in Landman (2000) so that the pluralization operator applies both to singular

and atomic sets, adjusting the relation between singular and plural roles accordingly. The interpretation of *Mary built houses* will be as in (39):

- (39) $\exists e' \exists y [*(\lambda e. \text{BUILD}(e) \wedge |e|_{<t, \forall e[\text{BUILD}(e) \wedge \exists e', e'' [e = s(e' \sqcup e'')] \wedge [\text{BECOME-BUILT}(e') \wedge \text{Arg}(e'') = \text{Th}(e) \wedge \text{INCR}(e', e'', C(e'')) \wedge |e'| = 1 \rightarrow |e| = 1 >}) = 1)(e') \wedge *Th(e') = y \wedge y \in *HOUSE \wedge *Ag(e') = \text{Mary}]$

The measure statement says that an atomic accomplishment is one which has an atomic BECOME event as part, and the theory of plurality requires the relation expressed by a plural thematic role to distribute to the singular parts of its plural value. But the denotation of *houses* is the plural *HOUSE, which is the pluralization of the singular set and not of an atomic set. So in (39) the VP does not denote either an atomic set or a pluralization of one, and it is atelic.

Fred Landman (personal communication) has pointed out that there is one case where an accomplishment with a bare plural complement does induce telicity – namely, when the bare plural is the name of a kind. He supports this with minimal contrasts in (40):

- (40)a. This morning Tolkein invented hobbits in half an hour.
b. This morning, Tolkein invented hobbits for two hours.

(40a) asserts that there was an event of inventing the hobbitkind, whereas (40b) asserts that there was an event of inventing individual hobbits. The kind as an entity is presumably atomic, and thus (40a) is telic, whereas (40b), where the bare plural has its normal use, is atelic.

In order to give a semantics for the interpretation of thematic roles with mass arguments, the relation between mass and count needs to be clarified, but I am not going to do this here. However, an extension of the account of (39) to mass predicates is, as far as telicity goes, straightforward. Take an atelic VP such as *eat bread*. The nominal *bread* does not make a set of atoms available and thus there are no identifiable atomic BECOME events which allow us to identify atomic events of eating, and the VP is atelic. The interpretation of (39) does predict that *Mary built houses* entails that a singular house was built, since it asserts that there was something in the domain of *HOUSE, and this wrongly predicts that (41) should be infelicitous.

- (41) Mary built houses last summer, but I'm not sure she finished a single house.

I assume that in certain contexts the singular set denoted by HOUSE may include almost finished houses, which in some contexts count as atomic houses. So the second conjunct explicitly indicates that the individual which makes the first conjunct true is not in the denotation of finished houses. Note that countability, or atomicity, is a semantic property, not a real-world property,

and the fact that we have a good idea what an atomic house or an atomic chunk of bread are is not relevant at this stage. The real-world facts become relevant where the linguistic context forces a telic reading, as in (42):

- (42)a. We built houses in three weeks.
 b. We ate sandwiches and cakes in five minutes and then rushed to the next meeting.
 c. They made hats for all the children in half an hour.

Here, the modifier *in α time* forces the bare plural to be understood as the pluralization of an atomic set, with the content of the atomic function contextually determined. The linguistic context forces the non-plural predicate to shift to a contextually determined atomic set, which is the input to the pluralization operation.

In sharp contrast to the accomplishment examples, achievements with bare plural themes are acceptable, as the examples from chapter 6:(12) show:

- (43)a. When she rang the bell, servants arrived in a minute.
 b. Owls arrived in five minutes, bringing letters and packages.
 c. Help reached me in five minutes.

This is because achievements are naturally atomic predicates and, as such, the atomicity of the BECOME event does not depend on the atomicity of its argument. When a predicate is naturally atomic, its singular set and its atomic set are identical (relative to a particular time), and so the predicate is always telic. I assume that a naturally atomic verbal predicate requires atomic thematic roles (or plural atomic thematic roles) defined on it, and this guarantees that the values of these roles are in atomic sets or pluralizations of such sets. Of course, as is well known, bare plural reading can induce what look like atelic readings, as in the well-known examples in (44), and we will come back to these when we discuss *for α time* in section 7.8

- (44)a. Guests arrived for two hours.
 b. Walkers reached the village/the mountain top for several hours.

7.7 A Note on Degree Predicates

When VPs are headed by degree predicates (as discussed in Dowty 1979, Abusch 1985, 1986, Hay, Kennedy, and Levin 1999, Kennedy and Levin 2002, and Section 4.3 of this book), telicity is affected not only by the direct object but also by the degree argument. Thus, as we saw in Section 4.3, a singular VP oscillates between telic and atelic, depending not only on the properties of the theme but also on whether a precise value is given for the degree variable (or whether a value is recoverable from context):

- (45)a. The council widened the road three meters in a month/*for a month.
 b. The council widened the road for two months.
 c. The council widened roads three meters for three months/*in three months
 d. The council widened roads for three months/*in three months.

As the data in (45) show, the VP is telic only if the theme is atomic and the degree value is specified. Assume, following Hay, Kennedy, and Levin (1999), that explicit degree predicates assign three thematic roles, including a “difference value,” as the representation of *widen* in (46) indicates:

- (46) $\lambda y \lambda d \lambda e. \text{INCREASE}(\text{WIDTH})(e) \wedge \text{Th}(e)=y \wedge \text{Ag}(e)=x \wedge \text{DIFF}(e)=d$

Then this predicate should be associated with a BECOME event which expresses a relation between an event, a theme and a difference variable:

- (47) $\lambda y \lambda d \lambda e. \text{BECOME}(\text{WIDE})(e) \wedge \text{Th}(e)=y \wedge \text{DIFF}(e)=(d)$

Assume that differences are atomic if they are sums of atomic units of measure (this is very vague but will serve our requirements for this note). Then the data in (45) indicate that the BECOME event associated with *widen* is telic only if both the thematic roles defined on *widen* are atomic.

7.8 For α time and in α time

The semantics of the two time adverbials *for α time* and *in α time* is intimately connected with a theory of telicity since they provide classic tests for distinguishing between telic and atelic VPs: telic VPs can be modified by *in α time* and not by *for α time*, whereas the converse is true for atelic predicates. However, they are not semantically complementary: *for α time* changes an atelic VP to a telic one, while *in α time* leaves the telic VP telic. A semantics for these adverbials should explain these facts and also Dowty’s (1979) observation that *y Vs for α time* implies that at (relevant) subintervals of α time *V* also took place, while *y Vs in α time* implies that at *y V-ed* is true at a unique subinterval of α time (see Dowty 1979, p. 334). Intuitively, *in α time* assigns a time-frame within which an atomic event took place and thus modifies sets of atomic events, while *for α time* imposes a temporal measure criterion on singular events which are not already atomic. We begin with *in α time*, and we’ll look at the predicate *in an hour*.

In an hour applies to atomic predicates or plural atomic predicates, and selects the subsets whose atoms have a maximal duration time of less than an hour. We define the function $\text{ATOM}(P)$ which selects the atomic parts of *P* if *P* is either atomic itself or the pluralization of an atomic predicate.

(48) If P is atomic then $ATOM(P)=P$.

If P is a pluralization of an atomic set then $ATOM(P)=\{x \in P \wedge |x|_{\langle t, M \rangle}=1\}$
otherwise $ATOM(P)$ is undefined.

In an hour denotes the following function:

(49) $\lambda P \lambda e. P(e) \wedge \forall e' [e' \in ATOM(P) \rightarrow \tau(e') \sqsubseteq 1 \text{ HOUR}]$

When applied to a telic VP like *run to the store*, we get the VP in (50) as the interpretation of *run to the store in an hour*:

(50) $\lambda e. RUN(e) \wedge |e|_{\langle t, \forall e [RUN(e) \wedge PATH(e)=TO \text{ THE STORE} \rightarrow |e|=1] \rangle}=1 \wedge PATH(e)=TO \text{ THE STORE} \wedge$
 $\forall e [e \in ATOM(\{e': RUN(e') \wedge |e'|_{\langle t, \forall e [RUN(e) \wedge PATH(e)=TO \text{ THE STORE} \rightarrow |e|=1] \rangle}=1 \wedge$
 $PATH(e')=TO \text{ THE STORE}) \wedge \rightarrow \tau(e) \sqsubseteq 1 \text{ HOUR}]$

This characterizes the set of atomic events of running to the store such that all atomic parts of the set have running times of less than an hour. Dowty's (1979) observation that *x V-ed in an hour* has a implication that *x V-ed* uniquely during that hour follows from the fact that *in an hour* is predicated of the members of the atomic P set, and the parts of the atoms of P will be the P-events themselves.

There are several reasons why the interpretation for *in α time* needs to be as complicated as this. We must capture the ambiguity of (37), repeated here; we must explain why *in α time* does not modify atelic VPs as in (51a), and we need to explain its co-occurrence with bare plurals, as in (51b):

(37) Mary built three houses in a month.

(51)a. #Mary pushed the cart in half an hour.

b. Mary built houses in three weeks.

(37) has a collective reading in which all three houses were built in a month. This is straightforward. Assume that *three houses* denotes the sets of atomic individuals which are formed by an operation on sums of exactly three houses. $\uparrow$ is the operation which maps sums of atoms onto an atomic element and which thus turns the plural sum into an atomic group (Landman 2000), whereas $\downarrow$ is the converse operation which maps an atomic group onto corresponding non-atomic sums of atoms. *Three houses*, on its collective reading, denotes the atomic set in (52):

(52) $\{y: \downarrow y \in \{y': y' \in *(\{z: z \in HOUSE \wedge |z|_{\langle t, M \rangle}=1\}) \wedge |y'|_{\langle t, M \rangle}=3\} \wedge |y|_{\langle t', M' \rangle}=1\}$.

Build three houses denotes the set of atomic events which have an atom from the set in (52) as theme. Since for every *e* in VP, its atomic subparts are identical

to *e*, *in a month* is mapped from the set characterized by VP to the subset of atomic events of building three houses which took place in less than a month. The distributive reading is more complicated. Here, the VP denotes a set of plural building events, where each atomic event is an event of building a house. *Build three houses* characterizes the set of plural events as in (38), repeated here:

$$(38) \quad \lambda e'. \exists y [*(\lambda e. \text{BUILD}(e) \wedge |e|_{\langle t, M \rangle} = 1)(e') \wedge *Th(e') = y \wedge y \in *HOUSE \wedge |y|_{\langle t, M \rangle} = 3 \wedge *Ag(e') = x]$$

Modification by *in a month* will give us (53):

$$(53) \quad \lambda e'. \exists y [*(\lambda e. \text{BUILD}(e) \wedge |e|_{\langle t, M \rangle} = 1)(e') \wedge *Th(e') = y \wedge y \in *HOUSE \wedge |y|_{\langle t, M \rangle} = 3 \wedge \forall e'' [e'' \in \text{ATOM}(\{e': e' \in *(\text{BUILD} \wedge |e'|_{\langle t, M \rangle} = 1) \wedge *Th(e') = y \wedge y \in *HOUSE \wedge |y|_{\langle t, M \rangle} = 3\}) \rightarrow \tau(e'') \sqsubseteq 1 \text{ MONTH}]]$$

This give us exactly what we want: the set of plural events with a cardinality of 3, the atoms of which are measured in terms of the atomic BECOME events to which they are incrementally related, and which have a duration of less than a month.

The common wisdom is that *in an hour* does not apply to atelic predicates, so (54) is ungrammatical, unless *John ran* can be interpreted telically:

$$(54) \quad \text{John ran in an hour.}$$

This is captured in the following way. The meaning for *in an hour* that we have given predicts that either (54) is ungrammatical or that it forces a telic interpretation on the predicate. *Run in an hour* is translated as (55):

$$(55) \quad \lambda e. \text{RUN}(e) \wedge \forall e' [e' \in \text{ATOM}(\{e: \text{RUN}(e)\}) \rightarrow \tau(e') \sqsubseteq 1 \text{ HOUR}]$$

Either $\text{ATOM}(\{e: \text{RUN}(e)\})$ is undefined, in which case the interpretation can't go through, or the presuppositional nature of the existential quantifier forces RUN to be reinterpreted as the atomic predicate $\text{RUN}(e) \wedge |e|_{\langle t, M \rangle} = 1$, with the measure statement supplied contextually.

The trickiest puzzle is how to give an interpretation for accomplishment VPs with bare plural themes as in (56):

$$(56) \quad \text{Mary built houses in three weeks for three months.}$$

Here the VP denotes a set of atelic plural events, and *in three weeks* gives the properties of its atomic parts. There is an apparent contradiction here, since if the plural set is a set of sums of atoms, it ought to be telic. The representation we have given explains the contradiction. *Build houses in three weeks* has the representation in (57):

- (57) $\lambda e'. \exists y [*(\lambda e. \text{BUILD}(e) \wedge |e|_{\langle t, M \rangle} = 1)(e') \wedge *Th(e') = y \wedge y \in *HOUSES$
 $\wedge \forall e'' [e'' \in \text{ATOM}(\{e': e' \in *(BUILD \wedge |e'|_{\langle t, M \rangle} = 1) \wedge *Th(e') = y \wedge y \in$
 $*HOUSES\}) \rightarrow \tau(e'') \sqsubseteq 3 \text{ WEEKS}]]$

We assume that, as in (55), the meaning of *in three weeks* forces a shift from the non-atomic predicate *build houses* to a set of atomic events of house-building, where the atoms are determined by a contextual M value. However, this shift takes place at the embedded level, within the scope of the universal quantifier. At the higher level, the predicate is not shifted, and the plural predicate is thus atelic. The higher atelic predicate can be modified by *for α time*. Now we will turn to the semantics of *for α time*, specifically *for an hour*.

Traditionally, *for an hour* is treated as denoting a function from sets of events to sets of events which last an hour. Dowty (1979) does this and makes it part of the semantics of *for an hour* that if John V-ed for an hour, then he V-ed at all relevant sub-intervals of an hour. This gives (58) as the meaning of *for an hour*, where τ is the temporal trace function, 1 HOUR denotes a set of intervals of exactly one hour and $\tau(e) = 1 \text{ HOUR}$ is short for $\tau(e) = i \wedge i \in 1 \text{ HOUR}$:

- (58) $\lambda P \lambda e. P(e) \wedge \tau(e) = 1 \text{ HOUR} \wedge \forall i \sqsubseteq \tau(e) \exists e' [e' \sqsubseteq e \wedge \tau(e') = i \wedge P(e')]$

However, the data in (59), repeated from Chapter 6:(9), show that *for an hour* must have scope over the existential quantifier which binds the event argument and any indefinite NP in the direct object position. (We won't discuss the subject position.)

- (59)a. John has owned more than half the houses on this street for the last five years, and he is adding to his property every few months.
 b. I carried at least two children around on this bicycle for ten years.
 c. The emperor has ruled fewer than 5 countries for the last ten years.

As we saw, this is because (59b), for example, does not require the same children to be carried around on the bicycle for ten years. Rather, (59b) means "there was an event which went on for ten years every relevant temporal part of which was an event of carrying at least two children around on this bicycle." I assume then that the modifier *for an hour* must mean something like (60):

- (60) $\lambda P. \exists e [\tau(e) = 1 \text{ HOUR} \wedge \forall i \sqsubseteq \tau(e) \exists e' [P(e') \wedge e' \sqsubseteq e \wedge \tau(e') = i]]$

This gives us the following for *John ran for an hour* and for *Truus carried two children on this bicycle for ten years*:

- (61)a. $\exists e [\tau(e) = 1 \text{ HOUR} \wedge \forall i \sqsubseteq \tau(e) \exists e' [\text{RUN}(e') \wedge \text{Ag}(e') = \text{JOHN} \wedge e' \sqsubseteq e \wedge \tau(e') = i]]$
 b. $\exists e [\tau(e) = \text{TEN YEARS} \wedge \forall i \sqsubseteq \tau(e) \exists e' \exists y [\text{CARRY}(e') \wedge \text{Ag}(e') = \text{TRUUS} \wedge$
 $\text{Th}(e') = y \wedge y \in \text{CHILDREN} \wedge |y| \geq 2 \wedge e' \sqsubseteq e \wedge \tau(e') = i]]$

So what *for an hour* does is pick out sets of events which run for intervals of an hour, and which are in effect sums of events in some set P, with the constraint that each relevant part of that hour must be the running time of some event in P. (I won't discuss what makes an interval relevant, but assume that it takes care of the fact that intervals which are "too short" cannot contain P events, and so on.) The set of events picked out by *for α time* is atomic since $\tau(e)=1$ HOUR will provides a measure statement which the atomic function uses. Thus we see that *John ran for an hour* passes all the tests for telicity. It induces the imperfective paradox since *John was running for an hour* does not entail that John ran for an hour, and in contextually appropriate situations *run for an hour* can be used with *take α time to VP* and can be modified by *in α time*:

- (62)a. It took John two weeks to run for three hours without a break.
- b. John ran for three hours in two weeks.

Most importantly, the events in the set denoted by *run for an hour* are not overlapping. So if *John ran for an hour three times* is true, he must have run for at least three hours. If *run for an hour* did not denote a set of atomic events, we would expect an event of John running for a little over an hour to be sufficient to make it true.

For α time applies to atelic predicates because they are the predicates which can meet the condition that every part of the specified interval contains a P event. They do not normally apply to telic predicates because an atomic predicate cannot make this true. So they apply to state predicates and activities and they apply to accomplishments with bare plural and mass arguments. However, there is nothing in their meaning which specifies that they can apply only to atelic predicate. If a telic predicate was constructed in such a way that it could meet the part-of condition, it could occur with this modifier too. In fact, here is one such case. Achievements are telic even with bare plural and mass subjects. However, they, too, may co-occur with *for an hour*, etc., since the temporal parts of a plural event of owls arriving may well be also events in which owls arrive. So as well as the examples in (43), repeated here, we have the examples in (63):

- (43)a. When she rang the bell, servants arrived in a minute.
- b. Owls arrived in five minutes, bringing letters and packages.
- c. Help reached me in five minutes.
- (63)a. Guests arrived for several hours.
- b. Owls arrived for an hour bringing letters and packages.
- c. Tourists discovered this village all summer.

Finally, *for α time* can apply to telic VPs with bare plural subjects as in (64a), but here the adverbial is not modifying a straightforwardly plural VP, but one

with a habitual reading. However, an analysis of the semantics of habituais is beyond the scope of this discussion.

- (64)a. Children ate an ice-cream here for twenty years before the corner shop closed.
- b. Three children ate ice creams here for ten years.
- c. John drank a beer here on the way home from work for ten years.

Chapter 8

Event Structure and Aspectual Classification

In this final chapter I want to tidy up a few left-over issues, say something about what lexical classes are, and try to give a general picture of the theory of lexical aspect which has emerged as a result of this study. The two “left-over” questions that I will discuss are what are semelfactives and why are atelic predicates naturally characterized by S-cumulativity. We start with the first question: what are semelfactives?

8.1 What are Semelfactives?

Semelfactives don’t fit neatly into the classification of verbal predicates that we used in chapter 1. We saw there that there are four Vendler classes; two which naturally head telic VPs (namely achievements and accomplishments) and two which naturally head atelic VPs (namely states and activities). Cross-cutting the telic/atelic distinction is the distinction between activities and accomplishments, which naturally occur in the progressive, and states and achievements which don’t. This classification can be formulated as follows (see also chapter 1:(16)):

(1)

	[±stages] = occurs in progressive	[±telic] = naturally heads telic VP
States	–	–
Activities	+	–
Achievements	–	+
Accomplishments	+	+

This table very naturally encourages us to consider “occurs in progressive” and “naturally heads telic VP” as features, and to think of lexical aspectual classes as constructed on the basis of features that verbs have or do not have (or properties that the events in their denotations have or do not have, depending on what the features actually mean). A featural-based system of verb classes makes a prediction about the number of verbal classes that we have: two features should mean four classes – as in (1) – while the addition of another feature should introduce four more classes (since 3 features should result in 2^3 elements). From such a perspective, the presence of semelfactives, as a fifth class, is a conceptual problem. If we want to maintain (1) as an insightful summary of the relations between verbal classes, we have to find some way to fit semelfactives into the picture. So let us look at what semelfactives are.

Semelfactive verbs, or semelfactive uses of verbs, are verbal predicates used to denote single instances of events usually considered to be activities. Classic examples are *jump*, *wink*, *kick (the door)*, *flap a wing*. These predicates occur as activity predicates denoting extended events, as in (2) where they occur with *for α time*, but they also have a “single event” use, as in (3), where they occur with the modifier *at α time*:

- (2)a. John jumped for ten minutes.
- b. Mary winked furiously for several minutes, until she caught his attention.
- c. He kicked the door angrily for some minutes until someone opened it.
- d. For twenty minutes, the newly hatched butterfly sat still and flapped its wings gently.

- (3)a. John jumped at ten o'clock.
- b. Mary winked at twelve o'clock to remind me to make the phone call.
- c. He kicked the door at twelve o'clock, as they had agreed.
- d. At daybreak, the bird flapped its wings.

Semelfactives have properties which make it very difficult to categorize them. Although the semantics of *at α time* are not quite clear, the modifier makes prominent a reading in (3) in which a single jump, wink, kick or flap occurs, and surrounds the point in time indicated. Semelfactives appear to be interval predicates, since they appear in the progressive, and as (4b,c) shows, they can also induce the imperfective paradox.

- (4)a. John was just jumping/kicking the door when I came in.
- b. John was laughing when he saw me, so he turned it into a cough (and didn't laugh).
- c. Mary was winking at her friend when the teacher shouted at her (so she turned the wink into a grimace instead).

Further, they occur with *in α time*, and the combination of (5) and (4b,c) is evidence that semelfactives are telic:

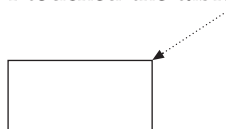
- (5)a. John jumped in three seconds.
 b. The bird flapped its wings in an instant.

So these predicates seem to be ambiguous between an atelic activity reading, represented by (2), and a telic reading shown in (3)–(5).

Smith (1991), who is one of the very few to grant semelfactives the status of a separate lexical category, argues that semelfactives are really atelic achievements. She claims that whereas achievements are single-stage events which are dynamic, telic, and instantaneous, semelfactives are single-stage events which are dynamic, instantaneous and atelic. They are single-stage events which are conceptualized as instantaneous events, though in reality they take time to reach a completion (Smith 1991, pp. 55–8). For Smith, the crucial distinguishing point is that while achievements are change-of-state events (which is what makes them telic), semelfactives do not result in a change of state.

However, characterizing semelfactives as atelic achievements can't be right. Achievements are genuinely near-instantaneous changes from $\neg\phi$ to ϕ , consisting of a starting point, the final instant at which $\neg\phi$ holds and a stopping point, the adjacent instant at which ϕ holds. If I assert *I touched the table*, as in (6a), and move my finger toward the table as in (6b), then all the time my finger is moving along the dotted line, the assertion (6a) fails to be true, but the instant it touches the table's surface, the change from $\neg\phi$ to ϕ takes place.

- (6)a. I touched the table.
 b.



In contrast, semelfactive predicates cannot denote (near)-instantaneous events, because the events in their denotation have internal structure. Events in the denotation of *jump*, *flap a wing*, *kick* and so on, have trajectories, and consist of a series of movements which must occur as part of the event. A wink involves closing an eye and opening it again, flapping a wing involves lowering the wing and raising it, kicking a door involves moving one's foot with force so as to bring it in contact with a door, and so on. And if being an event in the denotation of *P* involves following a trajectory, then we require information about at least two instants between the starting point and stopping point of *e* in order to determine if *e* is in *P*. So they do not look like near-instantaneous events, and the linguistic evidence supports this conclusion. They occur in the progressive, and when this is the case the imperfective paradox occurs, as we saw in (4).

Given this evidence, we cannot argue that semelfactives have the same structure as achievements. The evidence above indicates that semelfactives must be telic, interval predicates, which are related to a homonymous activity predicate in a predictable way. So the question is what is this relation?

If we compare an activity event such as *walk* or *run* which does not have a semelfactive use, with an event such as *jump* or *knock* which does, the difference is intuitively clear. As Dowty (1979) argued, an activity event has minimal parts which are the smallest events in P which count as events of P . If we look at an extended jumping or knocking event, and try to pick out the minimal events, it is fairly easy to do so, since an extended jumping event consists of an unbroken series of single jumps and an extended knocking event consists of a series of single knocks. If we try and do the same to a running or walking event, then there is no non-arbitrary way we can divide it into minimal running or walking events. The mechanism of natural atomic functions gives us a straightforward way to capture the difference. An activity predicate P will denote a set of events P , and will contain a subset $P_{\min}$, which is the set of minimal events in its denotation. If a predicate has a semelfactive use, then there will be a **natural atomic function** which picks out the set $P_{\min}$, and $P_{\min}$ will be an atomic set. If the predicate does not have a semelfactive use, then $P_{\min}$ will be a singular set and not an atomic set, containing minimal singular but overlapping entities. This reflects the intuition that two minimal events of walking may well overlap, but two minimal events of jumping will not. This is why, out of context, it will not be possible to pick out the minimal parts of an extended non-semelfactive activity.

$P_{\min}$ is lexically accessible only if it is characterized by a natural atomic function. This means that a predicate P which has both an activity and a semelfactive use will be ambiguous between a reading in which it denotes P and a reading in which it denotes $P_{\min}$. An “ordinary” activity predicate will unambiguously denote P , and $P_{\min}$ will not be lexically accessible. I will not discuss here why some Minimal Activity Events are associated with a natural atomic function while others are not; we will just assume that knowing whether or not a predicate is associated with a natural atomic function which picks out its minimal elements is part of knowing what the meaning of a predicate is – just in the same way that we learn that cups come in inherently individuable units and fences do not.

This difference between activity predicates which have a semelfactive use and those which do not shows up in a number of linguistic contexts. In general, these differences derive from the fact that the activities associated with a semelfactive reading are ambiguous in the way just described, and the rest are not.

First, (7) illustrates a difference in the counting possibilities:

- (7)a. Dafna jumped/skipped once/twice.
- b. Dafna ran once/twice.

When *once* or *twice* modify a predicate with a semelfactive reading, there is a natural interpretation in which the adverbials count the minimal jumping events, as well as the activity interpretation in which there was one (or two) extended jumping events. So if Dafna is jumping rope, (7a) could mean either that Dafna jumped over the rope twice (the semelfactive use, where the

predicate denotes $P_{\min}$) or that, for example, Dafna had two turns at jumping (the activity use where the predicate denotes P). An activity predicate like *run* has only the second interpretation. (7b) cannot mean that there were two minimal running events with Dafna as agent, only that there were two events which were running activities, whose size is contextually determined. Similarly, there are the contrasts in (8) and (9) involving temporal modification:

- (8)a. Mary jumped at twelve o'clock.
- b. Mary ran at twelve o'clock.
- (9)a. John jumped in two minutes.
- b. John ran in two minutes.

(8a) has a natural semelfactive reading in which the jump took place at twelve o'clock, or "minimally surrounds" twelve o'clock, beginning just before twelve and ending just after it. (8b) has only the activity reading (more precisely the inchoative derived from an activity), in which it is asserted that the running event began at twelve o'clock. (9a) has a semelfactive reading in which a single, unusually long jump lasted two minutes (note that the unlikelihood of such an event actually occurring doesn't make the reading less available). (9b) has the activity reading in which an event of running, whose extent was contextually determined, lasted two minutes. (10) shows that an activity event can be described either simply as an activity, as in (10a'), or as the iteration of a semelfactive, as in (10a). But while (10a) and (10a') are natural paraphrases of each other, this is not the case in the (b) examples.

- (10)a. He jumped again and again.
- a'. He jumped for several minutes.
- b. He ran again and again.
- b'. He ran for several minutes.

Note that in all these cases, the (a) examples also have an activity reading parallel to the (b) examples, but the semelfactive readings seem more prominent. Finally, there is a contrast in nominalizations. With a semelfactive, the nominalization denotes a single minimal event, as in (11a), but with the *run/walk/swim* class, the nominalization can only denote the extended activity event, as in (11b).

- (11)a. He gave a jump/a kick/a wink.
- b. He had a walk/a run/a swim.

8.2 Why Does S-cumulativity Characterize States and Activities?

In chapter 1, we discussed Krifka's claim that atelicity follows from cumulativity, and modified it so as to make atelicity characterizable by S-cumulativity, where S-cumulativity is defined as follows:

(12) X is **S-cumulative** iff:

$$\exists e \exists e' [X(e) \wedge X(e') \wedge \neg e \sqsubseteq e' \wedge \forall e'' \forall e''' [X(e'') \wedge X(e''') \wedge R(e'', e''') \rightarrow X({}^S(e \sqcup e'))]]$$

In other words, X is S-cumulative if it is not a singleton predicate, and if for any two elements x and y in X which stand in the appropriate relation, the singular element which is formed out of the sum of x and y is also in X . Two activity events stand in the R relation if they are temporally adjacent and share the same arguments.

Given the analysis of semelfactives in the previous section, we can show why S-cumulativity is so closely related to atelicity, and why activities and states, which are S-cumulative, naturally head atelic VPs. The denotation of an activity predicate simply is the closure of $P_{\min}$ under S-cumulativity, whether or not $P_{\min}$ is lexically accessible. States can also be seen as the closure of $P_{\min}$ under S-cumulativity. However, if we assume that time is dense, then the set of minimal (i.e. truly instantaneous) stative events will not be accessible, since we can't track down the set of "smallest events." Thus a stative predicate will denote only P and will not have access to the set $P_{\min}$. So both activities and states denote sets of events which are defined via the operation of S-cumulativity. I argued in chapter 7 that atelic VPs are VPs which denote sets of events which are neither atomic nor pluralizations of atomic sets. Clearly a singular set P which is defined via S-cumulativity cannot be atomic, since x , y , and ${}^S(x \sqcup y)$ will all be elements of the set. So the fact that S-cumulativity is an operation which is used in the construction of the sets denoted by state and activity predicate means that these predicates cannot be naturally telic.

The question now is, why does S-cumulativity apply only to activities and states and not to achievements or accomplishments.

The answer lies in the fact that achievements and accomplishments, as argued in the previous chapters, are events of change. Let us commit ourselves to the assumptions we have been making about the nature of the R relation in (12):

(13) The S-cumulativity operation applies to events which are temporally adjacent and which have the same participants.

So two events in P can be summed into a new singular event only if they are temporally adjacent. Achievements and accomplishments are both events of change, where an achievement is an event of change from ϕ to $\neg\phi$, and an accomplishment is a change from ψ to ϕ , where ψ entails $\neg\phi$. We will call these changes α to β changes. A change from α to β is an event whose minimal initial part is the last minimal interval at which α holds and whose final minimal interval is the first minimal interval at which β holds. An event of change from ϕ to $\neg\phi$ consists of two instants, and is thus what we think of as an instantaneous change, while a change from ψ to ϕ is an extended change. (For further discussion of the notion of change see Landman 1991, chapter 5). As Kamp (1979b) points out, it is therefore impossible for an event of change in P to be succeeded immediately by another event of same event type, since

(assuming sameness of participants) any event of change involving a change from $\neg\phi$ to ϕ must be followed by a change back from ϕ to $\neg\phi$ before another event of the same kind can occur. Thus S-cumulativity, as defined in (12) and (13) in principle, cannot apply to achievements and accomplishments.

This predicts that S-cumulativity could apply to changes which are not defined as changes from $\neg\phi$ to ϕ , but are defined in such a way that logically an event in a set denoted by a predicate of change P can be succeeded immediately by another event in P . I suggest that a possible candidate for such events of changes are the so-called “degree predicates” discussed in Dowty (1979) and Abusch (1985, 1986). As is clear from the discussion in section 4.3, I think that many degree predicates (in particular, agentive ones) are best treated as accomplishments. However, as Dowty and Abusch show, inchoative degree predicates such as *cool* and *darken* have properties of both achievements and processes. The sentences in (14) show that *cool* and *darken* have properties which liken them to activities:

- (14)a. The soup cooled for some hours.
 b. The sky darkened between 2 p.m. and 4 p.m.

And yet it must be the case that if the sentences in (14) are true, there were intervals, and near-instantaneous intervals, during the periods of darkening and cooling at which single changes of darkening and cooling took place. We also have sentences like (15), in which these degree predicates behave like achievements.

- (15) In an instant, the sky darkened.

If we analyze inchoative changes like these not as changes from $\neg\phi$ to ϕ but as changes of degrees on a scale, then there is no reason why the endpoint of one change should not be the starting point for the next change. Under such an analysis, S-cumulativity would not be blocked, and the “extended inchoatives” in (14) would be analyzed as intuitively they should be, namely as a series of changes of degree along a scale. I leave the working out of this idea to another time.

One other point. In putting S-cumulativity at the center not just of a theory of telicity but also of a theory of how the lexical classes are derived, we answer the question raised in chapter 1, which emerged from the discussion in Dowty (1979). In chapter 3 of his book, Dowty discusses the imperfective paradox with respect to accomplishments and activities, and shows that it is an imprecise tool for distinguishing between them because the imperfective paradox occurs with minimal activities too. Roughly speaking, it is true that (16a) is valid whereas (16b) is not:

- (16)a. John was walking ENTAILS John walked.
 b. John was building a house DOES NOT ENTAIL John built a house.

However, as Dowty points out, (16a) holds only if the event which makes *John was walking* true is bigger than a minimal event. Dowty expresses concern that the distinction between activity and accomplishment becomes “more ephemeral” (p. 172), although “hopefully it is clear that it has not vanished altogether” (p. 173). Recognition of the fact that the imperfective paradox occurs with minimal activities does blur the distinction between activities and accomplishments, especially if one rephrases the generalization about the imperfective paradox as “the imperfective paradox occurs whenever the witness event for the progressive is not bigger than a minimal event.”

However, although this formulation weakens the imperfective paradox as a tool for distinguishing between activities and accomplishments, it does allow us to see where the real difference between them lies. Accomplishment predicates always denote sets of minimal events. Therefore, the imperfective paradox will always occur with a progressive accomplishment. Activities denote sets of events of which the minimal ones form a very small subset. Therefore, the imperfective paradox will usually not occur. The difference between these predicate types derives precisely from the fact that sets of activities are constructed via S-cumulativity, while this operation cannot apply to accomplishments.

Put differently, on the assumption that sets of activities are constructed via S-cumulativity, we can see why the entailment in (16a) goes through in non-minimal cases: an event *e* in *P* which is “in progress” will contain a part *e'* which has already happened. If *e* is non-minimal, then since *e* it is derived via S-cumulativity from smaller events, it will contain at least a minimal event, *e'*, which is also in *P*, and thus the entailment in (16a) goes through. Thus, S-cumulativity allows us to see that the distinction between activities and accomplishments is not ephemeral. It is not the imperfective paradox which makes the distinction between the two classes, but the fact that the S-cumulativity operation applies to activity predicates and cannot apply to accomplishments. The imperfective paradox works the way it does because of this.

Still, some accomplishments do seem to have an activity reading, such as (17):

(17) Dafna read *The 101 Dalmatians* for two hours.

Does this indicate that some activities can be inputs to the S-cumulativity operation, and are therefore behaving as semelfactives? No, (17) is not derived in the same way as the activity reading of *jump* or *wink*, as we see from the contrasts between the accomplishment in (17) and the activities derived from semelfactives in (18):

- (18)a. The bird slowly flapped its wing for five seconds.
- b. John slowly winked for five seconds.

The activity readings of semelfactives, modified by *for α time*, entail that the action took place at least once (all my informants agreed about this), and (19) is thus contradictory (thanks to Sally McConnell-Ginet for this example):

- (19) The bird slowly flapped its wings for five seconds, when it was suddenly paralyzed so it didn't flap its wings even once.

This follows if the set denoted by the activities in (18) are derived from minimal events through S-cumulativity, and contain at least one minimal event.

However, activities derived from accomplishments do not have such an entailment. (17) does not entail that I read Dafna *The 101 Dalmatians* at least once, and in fact implies the opposite, that only a part of a read "*The 101 Dalmatians*" event took place, indicating that the predicate is not a S-cumulative predicate derived from a set of minimal events. I assume that in fact these readings are derived by "detaching" the activity part of an accomplishment from its BECOME event via the SHIFT operation we discussed in chapter 4. The operation is given in (20), repeated from chapter 4:(51):

- (20) $\text{SHIFT}_{\text{accomplishment} \rightarrow \text{activity}} (\lambda y \lambda e. \exists e_1, e_2 [e =^S (e_1 \sqcup e_2)$
 $\wedge \text{ACTIVITY}_{\langle X \rangle} (e_1) \wedge \text{Ag}(e_1) = x \wedge \text{Th}(e_1) = y$
 $\wedge \text{BECOME}_{\langle Y \rangle} (e_2) \wedge \text{Arg}(e_2) = \text{Th}(e_1)$
 $\wedge \text{INCR}(e_1, e_2, C(e_2))])$
 $= \lambda y. \lambda e [\text{ACTIVITY}_{\langle X \rangle} (e) \wedge \text{Ag}(e) = x \wedge \text{Th}(e) = y]$

This gives (21) as the interpretation for *Dafna read "The 101 Dalmatians"* in (17):

- (21) $\exists e [\text{ACTIVITY}_{\langle \text{READ} \rangle} (e) \wedge \text{Ag}(e) = \text{DAFNA} \wedge \text{Th}(e) = \text{THE 101 DALMATIANS}]$

The theme here is not incremental, since it is not the argument of a BECOME event, and (21) entails only that there was a minimal reading event which involved *The 101 Dalmatians* in some way, and not that there was an event of her reading the whole book.

8.3 Why Do We Have the Lexical Aspectual Classes that We Do?

As I said in chapter 1, in principle lexical aspectual classification could just be a set of generalizations about the meanings of existing lexical items. Properties of accomplishments, for example, would then be generalizations about what VPs such as *eat the sandwiches*, *build the house*, *read the book* happen to have in common, and studying these properties would not tell us anything "deep" about the grammar. On the other hand, lexical aspectual classification could express a set of constraints about what kind of meanings verbs can have, and what kind of events can be the denotations of verbs. Verkuyl (1972, 1993) argues for the first position, while Dowty (1979) argues that the lexical classes constitute a set of constraints on possible verb meanings. In chapter 2 of his book, Dowty suggests a lexical decomposition approach to determining why we have the verb classes that we do, proposing that verb meanings are derived from stative predicates using the operators DO, BECOME and CAUSE. In this

approach, verb classes derive from the different patterns of ways in which the operators can apply to the stative predicates. In chapter 3 of his book, Dowty re-examines aspectual classification in the framework of interval semantics and revises the Vendler classification, classifying predicates into states, activities, simple changes and complex changes (and subdividing each group into agentive and non-agentive predicates). I think that Dowty's position, that lexical classification expresses constraints on what kinds of events predicates can denote, is the correct one, and the classification that I present here is very much in his spirit.

The conclusions about aspectual classes presented in the earlier chapters of this book (especially chapters 3–5) support the hypothesis that lexical aspect is more than a set of accidental or ad hoc generalizations about patterns in predicate meanings. In those chapters, we studied operations of aspectual shift which shifted achievement and activity meanings into accomplishments. The operations are functions from structures to structures. When applied to a specific lexical item α , they insert α into a "slot" in an abstract structure. But this presupposes that there are such abstract structures, independent of specific lexical items, for the operations to operate with. I suggest that what lexical aspect contributes to the grammar is precisely the set of abstract structures which constrain what structures events in the denotation of verbs (and VPs) may have. This itself raises the question as to where the structures or constraints contributed by lexical aspect come from.

The table in (1), repeated here, suggested that the abstract structures determined by lexical aspectual classes themselves are not arbitrary, but result from the interaction of features or properties.

(1)

	[±stages] = occurs in progressive	[±telic] = naturally heads telic VP
States	–	–
Activities	+	–
Achievements	–	+
Accomplishments	+	+

If that is the case, then we want to analyze what the features [±telic] (or, more properly, [±naturally heading a telic predicate]), and [±stages] (or [±naturally occurring with the progressive]) actually mean.

The basic distinction we have, which is represented by the [±telic] feature in the chart, is between verbs denoting events of change and verbs denoting

eventualities which are not characterized as changes. The verbs of change are achievements and accomplishments and, as we have seen, they naturally head telic predicates because a change from α to β determines an atomic function. Verbs which do not denote events of change are states and activities, which naturally head atelic predicates as we have seen. The table in (1) also suggests a classification of predicates in which achievements and states pattern together and accomplishments and activities pattern together. Here is a natural way to see how this division of verbal predicates makes sense.

Verbs of change can determine minimal, or non-extended, changes, from $\neg\phi$ to ϕ , or they can determine extended changes from ψ to ϕ . In a "classical" theory of change, such as that adopted by Dowty (1979), an event of change from α to β is identified as an event whose starting point is the minimal final part of a eventuality in which α is the case and whose final point is the minimal initial part of an event of β being the case. This makes an event of change from $\neg\phi$ to ϕ a **minimal event of change** since it will consist of precisely two instants, the last instant at which $\neg\phi$ holds and the first instant at which ϕ holds. This is the characterization of an achievement. An accomplishment is an extended event of change from ψ to ϕ , which takes place over an interval which is long enough to get from ψ to ϕ , and which is "held together" by an incremental chain. While I can't think that there is a minimal size for accomplishments, they are clearly bigger than achievements. Furthermore, they must last long enough to enable an incremental chain to be built and so, therefore, an accomplishment must be perceptibly bigger than an achievement. The crucial thing about both achievements and accomplishments is that their stopping points have complementary properties to their starting points. This means that we may think of S-cumulativity as an operation which is freely available in the verbal domain, and which is structurally blocked if it is applied to events characterized either as changes from $\neg\phi$ to ϕ or as changes from ψ to ϕ . As I suggested above, this predicts that it could apply to changes characterized in some other way, and I offered degree achievements as candidates for changes to which S-cumulativity applies.

In the domain of non-changes, things are more complicated. Here, the intuitive distinction is between stative eventualities which are static (in the sense that nothing needs to happen in the course of the eventuality) and activities (which are dynamic in the sense that a number of distinct sub-eventualities need to happen in order for an event of the right type to occur). But the distinction between non-extended and extended events, which subdivided the events of change, can also be used to characterize this domain. States are in principle non-extended, since a state can hold at an instant i . They can be even shorter than achievements, which are the minimal events of change, since achievement must hold at a pair of instants, $\langle i_1, i_2 \rangle$, where e_1 (holding at i_1) is an event in $\neg\phi$, and e_2 (holding at i_2) is an event in ϕ . In contrast, the shortest possible activity event must hold at an interval, since even the most minimal activity must consist of a series of subevents. An activity is thus

inherently extended, and has internal structure. So activities can pattern like accomplishments in that they necessarily have internal structure, but states pattern with achievements in that they have no internal structure. States have no internal structure since they can consist of one instant and involve no change, and an extended state consists of a succession of instants in which exactly the same state of affair holds. Achievements have no internal structure, or more properly minimal internal structure, since they consist of a start event which holds at an instant and a final event which holds at an instant but nothing in between. With activities and accomplishments, what happens between the start and end points is crucial to their definition. It is this property of having internal structure that makes activities and accomplishments divisible into stages, or dynamic, and thus possible inputs to the progressive operation.

Note how this analysis differs from Dowty’s (1979) analysis. He argues that activities are dynamic because they have internal structure and involve internal movement, and he suggests that because activities are dynamic, they should be analyzed as necessarily involving change. Crucially, I distinguish between dynamicity, or having internal structure, and change proper.

In the domain of eventualities which do not involve change, S-cumulativity is an operation which is freely available, and it applies to both states and activities. When applied to a state, the effect is to stretch the state: a non-minimal state consists of a succession of instants at all of which exactly the same thing occurs. When applied to an activity, the effect is one of iteration: whatever a minimal activity event is, S-cumulativity builds other activity events by stringing smaller ones together. This means that the cardinality of sets of singular eventualities in the denotations of state and activity predicates is extremely large. It also means that the minimal events, which most naturally show the distinction between instant and non-instant predicates, are not very prominent among the huge number of events in the domain.

If we go back to our original table in (1), repeated here with some modifications as (22), we can see how the features constrain what verbal predicates we have, and thus why we have the lexical classes we do.

(22)

	Minimal events are extended (= dynamic)	Event of change
State	–	–
Activities	+	–
Achievements	–	+
Accomplishments	+	+

Predicates are classified according to two features: (i) whether or not the predicate denotes an event of change, and (ii) whether or not the minimal events in the denotation of each predicate are extended or non-extended. The structures of states and achievements, the non-extended sets, follow directly from these features. The structures of activities and accomplishments are complicated by the fact that where the events are extended, there has to be some additional structure to “hold them together.” In accomplishments, this is provided by the incremental chains. I haven’t even begun to talk about what holds minimal activities together; I leave that for another time and place. S-cumulativity is an operation which applies to events which do not involve change from α to β , and which makes it possible to use simple predicates to denote extended singular events (although it complicates the semanticist’s life by blurring the distinction between minimal and non-minimal events). Semelfactives are not a fifth class, but are related to activities in a predictable way. An activity in its semelfactive use denotes the set of minimal activity events in its denotation if, and only if, those events are characterized by a natural atomic function. Note that the events which are associated with an atomic function – semelfactives, achievements and accomplishments – are exactly those that Krifka’s theory would characterize as quantized.

8.4 The General Picture: Lexical Aspect and the Structure of the Domain of Events

What theory of lexical aspect is emerging from this study? By this question I mean to ask two things: how is the theory of lexical aspect used by the grammar, and what do we learn about the structure of the grammar from the way that lexical aspect works. The two issues are, of course, interrelated.

Perhaps the most striking distinction which has emerged from this book is the distinction between a singular event and an atomic event. We have seen that verbs have their denotations in a count domain, the domain of events, but that the countable elements are not necessarily atomic, but must be identified as atoms through some atomic function. Work by Parsons (1990) and Landman (2000), and the philosophical tradition going back to Kim (1966), has accustomed us to the notion of fine-grainedness – the idea that events are individuable only under particular descriptions. However, the distinction between singularity and atomicity shows that, even under a particular description, it may not be clear what counts as a single countable event in a particular context. In the nominal domain, many concrete nouns denote singular sets which are naturally atomic, so that the meaning of the noun carries with it information about what an atomic N is. Naturally atomic nouns include nouns like *dog*, *cup*, *bicycle* and so on. There are a few non-atomic homogeneous nouns (certainly more than we have as yet identified), such as *fence*, *wall*, *twig* and so on. But in the verbal domain, the balance is very different and there are a huge number of verbal predicates which are count but non-atomic.

Where does lexical aspect fit in? Well, in the first place, if we take fine-grainedness seriously, and assume that the events are individuable under particular descriptions, it looks as if the limits on what events we can pick out are determined only by the limits on the descriptions. And this means that it is the limitations on the descriptions which limit what we can individuate. From such a viewpoint, the role of lexical aspect is central. What the lexical classes do is provide constraints on what kind of events can be individuated by verbal predicates. Put differently, lexical aspect constrains what kind of event descriptions verbal predicates can express. As we saw in the previous section, the constraints can be expressed in terms of featural oppositions: verbs can distinguish events of change and events of non-change, and for each of these groups, events which we might call “simple” (i.e. with no internal structure) and “complex” (i.e. with internal structure). The system is enriched by two other mechanisms: the first is the operation of S-cumulativity which allows extended singular events to be constructed, and the second is a principle which allows atomic sets to be lexically accessed. As a consequence, some activity verbs can be seen either as a semelfactive reading (where they denote the set of naturally atomic events in their denotations) or a true activity reading (where they denote the closure of that set under S-cumulativity).

What makes the system interesting is that the grammar is sensitive to the distinction between atomic and non-atomic sets. The operations which distinguish between telic and atelic VPs – in particular, the operations of temporal modification – are distinguishing between VPs constructed from atomic sets and VPs constructed from non-atomic sets. This forces us to analyse which of the constraint sets that we label “state,” “activity,” “achievement,” and “accomplishment” identify sets of atoms and which identify sets of singular but non-atomic entities. We have seen that, with the exception of semelfactives, all minimal events of non-change, the minimal states and activities, are non-atomic, and that all non-minimal events in these classes are also non-atomic since they are derived via S-cumulativity. Among the events of change, achievements are naturally atomic, and accomplishments are potentially atomic depending on the whether their theme argument has its denotation in an atomic set.

The theory of lexical aspect doesn’t only constrain which events are individuated. It constrains how predicates can shift from one class to another, and in particular how singular predicates can be forced into atomic readings, and can thus head telic VPs. I have examined a number of these shifting operations here in more or less detail: resultative predication, modification by path arguments, and by measure phrases. There are surely others, and different languages will allow different mechanisms.

Many important questions are left open. I haven’t discussed degree achievements properly, or whether there is some mechanism which “holds together” an activity parallel to the way in which an accomplishment is held together by an incremental chain. There is much more to be said about the definition of a “stage,” and this will be connected to a closer study of activities. I have not discussed foundational issues and, in particular, the question of what changes

are. I have assumed a “conventional” theory of change in which a minimal change from $\neg\phi$ to ϕ consists of two instants, one at which $\neg\phi$ holds and an adjacent one at which ϕ holds, but Kamp (1979a,b) raises the possibility that change is a primitive notion and that an event of change holds at the instant which is the event of moving from $\neg\phi$ to ϕ , at which neither $\neg\phi$ nor ϕ holds. In such a framework, achievements as well as states would be truly minimal instant predicates, and the contrast between minimal and extended events would be much sharper. I think that a shift toward this framework raises many fascinating and important ways of rethinking and reanalyzing issues discussed here, but this will have to wait for another time.

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