Abstract

This thesis is devoted to the development of a unified formal treatment of aspectuality. The proposed treatment is based on the conception of aspectuality as a generic category, interpreted as the way in which the entities (objects or eventualities) belonging to the denotation of a predicate occupy an area within the universe in which the predicate is defined, as determined by the contour of the area, but irrespective of the nature (spatial or temporal) and the mereological and topological organisation of the domain. Such a conception is supported by the intuitive semantic analogy between the aspectual properties of the denotata of verbal and nominal expressions, which include the stativity and telicity of the former and the countability, quantification, specificity and definiteness of the latter. The analogy is also reflected in the formation of the temporal constitution of the eventuality expressed in the clause as a result of the interaction between the aspectual properties of the nominal constituents of the clause and the lexical semantics and the morphosyntactic properties of the verb.

As a starting point I use the set-theoretic account of plurality developed in Landman 1989, which presents a response to the lattice-theoretic Logic of Plurals and Mass Terms originally formulated in Link 1983. Landman’s account relies on a fundamental distinction between two kinds of compound entities, viz. sums, whose properties are fully determined by the properties of their components, and groups, for which that is not so. I propose some modifications of the formalism, aimed at achieving greater generality and inhibiting some cases of overgeneration.

I then explore the application of the theory of plurality to the domain of eventualities, focussing upon the formal parallels in the analysis of the referential properties of the classes of entities recognised in the nominal and the verbal domain.

Finally, I address the question of the treatment of aspectual composition in a group-based theory of aspectuality. I turn to the theory of properties of thematic relations developed by Krifka 1991 and show how by introducing the notion of a termset of argumets, by generalising the property uniqueness of events to sets of thematic roles and by including the run time directly into the argument frame of the predicate the power of Krifka’s theory can be recreated, and its coverage extended to a wider range of phenomena, within the proposed framework.

Groups and Eventualities: A Theory of Aspectuality

Ivan Alexandrov Derzhanski

Doctor of Philosophy
University of Edinburgh
1995
Declaration

I declare that this thesis has been composed by myself and that the research reported here has been conducted by myself unless otherwise indicated.

Ivan A. Dershanski
Edinburgh, 15 June 1995

Acknowledgements

I am indebted to my supervisors, Robin Cooper and Elisabet Engdahl, for encouraging me to undertake this research and to pursue it to a successful conclusion. I have always admired their attention to detail as much as the breadth and the depth of their scholarship. Without Robin’s scepticism, a lot of chaff would have been left in. Without Elisabet’s enthusiasm, I would have winnowed away much of the grain.

I am obliged to my colleagues from the working group on Tense and Aspect, especially Sheila Glabey and Martin Melloc, for numerous intriguing discussions of matters more or less directly related to my work. Many of my ideas were presented at various stages at meetings of this group, the working group on Meaning and Computation, the workshop on Parametric Variation and the Annual Conference of the Centre for Cognitive Science, as well as the conference ‘Events and Grammar’ held in November 1993 at Bar Ilan University (Ramat Gan, Israel), and I thank all those who listened to and commented on what I had to say.

A couple of discussions which took place in early 1992 on the Lojban mailing list (an Internet list devoted to the discussion of Lojban, a constructed language based on predicate logic) made me aware of the existence of some interesting semantic problems and inspired me to explore them in detail. Among those who took part in those discussions, I would mention here the names of John Cowan and And Posta. k’essi.

I very much appreciated the prompt and sharp judgements and valuable insights of my informants. I thank Chris Birch for sharing his native Welsh with a complete stranger and Scott Horne for treating a long-time friend to his knowledge of Chinese.

I am grateful to Donald Knuth, Leslie Lamport and Serge Roumrod for designing and developing \LaTeX{} & METAFONT, \LaTeX{} and Seth Hasnct (\LaTeX{}), respectively, and making scholarly writing as great a pleasure as it could ever be.

And I thank all my friends in Edinburgh, on the Internet and in the realm of conventional mail for their affection, their support and their faith in me.
Contents

Introduction vi

0.1 Aims and Motives vii
0.2 Organisation of the Thesis viii
0.3 Some Further Remarks ix

1 Plurality 1
1.1 The Logic of Plurality and the World of Battleships 2
1.1.1 Compound entities 3
1.1.2 Pluralisation 6
1.1.3 Typing 8
1.1.4 Lifting 9
1.1.5 Multiple pluralisation 13
1.2 The 'Real World' 14
1.2.1 Mass terms 14
1.2.2 Portions of matter 16
1.3 Grading and Packaging 18
1.3.1 Grading 18
1.3.2 Packaging 20
1.3.3 Representative pluralisation 25
1.3.4 A transition network 27
1.4 Number in Arabic 28
1.4.1 Singulatives 28
1.4.2 Dual and plural 29
1.4.3 Dual and plural of the plural 31
1.5 Summary 32

2 Aspectuality 34
2.1 The Structure of Time 35
2.2 Aspectual Classes 36
2.2.1 Aspectual classifications 36
2.2.2 Aspectual classes and Taylor's postulates 39
2.3 Conversion of Aspectual Classes 46
2.3.1 Organisation of Moes & Steedman's network 46
2.3.2 Aspectual modifiers in English 48
2.3.3 Some further considerations 53
2.4 Aspect in Bulgarian 56
2.4.1 An overview of the aspect system 56
2.4.2 Aspectual classes and Bulgarian aspect 58

2.5 Aspect in Chinese 63
2.5.1 Aspectual derivation 64
2.5.2 Aspectual inflexion 65
2.5.3 Negation: a dustbin? 69
2.6 Summary 70

3 Aspectual Composition 72
3.1 Eventualities and Thematic Roles 73
3.1.1 Ordered argument systems 73
3.1.2 Brent-based systems 74
3.1.3 Run times 75
3.2 Properties of Thematic Roles 76
3.2.1 Uniqueness of events and identification sets 76
3.2.2 Considerations on identification sets 77
3.3 Composition of Predicates 81
3.3.1 Direct composition 81
3.3.2 Lifting composition 82
3.3.3 Plural composition 83
3.4 Graduality and Degree of Affectedness 85
3.5 Graduality and Mode of Action 91
3.6 Summary 94

Conclusion 95

Language Index 97

References 100
0.2 Organisation of the Thesis

The present work is devoted to the development of a unified, cross-categorial formal treatment of aspectuality, compatible with the major current semantic frameworks. The proposed treatment is based on the conception of aspectuality as a generic category, which has both nominal manifestations (such as countability, number, quantification, specificity and definiteness) and verbal ones (such as stativity, telicity and iterativity). This category is interpreted as the way in which the entities (objects or eventualities) which belong to the denotation of a predicate defined in a given universe occupy an area within that universe, as determined by the contour of the area, but irrespective of the nature of the domain (spatial or temporal) and its nomenclature and topological organisation (including its finiteness, dimensionality, density, continuity, the existence of a metric etc).

There are two reasons, one of descriptive and one of explanatory nature, for which I believe that such a conception is eminently worthy of exploration:

First, it is supported by the intuitive semantic analogy between the aspeetual properties of the denotata of nominal and verbal expressions, which has been pointed out by numerous authors and in many different contexts (Interv alia, Lecchi 1938, Weinreich 1963, Allen 1966, Bolinger 1975, Taylor 1977, Bach 1979, Borsch 1983, Mourelatou 1981, Wittmach 1982, Dahl 1984, Bach 1986). A frequently drawn parallel is the one between countability and telicity, both of which, to use a metaphor due to Taylor 1977, characterise the way in which an entity (be it a stuff or substance or an astatic or telic eventuality) occupies a spatial or temporal area by either filling it uniformly or delimiting it. A similar relation exists between plurals and itivatives, two categories which are grammaticalised alike in some languages (Gleason 1969; cf. p. 51). At the level of linguistic description, then, the conception of aspectuality as a generic category deserves attention because of its implications for the development of compact semantic formalisms, in which the perceived analogies are carried over to the formal representation.

Second, it has been suggested (Interv alia, by Carlsson 1981, Krifka 1991, Berle 1991, Kabakiev 1992) that the parallelism between nominal and verbal aspectuality can provide an important insight into the nature of aspectual composition (the interaction between the aspeetual properties of the non-verbal constituents of the clause and the lexical semantics and the morphosyntactic characteristics of the verb towards the formation of the aspeetual properties of the eventuality expressed in the clause). The reasoning behind this suggestion is that, if the principal types of nominal and verbal aspectuality are analysed as manifestations of some generic types of reference in the corresponding domains, then aspectual composition becomes effectively a process of transfer of reference properties from the non-verbal constituents to the eventuality. Various strategies for the treatment of aspeetual composition which make use of this analogy have been proposed in the literature.

In Krifka 1991 it is demonstrated how both the opposition between unquantified plural/mass and singular count or quantified plural/mass terms and the opposition between astatic and telic predicates can be analysed as manifestations of two generic types of reference, viz. cumulative and quantified (cf. p. 4). In its original form the account leaves some problems open. Consider the following examples:

(0.1) a. John saw seven zebras in an hour.
   b. John saw a zebra in an hour.

The acceptability of the time-span adverbial on an hour in (0.1a) as opposed to (0.1b) argues for the existence of an aspectual difference between the two eventualities. (Paraphrasing one of Vendler's criteria for aspectual classification, accomplishments but not achievements concur with time-span adverbials.) In light of the adopted conception of aspectual composition, we should be able to explain this difference by appealing to a parallel difference in the reference types of the objects of the two sentences. However, since both seven zebras and a zebra are quantified, we are led to conclude that, despite its evident virtues, the bipartition of reference types on its own is not sufficient to capture fully the details of the interaction of nominal and verbal aspectuality, and consequently it needs to be employed jointly with a more elaborate treatment of plurality.

For this purpose I use the set-theoretic account of plurality developed in Landman 1989, which presents a response to the lattice-theoretic Logic of Plurals and Mass Terms (LPM) originally formulated in Linsky 1983 and aimed at giving more structure to the domain of individuals than, for example, Montague's semantics does. Landman's account relies on a fundamental distinction between two kinds of compound entities, viz. sums, whose properties are fully determined by the properties of their components, and groups, for which that is not so. All expressions in the formal language, terms and predicates alike, are further classified according to the level of grouping on the basis of an associated system of floating types, with the possibility of altering the type of an expression by means of a lifting operation. In the present theory the same mechanism is applied to the domain of eventualities, and I argue that its use makes it possible to capture some aspectual distinctions which are lost in an account relying on a simple bipartition of reference types.

0.2 Organisation of the Thesis

The exposition is divided into three chapters.

In Chapter I I introduce the principal provisions of Landman 1989's theory of plurality. I propose some modifications and extensions of the formalism, aimed at achieving greater generality and inhibiting some cases of overgeneration. I then concentrate on the formal representation of number and countability, the classes of nominal expressions determined by them and the processes of conversion between those classes. I also discuss the implicit and explicit realisation of the individual classes and conversion processes in natural languages.

In Chapter 2 I explore the application of the theory of plurality to the domain of eventualities. Using the postulates of Taylor 1977 and the aspeetual network of Mousa & Steedman 1988 as my theoretical starting point, I discuss the representation of the individual aspeetual classes and the processes of conversion between them which find their realisation in natural languages, with particular emphasis on the formal parallels in the analysis of aspectuality in the nominal and the verbal domain.

Finally, in Chapter 3 I address the question of the treatment of aspectual composition in a theory of aspectuality which employs the framework developed in the first two chapters. I turn
0.3 Some Further Remarks

Throughout the discussion I draw support for the theory from, and test it against the facts of, a variety of genealogically and typologically diverse languages. In doing so I am guided by the assumption that it is an advantage for synchronism and polysemy to be reflected by parallelism in the formalisation (and my sharing of Dowty 1989's belief that 'the general expectation of parallelism in syntactic form and semantic function has, historically, led us to insightful analyses of natural languages far more often than it has led us astray'), as well as my concern for the cross-linguistic relevance of the proposals.

Due to the nature of the research, the exposition abounds in formulae which represent interpretations of terms, predicates, sentences and derivations between them. In designing the notation for this study I have pursued simultaneously many goals, among which were acknowledging the existing tradition without being constrained by it, achieving compactness without leaving out any relevant details, emphasizing some useful analogies without suggesting many false ones and satisfying my own sense of aesthetics, without, I hope, going too sharply against that of the reader.

Some of the ideas presented in Section 1.3, Subsection 2.2.2 and Sections 2.3 and 3.2 were reported in Dershanski 1993, but have been fundamentally reworked here. The exposition in Subsection 1.2.1 and Section 1.3 is largely derived from Dershanski 1994.

The information on the genealogical affiliation of each language which accompanies each entry in the Language Index comes from Ruhlen 1987.

Chapter 1

Plurality

In the poem 'Die Vergänglichkeit' ('Ephemeraliteit') by Johann Peter Hebel (1760–1826) the smooth-tongued grandfather extols the splendour of the town of Basel (Switzerland) in the following terms:

```
... 's s villagers Höärer drvn, ...'s s ich mengi Oislche nst
there are [such] houses in it [that] there is many a church not
so groß, un Oislche, ...'s s villagers mengem Dorf
so big and [so many] churches [that] there are in many a village
nicht so voll Höärer ...
not so many houses
```

What is remarkable about this verse is that, despite the syntactic parallelism in the construction employed, which can be represented schematically as '[in Basel] there are houses with property $\phi$ and churches with property $\psi$',

\[
\exists h \text{houses}(h) \land \text{in...Basel(h) and } \phi(h) \land \exists c \text{churches}(c) \land \text{in...Basel(c) and } \psi(c)
\]

there is a semantic difference, which is characterised as a difference in the type of reference associated with the predication in the two cases: the property $\phi$ is possessed by every one of the selected Basel houses, whereas property $\psi$ is not a property of any individual church in Basel. Using the terminology which shall be introduced further in this chapter, the former is an instance of distributive and the latter of collective predication. An adequate theory of plurality must be able to predict this distinction on the basis of the properties of the predicates $\phi$ and $\psi$.

A related, more general task for such a theory is to account for the variation in the applicability of collective predication to singular and plural count terms, collectives and mass terms, as illustrated in examples (1.2–1.5).\(^1\)

(1.2)

a. The water gathers in big pools.

b. !The horse gathers in the field.

c. The horses gather in the field.

d. The herd of horses gathers in the field.

e. The herds of horses gather in the field.

---

\(^1\)The acceptability judgements for examples (1.1) presuppose the use of the verb count as meaning 'determine the quantity of' rather than 'assign a number to'.

1.1 The Logic of Plurality and the World of Battleships

In this section I shall introduce the syntax and semantics of the theory of plurality of Landman 1989 and discuss the fundamental types of reference, by which is understood the relation of a predicate to entities structurally connected to elements of its extension. For the sake of observability, the functioning of the theory shall be demonstrated initially by means of an exemplary universe defined in a two-dimensional finite discrete space, although frequent references to the merologically and topologically more complex 'real world' shall be made throughout this section of the exposition.

Figure 1.1 displays a board on which a player has allocated his fleet for a game of battleships. The fleet consists of 4 boats, 3 tankers, 2 destroyers and 1 cruiser, with the ships of each category taking up respectively 1, 2, 3 and 4 fields.

The universe in this example is built upon the sixty-four fields of the chessboard, which are the atoms in the model. Over these there are defined basic predicates reflecting the location of each field in absolute terms and relative to the other fields, as well as its state of being occupied or vacant. The remaining entities distinguished in the game (ships and collections of ships) are to be understood in the usual metalegal way.

---

Although the language of plurality is a first-order language, for the sake of convenience I shall occasionally use formulas which involve higher orders of quantification, in particular when defining properties of predicates, in the exposition. Such formulas, which are not part of the semantic representation language in the strict sense, are to be understood in the usual metalegal way.

---

Similar lessons can be drawn from other board games, such as chess or Go, and cellular automata, such as John Conway's game of Life.

---

1.1.1 Compound entities

A formal counterpart to nominal conjunction in natural language is provided by the idempotent, commutative and associative operation of sum*ation, which relates any two entities a and b to their sum c = a ∪ b. In the set-theoretic model summation is represented by set union, which is why it is postulated that individual entities, such as the fields in the extensions of the predicates in examples (1.5–1.7), must be represented as singleton sets.

The sum a ∪ b is a compound entity (a plural individual) of which a is a part (as is b). I shall use the notation a \subseteq c (respectively, b \subseteq c) for this partial ordering relation.

---

It is interesting to observe that the English conjunction and and its counterparts in other languages actually require their conjuncts not to be parts of one another, ruling out such constructions as cabbage and vegetables, although a conjunction of this kind is employed in the definition of the part relation in (1.9).
The Logic of Plausibility and the World of Battleships

1.1. The Logic of Plausibility and the World of Battleships

Any entity a is trivially a part of itself. A proper part is a part not equal to the whole. The relation under consideration refers to an individual part of a collection (e.g., two books out of five). A collection is a whole with respect to its parts, and a whole is trivially a part of itself. By virtue of what is now called the whole, the set of the six fields which they take up between them forms the sum of the two smaller squares, which by the operation of addition is a new component of the whole. The operations are obtained by means of the components of the whole. The set of the six fields which they take up forms the sum of the two smaller squares, which is the whole, the set of the six fields which they take up.

The notion of a proper non-empty subset.

A group is a formally singular entity which is subject to collective adjudication, but whose components are obtained by means of the components of the whole. The set of the six fields which they take up forms the sum of the two smaller squares, which is the whole, the set of the six fields which they take up. A group is a formally singular entity which is subject to collective adjudication, but whose components are obtained by means of the components of the whole. The set of the six fields which they take up forms the sum of the two smaller squares, which is the whole, the set of the six fields which they take up.

The notion X of the group is denoted by X. The set of the six fields which they take up forms the sum of the two smaller squares, which is the whole, the set of the six fields which they take up.

The value of the notation X is given by:

\[ X = \{ x \mid \exists y \in X : x \subseteq y \} \]

By contrast, a predicate such as being a book field which applies to any part of an entry in the collection, is said to be a predicated reference. Such a reference is said to be the predication of an element of the collection.

\[ v(g \in \Phi \to w) = \{ w \in \Phi \mid \exists g \in \Phi : w \subseteq g \} \]

Quantitative reference characteristics also the formally singular entity, which holds for every set of the six fields which they take up. The set of the six fields which they take up forms the sum of the two smaller squares, which is the whole, the set of the six fields which they take up.

Thus, the condition for a group to be a group is always to have a group field which applies to every part of the group. A group field which applies to every part of the group is trivially a part of itself. A group field which applies to every part of the group is trivially a part of itself.

By contrast, a predicate such as traveling being a ship which applies to a group field which applies to every part of the group is trivially a part of itself. A group field which applies to every part of the group is trivially a part of itself.

The role of the group field which applies to every part of the group is trivially a part of itself. A group field which applies to every part of the group is trivially a part of itself.

1.2. The Logic of Plausibility and the World of Battleships

In the present example, the six fields which they take up between them form the sum of the two smaller squares, which is the whole, the set of the six fields which they take up. A group is a formally singular entity which is subject to collective adjudication, but whose components are obtained by means of the components of the whole. The set of the six fields which they take up forms the sum of the two smaller squares, which is the whole, the set of the six fields which they take up.

It is defined in terms of singular characteristics of the six fields which they take up between them. The six fields which they take up between them form the sum of the two smaller squares, which is the whole, the set of the six fields which they take up.

The six fields which they take up between them form the sum of the two smaller squares, which is the whole, the set of the six fields which they take up.

1.3. The Logic of Plausibility and the World of Battleships

The six fields which they take up between them form the sum of the two smaller squares, which is the whole, the set of the six fields which they take up. A group is a formally singular entity which is subject to collective adjudication, but whose components are obtained by means of the components of the whole. The set of the six fields which they take up forms the sum of the two smaller squares, which is the whole, the set of the six fields which they take up.

The six fields which they take up between them form the sum of the two smaller squares, which is the whole, the set of the six fields which they take up. A group is a formally singular entity which is subject to collective adjudication, but whose components are obtained by means of the components of the whole. The set of the six fields which they take up forms the sum of the two smaller squares, which is the whole, the set of the six fields which they take up.

The six fields which they take up between them form the sum of the two smaller squares, which is the whole, the set of the six fields which they take up. A group is a formally singular entity which is subject to collective adjudication, but whose components are obtained by means of the components of the whole. The set of the six fields which they take up forms the sum of the two smaller squares, which is the whole, the set of the six fields which they take up.
1.1. The Logic of Plurality and the World of Battleships

(1.17) The boys carried the piano upstairs.
(This includes the one walking in front with a flag, as well as those who actually were holding one end of the instrument or the other.)

(1.18) The marines invaded the island.
(This is unlikely to refer to two unauthorised marines landing in a rubber boat; but in any case it is the shared responsibility, not the numbers, that makes the use of collective predication possible.)

It is convenient for ships in the battleships game to be regarded as groups of fields.

\[ \text{[boat]} = \{ [\text{a1}], [\text{a4}], [\text{b6}], [\text{d4}] \} \]

\[ \text{[cruiser]} = \{ [\text{f1, f2, f3, f4}] \} \]

Groups can be components of sums, which in turn can undergo group formation without restriction on the iteration. As an illustration Landman 1989 uses the example of a fragment of the structure of society as analysed in Das Kapital by Karl Marx, where the farmers and the city proletariat, both of which are groups of individuals, are components of the larger group which is the working classes, the working classes and the exploiting classes further constitute the state, and the process can continue, so that the states of Central Europe and the states of Western Europe who distrust one another denotes a group of groups of states.

It is nevertheless important to observe that the possibility for unlimited grouping is merely a conceptual one, and that languages only provide a finite set of number distinctions; e.g., in English both class and state are singular collective nouns, regardless of the fact that a class is a component of a state.  

1.1.2 Pluralisation

It was stated that in the present theory the properties of a sum are fully determined by the properties of its parts. Two operations of pluralisation of predicates are designed to express this regularity.

Ordinary pluralisation

For a given unary predicate \( \phi \) its corresponding (ordinary) plural predicate \( \phi^* \) denotes the closure of \( \phi \) under summation; in other words, the plural predicate holds for all entities for which the singular one does, as well as their sums.

\[ \forall x \forall y \forall z (\phi(x \land \phi(y) \land \phi(z)) \Rightarrow \exists C (C \land \phi(c)) \Rightarrow C \land \phi(c)) \]

\[ \forall x \forall y (\phi(x) \land \phi(y)) \Rightarrow \phi^*(x \lor y) \]

\[ \forall x \forall y (\phi^*(x) \lor \phi^*(y)) \Rightarrow \phi^*(x \lor y) \]

Rule (1.25), according to which, if a plural predicate holds for an entity, it holds for any part of it, expresses the essence of distributive predication. Link 1983 proposes that all inherently distributive predicates working on plural terms, unlike all other predicates, should enter the formalisations in the form of the corresponding plural predicates, otherwise singular (collective) predication is assumed. This ensures the correct handling of cases such as the ones presented in examples (1.27)

(1.27) a. The dogs died.
   b. The dogs died.

\[ \phi(d_1, \ldots, d_n) \Rightarrow \phi(d_1) \land \ldots \land \phi(d_n) \]

If distributed consistently represented as the plural predicate \( \phi^* \), it is reduced to the singular predicate \( \phi \) when, as in (1.27b), it is applied to a singular entity. It would be incorrect to apply the singular predicate to a plural entity, which is why in (1.27a) the reduction only takes place after the predicate is distributed over the sum which constitutes its argument, including the individual dogs (represented here by \( d_1, \ldots, d_n \)).

Example (1.28), on the other hand, has two readings, depending on whether carried the piano upstairs is represented as a singular or a plural predicate.  

In the latter case it distributes over the three individual piano carriers.

(1.28) Tom, Dick and Harry carried the piano upstairs.

a. \( C(t \cup d \cup h) \)

b. \( C(t) \land C(d) \land C(h) \Rightarrow C(t) \land C(d) \land C(h) \)

Characteristically, the distributive reading is excluded in the alternative construction in which a part of the group is expressed as a collective constituent. The availability of the distributive reading sets (1.28) apart from (1.29).

(1.29) a. Tom and Dick carried the piano upstairs with Harry.

b. Tom carried the piano upstairs with Dick and Harry.

This indicates that the collective construction in (1.29) is connected by way of a meaning postulate to (1.28), but not to (1.28b).

One further distinction between singular and plural predication is that only the former is thematic (Landman 1993), i.e., associated with certain semantic properties characteristic of the corresponding argument position. In the case of a sum it is its components, rather than the sum as a whole, that have the relevant thematic properties.

The representation of the argument position as a group in (1.28a) and a sum in (1.28b) follows from the representation chosen for the predicate in a way which shall be discussed in subsection 1.1.4.
1.1. The Logic of Plurality and the World of Battleships

Proper pluralisation

The extension of the proper plural predicate "ψ" present in Link 1983 but not in Landman 1989, contains just the non-trivial sums in the extension of "ψ":

(1.30) \( \forall c \psi(\{c\}) \iff \psi(\{c\}) \land \neg \psi(\{c\}) \)

(1.31) \( \forall c \psi(\{c\}) \iff \#(c) > 1 \)

As pointed out by Ojeda 1993, the plural in natural languages such as English is ambiguous between a general reading, semantically indeterminate with respect to number,

(1.32) a. How many children do you have?

b. Are there any questions?

and a specific reading, restricted to numbers greater than one (i.e., to the semantic difference between the domains of the general reading of the plural and the singular). By virtue of excluding the singular, proper plurals are a formal counterpart to the specific reading of the plural, for example, if "Tom, Dick and Harry" interpreted as are boys, applies to the referent of "Tom, Dick and Harry," then it applies to any two of Tom, Dick and Harry, but unlike the ordinary plural "boys" it does not apply to any one of them alone. On the other hand, ordinary plurals correspond to the general reading of the plural in English, or to the basic (neutral) with respect to number) form of the noun in a wide range of other languages. Since proper plurals are cumulative, but not generally distributive, their reintroduction into the theory means that cumulative and distributivity are not quite the two sides of the same coin any more, as they are for Landman 1989.

Obviously, if a singular predicate has an empty or singleton extension, the ordinary plural predicate is trivially equivalent to it, and the proper plural predicate has an empty extension.

(1.33) \( \forall \psi([\{\}] \leq 1 \rightarrow [\psi] = [\psi] \land [\psi] - [\psi] \)

It is understood that any pluralisation of a predicate whose arity is greater than one is associated with a certain argument position.

1.1.3 Typing

In order to ensure that predicates apply to terms with the appropriate structure, all expressions in the language of plurality are rigidly typed: a term \( x \) has a type (denoted 'typ x') associated with it, and a predicate imposes certain requirements on the types of its arguments. The type of a term is a non-negative integer corresponding to the level of grouping. The type of a sum is equal to, and the type of a group is greater by one than, the type (or the highest of the types) of its parts.

(1.34) \( \text{typ } [0] = \left\lfloor \text{max typ } a_1 \right\rfloor \)

(1.35) \( \text{typ } t c = 1 + \text{typ } c \)

Thus, if fields in the battleships game are entities of type 1, ships are entities of type 2. The predicate for a fleet belongs to type 3 if the fleet, which occupies 20 fields altogether, is taken as the group of all 10 ships, or to type 4 if it is thought of as a structure consisting of the groups of boats, tankers and destroyer and the cruiser. In the 'real world' it is reasonable to assume that individual physical entities belong to type 1. In the example based on Das Kapital the group of the states of Central Europe and the states of Western Europe is, by virtue of its construction (though not because of any direct linguistic evidence), of a type higher by 3 than the type of the farmers.

A verbal or nominal expression of a natural language is normally formalised as a family of predicates, consisting of various pluralisations of a primitive predicate. The type signatures of the members of this family reflect certain properties of the thematic relations, the nominal reference of the arguments and (where applicable) the temporal constitution of the eventuality.

The relevant mechanisms will be explored in Section 3.2

A right superscript notation will be used to indicate the types of both terms and predicates. Thus, \( x^{m} \) will stand for the term \( x \) of type \( m \) and \( \Phi^{m} \) for the \( m \)-ary predicate \( \Phi \) which expects its \( i \)-th argument to be of type \( m_i \) for each \( i \leq n \). The values of \( m_i \) compose the type signature of the predicate \( \Phi \), which is also where pluralisation is indicated, being prefixed to the type of the corresponding argument, e.g., the binary predicate \( \Phi^{m1,m2} \) is converted to \( \Phi^{m1,m2} \) by ordinary pluralisation relative to its first argument, and to \( \Phi^{m1,m2} \) by proper pluralisation relative to its second argument.

1.1.4 Lifting

The mechanism of lifting, introduced by Landman 1989, realises the possibility of the application of a predicate to arguments belonging to types other than the ones indicated in the predicate's type signature. It is derived from a mechanism discussed by Partee & Rooth 1983 in connexion with the problem of treating conjunctions of predicates which call for functional or individual readings of their arguments, as in

(1.36) a. The temperature is ninety and rising.

b. The president is a Republican now, but changes next week.

In either of these examples the second of the conjoined predicates interprets the subject as denoting a function (a physical magnitude or a civil office) and the first interprets it as denoting the current value of this function (a numeric value or an individual, respectively). The conjunction takes place at the lowest matching types, implying the insertion of corresponding type-converting operations.

In the present theory a parallel mechanism is needed to account for cases of conjunction of predicates which require their shared arguments to be treated as belonging to different types. Consider:

(1.37) The girls met at breakfast and were wearing their golden earrings.

a. \( (\forall x)(M(x) \land \forall W(x)) (g) \)

b. \( M(x) \land \forall W(x) (g) \)

Here \( M \) (met at breakfast) requires the girls to be translated as a group, while \( W \) (were wearing their golden earrings) requires it to be interpreted as a sum over which the predicate can distribute. Consequently, regardless of the precise choice of \( g \) for the initial representation of the girls, after the transition from (1.37a) to (1.37b) one of the two predicates will not be directly applicable to \( g \). The mechanism of lifting is aimed at dealing with this problem.
Lifting of predicates

If a predicate is to be applied to a term belonging to a higher type, prior to the application the type of the argument is lowered, or, using Landman's phrasing, the predicate $\phi$ is lifted to $\bar{\phi}(x) = \lambda x[\phi(\text{LWBR}(x))]$, where LWBR(x) converts x to a term of a lower type. This is warranted by the fact that nominal expressions in natural language often describe a structure which is not directly relevant to the interpretation (in other words, what is true for the complex structure is true for the flat sum), a regularity which Schwarzschild 1982 formulates as

(1.38) The Upward Closure Phenomenon: If a predicate […] is true of a group $\mathcal{G}$ of first order, it has a homonym that is true of all higher order groups formed using all the members of $\mathcal{G}$.

The nature of the conversion depends on the predicate $\phi$, as follows:

(1.39) a. A singular predicate ‘flatens’ its argument x by converting it to $\bar{\phi}lx$ (the group of the components of its elements), where the operator ‘\bar{\phi}’ (written as ‘$\phi^{\downarrow}$’ in Landman 1989) is defined by the condition $\bar{\phi}(x \cup \emptyset) = x \cup \emptyset$.

b. A plural predicate distributes over the parts of the argument, which is to say that it applies to $\bar{\phi}$.

Here 'singular' and 'plural' are interpreted relative to the argument whose higher type causes the lifting.

Thus it is possible to make the following statements about the cards of the minor suits and the cards of the major suits, a group of groups of playing cards:

(1.40) a. The cards of the minor suits and the cards of the major suits are green.

b. The cards of the minor suits and the cards of the major suits form a deck.

c. The cards of the minor suits and the cards of the major suits are shuffled.

d. The cards of the minor suits and the cards of the major suits are separated.

In the first three cases the argument is converted to the appropriate type and structure by lifting the predicate in a way which follows directly from the type of the predicate. Be green, which is defined for single objects, is distributively applied to the sum of all cards (and hence to every individual card). Form a deck, which is defined for groups of single objects, is applied to the group of all cards. Be shuffled, which is also defined for groups of single objects, is distributively applied to the sum of the two groups of cards. Be separated, which is defined for groups of any type, is applied to the group of the two groups of cards.

In the battleships game lifting accounts for the possibility for spatial predicates to be applied to entities of types higher than the type of fields. For example, in

(1.41) The boat $\{4\}$ is in the left half of the board.

the predicate $L$, be in the left half of the board, is lifted once:

(1.42) $L(\{4\})$ $\equiv (\bar{L}(\{4\}))$ $\equiv \bar{L}(\{4\})$ $\equiv L(\{4\})$

This allows the derivation of statements about the parts of singular entities, such as any of the four fields that constitute a cruiser:

(1.43) The cruiser is in the right half of the board.

$R(\{4\})$ $\equiv (\bar{R}(\{4\}))$ $\equiv \bar{R}(\{4\})$ $\equiv (\{4\}) \cup \emptyset \cup \emptyset \cup \emptyset \rightarrow R(\{4\})$

Groups of ships and their characteristic predicates, such as be four boats, belong to type 3. Consequently, in

(1.44) The four boats are in the left half of the board.

the predicate $L$ is lifted twice (before and after being distributed):

(1.45) $L(\{4\}) (\bar{L}(\{4\}))$ $\equiv \bar{L}(\{4\}) (\bar{L}(\{4\}))$ $\equiv \bar{L}(\{4\}) (\bar{L}(\{4\}) (\bar{L}(\{4\}) (\bar{L}(\{4\}))))$

In example (1.37) above the type difference between $M$ and $W$ will lead directly to the conversion of the conjunction $\lambda x[M(x) \land W(x)]$ to $\lambda x[M(x) \land (W(x))]$, where both conjunctive predicates are of the same type.

Lifting of terms

If the predicate is defined for a type higher than the type of the argument, Landman allows for the argument, call it x, to be lifted (that is, to have its type raised) by being converted into the singleton group $\bar{x}$. I shall leave out this rule, which I find to be of more harm than help, for reasons which shall be exposed presently.

Consider again examples (1.2–1.3), partly repeated here as (1.46–1.47).

(1.46) a. The horses gather in the field.

b. The horses gather in the field.

c. The herd of horses gather in the field.

(1.47) a. I counted the horse.

b. I counted the horses.

c. I counted the herd of horses.

The sentences in (1.46a) and (1.47a) are unacceptable (except under generic interpretation) rather than simply false in all situations. A natural way to account for this is to assume that gather in the field and count, being predicates of type 2, require a group, while the horse belongs to type 1, and application is impossible in such circumstances. But if the option of lifting arguments exists, we are obliged to lift the object to a singleton group and assign a truth value to the sentence.
1.1. The Logic of Plurality and the World of Battlehips

On the other hand, if the horses already belong to type 2, as does the herd of horses, lifting the argument in the other two sentences in each group of examples is superfluous. Consider also the following.\(^\text{10}\)

(1.48) a. The cards with blue backs and the cards with green backs are separated.

b. The cards up to six and the cards from seven up are separated.

c. The cards are separated.

When interpreted as saying that the blue-backed cards are separated from the green-backed cards, example (1.48a) can be translated as

\[
S(\bigcap_{B} b) \cup S(\bigcap_{G} g)
\]

with \(S\) standing for be separated, \(B\) for be a blue-backed card, and \(G\) for be a green-backed card. Under this interpretation \(S^m\{a\}\) is true if \(a\) is a group of type \(m\), where \(m \geq 2\), and the components of \(a\) (of which in this case there are two, the group of the blue-backed cards and the group of the green-backed cards) are separated from one another.

Example (1.48b), referring to the situation where the cards up to six are separated from the cards from seven up, yields a very similar structure.

\[
S(\bigcap_{r=1}^6 x) \cup S(\bigcap_{r=7}^n y)
\]

Here \(r\{a\}\) stands for the rank of \(a\) and \(a\{a\}\) for the ordering of ranks within a suit.

In contrast, what (1.48c) is saying may be that all individual cards in the deck(s) are separated from one another, as in (1.51),

\[
S(\bigcap_{C} c)
\]

or it may have the sense of (1.48a) or (1.48b), if offered by a player in order to state that the two decks, which have just been used for a game of rummy, are now ready for playing bridge, or that the deck is prepared for a game of belote. There may also be an explicit indication of the partition in the sentence or elsewhere in the discourse.

(1.52) a. The cards are separated by the colour of their backs.

b. The cards are separated by rank.

The latter options are accounted for by a representation parallel to the one in (1.51), but with a different predicate translating be separated, namely, one defined so that \(S_{C}(c_1, c_2)\) is true if the components of the group \(c_2\) form, in some unspecified way, groups which are separated from one another. In other words, \(S_{C}(c_1, c_2)\) is true if \(S_1\) applies to some group \(c_1\) of higher type, from which \(c_2\) can be obtained by the flattening operation described in (1.53a).

(1.53)

\[
S_2 = \alpha_2 \beta_2 \epsilon_2 (c_2) \equiv \{ \forall c_1 \in S_1 (c_1) \}
\]

Schwarzfeld 1992 formulates the connection between \(S_2\) and \(S_1\) as

\[\text{The discussion of examples similar to (1.48) constitutes the key part of Landmann 1989's argument for the introduction of groups into the theory of plurality. He observes that if the noun phrase which is the subject of that sentence is expressed in the same way as the one in the corresponding positions in (1.48a) or (1.48c), as it would be in a theory operating with nouns alone (such as the original one of Link 1985), the information about the way in which the cards are separated, which is provided by the internal structure of the term and which sets the interpretations (1.49), (1.50) and (1.51) apart from one another, would be lost. He further notes, by means of similar examples, that the same phenomenon obtains at higher levels of grouping, which argues for the existence of groups of a theoretically infinite number of different types.}\]

1.1. The Logic of Plurality and the World of Battlehips

(1.54) The Mereological Generalisation: If a predicate \(\ldots\{a\}\) is true of a group \(G\) of any order, it has a homonym that is true of that first order group which is composed of the individuals used to generate \(G\).

and notes that it appears to involve an operation converse to lifting of predicates. Indeed, from (1.53) it follows that \(S_1(c) \rightarrow \{ \forall S_2(c) \}\{c\}\).

But what does that say about the possibility to apply lifting of terms? Let us observe that in order to interpret (1.46c) in one of the abovementioned ways, or in any other way, the bearer uses information which is not present in the form of the noun phrase chosen by the speaker and which is not going to be recovered by lifting the cards to a type 3 group of one element.\(^\text{11}\) Therefore there is nothing to be lost by allowing only the lifting of predicates, but not of arguments. I shall postulate instead that the application of a predicate to an argument of a lower type does not yield any truth value, reflecting the semantic ill-formedness of the corresponding sentences.

This decision has one important consequence. Since predicates can always convert their arguments into sums of a lower type for the purpose of distributing over their components, I shall postulate that no referents of noun phrases are ever introduced as sums of two or more elements. Instead, all nominal expressions introduce groups which, if necessary, are ungrouped by lifting the predicate.

1.1.5 Multiple pluralisation

Linguistic evidence suggests that, apart from referring to a single argument position, pluralisation must also be allowed to affect more than one argument position at a time (to affect a termset\(^\text{12}\), a tuple of argument positions). Consider the examples:

(1.55) a. The two hens saw two eggs.

b. The two hens laid two eggs.

One of the possible interpretations of (1.55a) is that each of the two hens (call them \(h_1\) and \(h_2\)) saw [each of] the two eggs (\(c_1\) and \(c_2\)). If the predicate \(S_1^1(x, y)\), \(y\) saw \(x\) is pluralised relative to both the hen and the egg (\(S_1^1(x, y)\), then it can be distributed over both arguments.

\[^{11}\text{The fact that (1.49) can be interpreted as (1.49) or (1.50), and each of (1.48a) and (1.48b) can have the interpretation intuitively assigned to the other, leads to the question whether it is justified to regard the interpretations (1.49) and (1.50) as directly derived from the corresponding examples and the sentences in (1.48a–1.48b) as ambiguous between a specific reading, in which the partition is the one indicated by the form of the noun phrase, and a general one, in which that is not necessarily the case.}\]

\[^{12}\text{Schwarzfeld 1992 argues that there is not sufficient justification for this approach. In his view the listener always starts with the more general (1.43), of which all other interpretations are subcases (and which can be obtained from (1.43a–1.43b) by means of lifting), and then possibly uses the information provided by the construction of the noun phrase, along with information derived from prior discourse and extra-linguistic knowledge, to choose the appropriate partition corresponding to \(c\) in (1.53). This leads him to abandon the group approach altogether and to return to an ontologically simpler sum approach, in which the form of the noun phrase does not enter the formalisation directly, although the information contributed by it is considered at a subsequent stage, when the partition is reconstructed. He does not elaborate on the formal representation of this information, which seems to require a mechanism not unlike Landmann's groups.}\]

\[^{11}\text{The term set is borrowed from the terminology of Lojban. To the best of my knowledge, it was introduced by John Cown.}\]
1.2 The "Real World"

In the "Real World," many abstract notions are morphologically similar to the present state, and explanations are not needed. For simplicity, we assume that the present state is the intuitively obvious and that explanations are not needed.

On the other hand, the distinction between common and rare terms in the Danish language is illustrated by the following examples:

Example 1: If the liquid in your glass is water, then the liquid in your glass is water. Otherwise, the liquid in your glass is not water.

Example 2: If the liquid in your glass is water, then the liquid in your glass is water. Otherwise, the liquid in your glass is not water.

Similarly, the distinction between common and rare terms in the Danish language is illustrated by the following examples:

Example 1: If the liquid in your glass is water, then the liquid in your glass is water. Otherwise, the liquid in your glass is not water.

Example 2: If the liquid in your glass is water, then the liquid in your glass is water. Otherwise, the liquid in your glass is not water.

The difference is that the common domain has an intuitive notion, whereas the rare domain has a formal theory. The distinction between common and rare terms is illustrated by the following examples:

Example 1: If the liquid in your glass is water, then the liquid in your glass is water. Otherwise, the liquid in your glass is not water.

Example 2: If the liquid in your glass is water, then the liquid in your glass is water. Otherwise, the liquid in your glass is not water.

Here we translate a rare term, i.e., "beaker," as defined for a single field of the form, and the resulting term is the intuitively obvious.

We shall encounter multiple partitionings again in Section 3.3.

1.2.1 Mass terms

Having used the example of the bushes to illustrate some aspects of pliancy, I shall now proceed to considering a number of cases where the concept of mass terms is particularly difficult to formalize. This is due in part to the fact that mass terms are often used with both physical objects and quantities.

In a straightforward manner, the inference is presented below (for simplicity, only those aspects of the inference are noted):
cake (a stuff heterogeneous above the level of molecules). Furthermore, since language does not provide access to any 'water atom' (witness the ill-formedness of *three water and the absence of a 'natural', context-free interpretation of three waters), any atomisation of mass terms will necessarily rely on the recognition of an abstract entity for purely theoretical purposes.

Let us therefore adopt a slightly different approach (one based on mathematics rather than natural science) and begin by considering the organisation of space in the chessboard game, as compared to the real world.

On the chessboard the elementary unit of space is the field, a group of such units may make up an area occupied by a ship or by water. In the real world space is a three-dimensional continuum of points. My proposal is to regard those points as being able to contain abstract amounts of matter, which will be referred to as atoms (entities of type 0, which have no proper parts and do not directly correspond to any linguistic expression). A group of atoms makes up a thing (an entity of type 1), which can be an individual thing or an amount of matter. The characteristic predicates of mass terms apply to sums of atoms, and by virtue of this they are formally very close to the formalisations of plural, which apply to sums of things. The properties shared by mass terms and plurals are expressed as properties of sums of any kind, whereas the properties restricted to mass terms pertain to type 0, and the ones restricted to plurals (such as cooccurrence with explicit numerals) require a sum of type 1 or higher.

This allows us to apply the regularity in (1.62) to the real world, assuming that the summation is done over the infinite set of points enclosed in a given spatial area.

It is my opinion that this strategy serves better to emphasise the analogy between mass terms and plurals, and in Section 3.3 it will become evident that it is also advantageous because it offers an elegant account for the transfer of reference type. 15

1.2.2 Portions of matter

In board games such as chess and battleships a field is commonly equated with the chessman — or a group of fields with the ship — occupying it, if a white piece is occupied by the white queen, 161 it is used to refer to the white queen, if there is a tanker on d-4, a tanker is what d-4 refers to. This doesn’t work any longer, however, as soon as colloquial entities are taken into consideration. For example, on the chessboard two rooks of the same colour may form a battery, which has properties separate from theirs, it hasn’t existed for as long a time as they have done (which, from the point of view of the game, is most likely since its beginning), and it may cease to exist while the player is still in possession of both rooks.

In the ‘real world’ copartisal entities are very frequently under consideration. A ring and the gold which constitutes it occupy exactly the same space, but they have different and even contradictory properties. For one thing, the ring is certainly newer, probably significantly newer, than the gold. Furthermore, if the object is hammered or molten, the ring will be destroyed, whereas the gold won’t be.

In order to deal with this problem, Grandy 1979 proposes that objects be analysed as relations between times and quantities of stuff. 17 Suppose a wedding ring is made of the same gold which was previously an Ottoman coin. Then the coin C relates an amount of gold g to the period tC, between its minting and its melting, while the ring R relates the same amount of gold g to the later period tR from its melting onwards. The statements that gold g constitutes thing C and thing R at the corresponding times are expressed as C(g, tC) and R(g, tR), respectively. The coinhood of C and the ringhood of R are represented formally as second-level predicates

\[
\exists t_1 \exists t_2 (C(g, t_1) \land R(g, t_2))
\]

Note the correspondence between the indefinite determiner a in the English sentence in (1.63b) and the existential quantifier in the formal representation.

This makes gold a first-order and ring a second-order predicate. A difference in order must obtain accordingly between all predicates applying to the corresponding entities.

(1.64) a. The gold is new.
   \[N(g)\]
   b. The ring is new.
   \[N(R)\]

Here N and N are respectively the first-order and the second-order version of be new. In the view of Chellas 1979 this is a disadvantage, since the newness of the gold and the newness of the ring seem to be instances of the same concept. He is right in so far as we can compare the two, but it is not obvious that we can do so legitimately, since in fact the newness of the ring refers to the recency of the forming of its shape (a property which a stuff can’t have) and the newness of the gold to the recency of its having been extracted from nature and made fit for use in art or industry. Consequently it is only the newness of the gold, not of the ring, that distributes to all of its parts.

In the present theory the difference in order between the predicates be gold and be ring and the associated versions of be new, which is postulated in Grandy’s account, corresponds to a difference in type. Compare

(1.65) a. The thing x is gold.
   \[G(x)\]
   b. The thing x is a ring.
   \[R(x)\]

(1.66) a. The gold is new.
   \[N(g)\]
   b. The ring is new.
   \[N(R)\]

Whether two levels are sufficient depends on one’s interpretation of the relation consists of. Bach 1986 draws attention to the fact that a stuff may make up another stuff, as water makes up snow (or ice). Furthermore, stuffs may be put together to form an alloy or solution: apart from water, snow also contains air, hydrogen and oxygen atoms make up water, bronze consists of copper and tin.

Since mass terms are involved in these cases, however, they refer to different relations (i.e., different kinds of constitution), from the point of view of both ontology (since the type recognised as unequivocally the same stuff (thus S(x) \land S(y) \land S(t), where x and y) is a predicate in Grandy’s account).

Consider also the Tin Woodman (L. Frank Baum, The Wizard of Oz), whose entire body was cut off, limb by limb, and made again from tin, somehow preserving the identity of the whole in the process. This may look like a far-fetched example, but in fact it is only differs from the constant update of the matter which makes up any living organism in that the latter happens gradually.

Such cases can be subject to ambivalent judgements. The discussion in Burgess 1979 of a steel engine whose parts are taken out one by one and replaced by aluminium ones leads to the conclusion that this engine was once steel, but is now aluminium is less salutary if steel parts have been assembled into the same configuration in the meantime, so that there are two candidates for the designation the engine.
of the predicate is not raised) and natural science (since they appeal to different physical or chemical phenomena). In my opinion those relations should be kept separate from one another and from the relation of constitution which connects a mass term to a count term.\footnote{It must be noted that the type assigned to the various forms and states of existence of matter are not fixed in the theory, and in such particular context they can be chosen so as to accommodate as many levels of grouping as need be accounted for. It follows that it is possible, if necessary, to assign different types to atoms, molecules and principle phases of matter, thus acknowledging the fact that ice crystals in general, and snowflakes in particular, have more structure than hydrogen dioxide, which in turn has more structure than the hydrogen and oxygen atoms, and consequently translating be snow as a plural predicate of a type higher than 0.}

\section*{1.3 Grinding and Packaging}

\subsection*{1.3.1 Grinding}

As Pelletrier 1979\textsuperscript{1} observes, masshood is a property which can be acquired by a nominal expression in appropriate contexts; to use the terminology employed by Bach 1986 and based on Pelletrier's 'Universal Grinder' (attributed to David Lewis), a count term can undergo grinding into a mass term. For example, although apple is normally a count noun, and is used as such in examples (1.67a), in (1.67b) it has the features of a mass noun:

\begin{enumerate}
\item[(a)] There is an apple on the table.
\item[(b)] There is apple in the salad.
\end{enumerate}

Despite Pelletrier 1979\textsuperscript{1}'s statement that 'there can be made a prima facie case that nothing is immune from the grinder treatment', it can be shown that the universality of the Universal Grinder is subject to certain limitations. Some examples offered by Ware 1989 include hole, opening and mouth, with which the Grinder would have a hard time, since there is no grindable matter in them. Collective nouns, such as herd, team, department or parliament, are also difficult to grind.

\begin{enumerate}
\item[(a)] Much flock was slaughtered for the feast.
\item[(b)] The conference hall was full of committee.
\end{enumerate}

But there are many individual physical entities which are no less problematic. The Grinder would grind an apple into apple and a rabbit into rabbit (though in common usage such mass terms often refer to the stuff making up a particular, paradigmatically determined part of the countable thing; the core of an apple is not normally considered apple, and rabbit is the flesh or the fur of rabbits, depending on whether one is talking cooking or furrieries). But it would grind a chair into sawdust (or wood, or oak, ebony or whatever other kind of wood furniture can be made of), not into chair, and if it is operating properly, it would grind a table into indistinguishable sawdust. It wouldn't grind a ring into ring, it would grind it into copper, silver, gold or whatever else it happens to be made of. We can conclude that the ease with which apple is used as a mass term has to do with the fact that the apple is the only natural object consisting of apple, whereas a ring owes its ringhood solely to its shape. This restriction affects all nouns which refer to entities for which configuration is significant.

Still, the productivity of grinding can't be doubted, and it becomes even more pervasive if we consider that a mass term need not denote a physically homogeneous mass. Many a mass term refers to a non-individuated plurality of things. In this sense chairs and tables can be 'ground' into furniture, which is not the same thing as wood, or shoes and boots into footwear, which again is different from leather.

Let us move on to the formal representation of grinding. For any predicate $\phi$ Link 1983 introduces its mass term correspondent $\Psi\phi$, which holds for all portions of matter constituting part of an entity for which $\phi$ holds; e.g., if $P$ is be apple, $\Psi P$ is be apple [matter]. He also defines corresponding mass term versions of the part relation and the summation operation.

In (1.69) $D$ is the set of individual portions of matter and $h$ is the semilattice homomorphism which grinds every individual into the portion of matter constituting it.

\begin{equation}
\forall \Psi(\forall x(\phi(x))) \rightarrow \exists y \in D \land \forall x \in y \ni h(x) \ni \phi(x)
\end{equation}

My strategy will be based on the approach of Subsection 1.2.1. I shall write $P$ for be an apple atom. (Here 'atom' must not be understood in the sense in which it is used in natural science, as we are talking not just of a minimal, but of a dimensionless amount of apple matter, that is, an amount fitting into a point in space—obviously an abstract entity, to which language provides no direct access, just as it provides no access to the 'water atoms' discussed in that subsection.) The atomisation operator $\Psi$ converts a predicate $\phi$ into the predicate $\Psi \phi$, which holds just for the atoms belonging to elements of the extension of $\phi$.

\begin{equation}
\Psi [\phi] = \{ \alpha \mid \alpha \in A \land \alpha \in \Psi [\phi] \}
\end{equation}

(Here $A$ is the set of atoms in the model and $\Psi$ the transitive closure of the membership relation.) Accordingly $\Psi P$ means be apple [matter].

\begin{equation}
\mathbf{ord} (\Psi \phi) = \Psi \phi
\end{equation}

Each 1986 makes the point that no entity to which $\phi$ applies need actually exist. As noted in his discussion of what he calls the participle puzzle, the principle 'no apples—not apple' (i.e., if there were no apples in nature, none could be ground, and consequently the mass term apple could not have the meaning attributed to it here, derived from the one of the count term apple), which seems to follow from (1.69), does not hold: a quantity of matter synthesised in a laboratory may qualify for applehood without ever having been part of an apple. This is even more obvious with respect to concrete or abstract artifacts.

\begin{equation}
\text{This is part of a paper on natural language metaphysics.}
\end{equation}

B. W. found part of a Roman aqueduct.

It is crucial, however, that the paper be at least conceived as existing in the future; no amount of text is part of a paper unless there is intention for it to be included into one. Similarly, the aqueduct must have existed at least in the minds of the Roman engineers and construction workers, even though their effort may, as Bach puts it, have been interrupted by an invasion of hordes of barbarians from the north. And although apple need not come from apples, the concept of it does, otherwise it would not be referred to by a ground count term. The refutation of 'no apples—not apple' merely shifts the meaning of apple from 'stuff that apples consist of' to 'stuff empirically indistinguishable from the one that apples consist of'.

The grounding of count terms is not normally indicated in the morphology of English. Consequently, the conversion for them follows the diagram in Figure 1.2.
1.3. Grinding and Packaging

1.3.2 Packaging

The operation opposite to grinding, i.e., the conversion of mass into count terms, is called packaging by Bach 1986, who notes that packaging, unlike grinding, is polyvalent, since there are infinitely many ways to package a certain kind of matter, and among them not infrequently there is more than one which is of linguistic relevance. For example, a beer can refer to any sort of beer or to a conventional amount (a standard glass or bottle) of beer. Similarly, a sugar, apart from a kind of sugar, can denote a quantity ranging from a cube or sachet to a single molecule, depending on the setting being a tea table or research in organic chemistry, and in the context of shopping it may acquire the additional meaning of a standard (e.g., kilogramme) package of sugar.

In light of the conventions regarding the treatment of mass terms, the primary mass predicate be \( \psi \) is to be represented as \( \psi^\mathit{p} \), and then the outcome of the packaging, be a [specific] quantity (portion, piece) of \( \psi \), is formally represented as in (1.73),

\[
\text{PACK}_{\psi}(\psi^\mathit{p}) = \lambda x(\psi^\mathit{p}(x) \land \mathit{Q}^\mathit{p}_x(x))
\]

where \( \mathit{Q}^\mathit{p}_x \) symbolically represents the conditions set on the quantity or the physical integrity (i.e., the spatial continuity) of the entity or on its constituting a subkind of \( \psi \).

The packaging of mass terms into names of kind and names of standard unit is not normally indicated in the morphology in English, cf. beer and sugar above, and the same is true for many other languages. None the less, the conversion can be established by syntactic tests, such as pluralisation or the presence of the definite article the in English. In the Welsh sentences in (1.74) the morphologically singular noun curw ‘beer’ can be recognised as a mass or a count term by its cooccurrence with the mass quantifier peth or the count quantifier rhais, both of which correspond to some in English.\(^{13}\)

(a) Mae peth curw yn weel na dem.  
   ie. some (mass) beer is better than none
   ‘Some beer is better than none.’

(b) Mae rhais chwarau yn weel na giwadd.  
   ie. some (count) beer is better than others
   ‘Some beers are better than others.’

The usual explicit construction for naming both standard and non-standard quantities of stuff in English is the one represented in (1.75),

\[
\text{PACK}_{\psi}(\psi^\mathit{p}) = \lambda x(\psi^\mathit{p}(x) \land \mathit{Q}^\mathit{p}_x(x))
\]

a special case of (1.73), where the quantity (and possibly also the shape) \( \mathit{Q}^\mathit{p}_x \) is expressed by the head noun.\(^{26}\) For example, a pound of sugar is sugar and has to weigh 0.454 kg; on the other hand, in its physical integrity and shape no conditions are set. A cube of sugar is also sugar, the conditions set on its quantity are less strict, but it must be a single physical entity, whose shape, and to a certain extent its size, are determined by its cuboid, though in a stuff-specific manner.

In some languages there is a more or less productive derivational strategy associated with this process. In Russian, for example, the suffixes -ni-a and -ni-ka form count nouns denoting individual entities pertaining to a stuff, a heterogeneous collection or a pair.

<table>
<thead>
<tr>
<th>Russian</th>
<th>name of class</th>
<th>name of unit ( -ni-a )</th>
<th>name of unit ( -ni-ka )</th>
</tr>
</thead>
<tbody>
<tr>
<td>samčuľ</td>
<td>‘pears’</td>
<td>samčuľina</td>
<td>‘pear’</td>
</tr>
<tr>
<td>šanžy</td>
<td>‘trousers’</td>
<td>šanžynina</td>
<td>‘trouser-leg’</td>
</tr>
<tr>
<td>lěd</td>
<td>‘ice’</td>
<td>lědina</td>
<td>‘ice-block’</td>
</tr>
<tr>
<td>soloma</td>
<td>‘straw’</td>
<td>solomina</td>
<td>‘a straw’</td>
</tr>
<tr>
<td>rosua</td>
<td>‘tea’</td>
<td>rosunika</td>
<td>‘drop of tea’</td>
</tr>
<tr>
<td>čaj</td>
<td>‘tea’</td>
<td>čajnica</td>
<td>‘tea-leaf’</td>
</tr>
</tbody>
</table>

The second of these suffixes is in fact a composition of the first and the feminine diminutive suffix -ki. The presence of -ki is obligatory with some stems (‘tea-leaf’ is never ‘čajnica’), and if it is not, as it is often the case with diminutives, it may or may not alter the kind of thing referred to (a lědina is normally a block of ice floating in the Arctic Ocean, say, while a lědinka can be any odd ice crystal; on the other hand, a samčuľina is simply a pear on small size). Occasionally the diminutive alone serves the same purpose, in those cases it could be said that the size specification is preceded by an implicit packaging operation.

<table>
<thead>
<tr>
<th>Russian</th>
<th>name of class</th>
<th>name of unit ( -ni-a )</th>
<th>name of unit ( -ni-ka )</th>
</tr>
</thead>
<tbody>
<tr>
<td>karameľ</td>
<td>‘caramel, toffee’</td>
<td>karameľka</td>
<td>‘caramel, toffee sweet’</td>
</tr>
<tr>
<td>morkov’</td>
<td>‘carrots’</td>
<td>morkovka</td>
<td>‘carrot’</td>
</tr>
<tr>
<td>burmag’</td>
<td>‘paper’</td>
<td>burmakša</td>
<td>‘strip of paper, document, banknote’</td>
</tr>
<tr>
<td>šokolad</td>
<td>‘chocolate’</td>
<td>šokoladka</td>
<td>‘chocolate bar’</td>
</tr>
</tbody>
</table>

All names of unit form plurals, and so do some names of class; the plurals of the former denote a plurality of units and plurals of the latter a plurality of kinds.

<table>
<thead>
<tr>
<th>Russian</th>
<th>name of class</th>
<th>name of unit ( -ni-a )</th>
<th>name of unit ( -ni-ka )</th>
</tr>
</thead>
<tbody>
<tr>
<td>singular</td>
<td>frava</td>
<td>‘grass’</td>
<td>fravunika</td>
</tr>
<tr>
<td>plural</td>
<td>frava</td>
<td>‘herbs’</td>
<td>fravunika</td>
</tr>
<tr>
<td>singular</td>
<td>pyl’</td>
<td>‘dust’</td>
<td>pylniska</td>
</tr>
<tr>
<td>plural</td>
<td>pyl’</td>
<td>—</td>
<td>pylniska</td>
</tr>
</tbody>
</table>

These examples show that, instead of one, Russian has two standard lexical packaging operations, only one of which has an overt realisation in the morphology. The relevant part of the conversion network is presented in Figure 1.1.

\(^{13}\)The mutation of curw to chwara after rhais is morphologically determined, and is not related to the change in reference type.

\(^{26}\)A consequence of this view is that in the present theory the predicates sugar and pound of sugar apply to different entities and having to different types.
The process of formation of names of unit is even more productive in the Brythonic branch of the Celtic languages, which part ways with the rest of the Indo-European family, including the Goidelic branch of the same group, in their treatment of class nouns denoting things typically found in collections. In Welsh (Jones & Thomas 1977) from such a name of class there can be derived, by means of one of the suffixes -yn and -en, a name of unit, for which the term singularive has been introduced by Zeusas 1871. The only difference between the two singularive suffixes is that the nouns formed with -yn are masculine and the ones formed with -en are feminine. Semantically the two singularive are equivalent, and either one or the other is formed from a given class noun, although exceptionally there may be two singularive with different meaning corresponding to the same class noun, as in the case of coed ‘wood; trees’ (in the bottom row of the table); the semantic difference, however, is idiosyncratic.

There are a few mass nouns among the English counterparts in the columns containing the class nouns. In all cases it is the name of class which is used to denote the outcome of grinding: e.g., pygod ‘fish (pl.)’ also has the meaning ‘fish matter’.

The generalisation is captured by translating pygod as ‘fish’ in (1.80). It is lifted once when applied to a thing (an entity of type f) and twice when applied to a group of things (an entity of type 2).

(1.80) PACK_F (x) = \sum_{i=0}^{m} \epsilon_{i} x \uparrow x \land C_{i} (x)

Note that grinding for count terms is unmarked, as it is in English (Figure 1.2), cf. afal ‘apple (mater); pl. afalau ‘apples’.

Unlike their Russian counterparts, in Welsh names of class are grammatically plural (serving as antecedents for plural anaphora). Compare:

![Figure 1.3: Packaging and pluralisation in Russian.](image)

![Figure 1.4: Packaging and pluralisation in Welsh.](image)

Traditional grammars of Welsh and of other Brythonic languages often consider the singularive and the class noun to be the singular and the plural members of the same nominal paradigm. There are two reasons to consider this less than fully adequate. First, the class noun can be used as a count noun denoting a kind (or sometimes an amount other than the canonical one, which is the domain of the singularive) without any morphological indication. Some class nouns can even be morphologically pluralised, as if they were singularive. Second, the singularive also can often be pluralised, as if it were a primary singularive. gawnym ‘grains’, dafarnau ‘leaves’ (of a book), pages.

The existence of such forms as ydau and gawnym is identified the formation of the Welsh singularive as a derivational process akin to the one operating in Russian. There are two differences, however: first, in Welsh this process is morphologically more regular and significantly more productive, and second, the formation of the plural of the Welsh singularive, while still sometimes possible, is strongly limited by the syntax (though not morphological) plurality of the class noun. The relevant part of the conversion network is presented in Figure 1.4.
The suffix -stuck in German serves a very similar purpose.

Count terms can also be packaged into collectives, which deserve attention for their resistance to splitting (cf. examples (1.68) above) and some other properties correlated with the fact that the type of the corresponding predicates is greater than or equal to 2. In Egyptian collectives, like mass nouns, are written with the three strokes of plurality, regardless of their grammatical number. The suffix in British English many collective nouns can trigger plural agreement and serve as antecedents for plural anaphora. The latter phenomenon is also observed in Welsh (Jones & Thomas 1977).

(1.83) Welsh

— Beth mae’r llywodraeth yn mynd i weld?
   what is the government in go to do
— Mae’n i newid y gronw addi. They’re going to raise taxes.
   are they in go to raise taxes

‘What’s the government going to do?’—They’re going to raise taxes.’

Neither English nor Welsh have productive processes of collective noun formation, but such derivational techniques are found in other languages, such as Chukchi (Shvich 1977);\(^{1}\) Eskin (Mesovolzhiev 1997) and Basque (Saltarelli & Askarate 1988).

(1.84) Chukchi

<table>
<thead>
<tr>
<th>singular</th>
<th>collective</th>
</tr>
</thead>
<tbody>
<tr>
<td>niiqey</td>
<td>‘boy’</td>
</tr>
<tr>
<td>s’gr-ym</td>
<td>‘wolf’</td>
</tr>
<tr>
<td>niiqey-y-mk-in</td>
<td>‘village’</td>
</tr>
<tr>
<td>jara-ny</td>
<td>‘house’</td>
</tr>
<tr>
<td>lele-yqym</td>
<td>‘glove’</td>
</tr>
<tr>
<td>y’il-yqym</td>
<td>‘dog’</td>
</tr>
<tr>
<td>kepn-iqym</td>
<td>‘brown bear’</td>
</tr>
<tr>
<td>jara-ny</td>
<td>‘house’</td>
</tr>
</tbody>
</table>

(1.85) Eskin

<table>
<thead>
<tr>
<th>singular</th>
<th>collective</th>
</tr>
</thead>
<tbody>
<tr>
<td>ju-k</td>
<td>‘man’</td>
</tr>
<tr>
<td>qaqwa-yk</td>
<td>‘bird’</td>
</tr>
<tr>
<td>tun-tu</td>
<td>‘wild deer’</td>
</tr>
<tr>
<td>anja-yq</td>
<td>‘boat’</td>
</tr>
</tbody>
</table>

1The data and the formulation of part of the empirical observations in this passage are drawn from Blith Mincinkova’s summary of the responses to her query on representative plural forms; a detailed discussion of the phenomenon is found in the paper by Blith Mincinkova (1977). The semantic pattern of this category is shared by the non-singular personal pronouns for the first and second person, which are representative plural forms of the corresponding singular pronouns and are used with the same type of noun phrase.

2The semantic pattern of this category is shared by the non-singular personal pronouns for the first and second person, which are representative plural forms of the corresponding singular pronouns and are used with the same type of noun phrase.

3The size of the group may be restricted, yielding subcategories such as representative dual.
1.3 Grinding and Packaging

Several different strategies for the realisation of representative pluralisation are found in natural languages, including regular or exceptional non-singular (plural or dual) marking. Some examples of these strategies follow.

(1.90) Kipsigis (Vogt 1940) öm- simiento
   PL coyote
   'the coyotes; the coyote and his people/friend(s)/son(s)'

(1.91) Turkish
   a. kardeş -i -er 'my brother and his family'
      sibling 1SG.POSS.PL
   b. kardeş -i -er -im 'my brothers'
      sibling PL 1SG.POSS

(1.92) Japanese
   a. sensei -tachi
      teacher PL
      'the teachers, the teacher and his colleagues or friends'
   b. watashibushii -tachi
      f. PL
      'we (I, 1 and the others)'

Less frequently a collective noun is appended to the pivot, as in some English-based creoles and pidgins (Australian Aboriginal English Bull-mob [the mob (i.e., the group) consisting of] Bill and his associates; Hawaiian Pidgin English Bull-folk 'Bill and his folk'), or the subject noun itself does not acquire any overt marking, and the conversion is indicated merely by non-singular agreement carried by the verb.

(1.93) Gurindji Bill nga -wuda yami.
   AUX 3DL went
   'Bill and someone else went.'

Such cases of implicit representative pluralisation are effectively cases of grammaticalised synecdoche, lying halfway between the domains of semantics and stylistics.

A formal representation for the most general case of a representative plural from the predicate φ is offered in (1.94).

$$\lambda x [x \mapsto \top \iff \exists y (\phi(y,x) \wedge q(y,x))]$$

Here the predicate applied to the individual elements of the sum from which the group x is formed can be informally interpreted as "φ or a ψ of φ", with ψ(i,1) standing for a vaguely defined relation such as 'i is a relative/companion of j'; this relation is never overtly expressed in the construction, and its precise interpretation varies depending on the language, the construction chosen (where there is more than one) and the predicate φ. The condition q(y,x) represents any restrictions on the size of the whole group x.

1.3.4 A transition network

For ease of observation, the conversions discussed in this section are presented in Figure 1.5 in the form of a transition network. The possibility for collectives to be further packaged, yielding terms of types higher than 2, is not reflected in the diagram; when explored, it follows the pattern of the upper two rows. It must be noted that although collectives (other than representative plurals) are semantically formed from plurals, as shown in (1.87) and indicated by the corresponding arrow in the diagram, in the morphology it is usual for them to be formed directly from the nominal stem, not from a form inflected for plural number.

It can be seen that the network constitutes a chain consisting of triangular links of the type displayed in Figure 1.6.

$$\lambda x [x \mapsto \top \iff \exists y (\phi(y,x) \wedge q(y,x))]$$

In principle a transition is possible from every node of the nucleus to either of the two others, but a comparison between the diagrams in Figure 1.5 and Figure 1.6 shows that the actually occurring transitions are subject to a number of restrictions. In particular, singular count terms of type φ are not normally formed, since their denotations would be the abstract atoms introduced in the present theory. Also, count terms of type 2 and higher are not normally ground, as shown by examples (1.68).

The arrow marked with x corresponds to an operation which could be called singularisation. Where it occurs, it affects ordinary plurals rather than proper ones.

$$\lambda x [x \mapsto \top \iff \exists y (\phi(y,x) \wedge q(y,x))]$$

The Basque definite singular, formed from an indefinite general plural (jende-a 'the person' from jende 'a person, people', cf. the definite (proper) plural jende-ak 'the people'), can be
regarded as an example of singulatisation. On the other hand, the formation of singulatives, as I argued above, is more appropriately treated as a case of packaging.

The arrow marked with $<$ corresponds to selecting the most prominent member of a group, the converse operation to representative pluralisation (another form of synecdoche).

### 1.4 Number in Arabic

For some additional illustration of the conversion processes and their formal treatment in the present theory we shall now look briefly at the number system and the status of count and mass terms in Arabic.

The nominal morphology of Classical Arabic is characterized by a uniquely sophisticated category of number, in which several different kinds and levels of pluralisation are distinguished. This system is preserved to varying degrees in the Arabic vernaculars of the present day, as well as in Standard Maltese.

#### 1.4.1 Singulatives

One of the most characteristic features of the Arabic number system is the formation of singulatives. The addition of the feminine suffix -$\text{m}$ to a mass noun (which is nearly always masculine) yields a category which traditional grammar knows under the Latin term *numen univocis* (but singularia tantum—a singulative, which denotes a specific subkind or a specific quantity of the stuff).

(1.96) name of class name of unit

<table>
<thead>
<tr>
<th>أكل</th>
<th>اكلة</th>
<th>'meal'</th>
</tr>
</thead>
<tbody>
<tr>
<td>أكل</td>
<td>اكلة</td>
<td>'eating'</td>
</tr>
<tr>
<td>دارب</td>
<td>داربة</td>
<td>'stroke'</td>
</tr>
<tr>
<td>دارب</td>
<td>داربة</td>
<td>'striking'</td>
</tr>
</tbody>
</table>

If the primary noun indicates a kind or collection of things (normally corresponding to an English plural), the *numen univocis* refers to an individual member of it.

(1.97) name of class name of unit

<table>
<thead>
<tr>
<th>جهازة</th>
<th>جهاز</th>
<th>'beeps'</th>
</tr>
</thead>
<tbody>
<tr>
<td>ناهض</td>
<td>ناهض</td>
<td>'beeps'</td>
</tr>
<tr>
<td>دجاج</td>
<td>دجاج</td>
<td>'chickens, fowl'</td>
</tr>
</tbody>
</table>

Not infrequently the primary noun denotes both a collection and a stuff. An example is دجاج 'chickens, fowl (as a generic designation); chicken flesh', whose singulative دجاج is accordingly ambiguous between 'hen, chicken' and 'portion of chicken meat', two subcases of the more general interpretation 'a quantity of chicken [property of the stuff] such that it constitutes a natural object or a conventionally determined amount [property of the thing]'. The treatment proposed for the Welsh noun pygod 'fish', formulated in (1.82), is equally applicable to this case.

(1.98) $\text{pact}_{\text{m}}(\text{C}(x)) = \lambda x \eta\text{C}(x) \land \text{Q}_{\text{m}}(x)$

except that here there are two ways in which the predicate can be quantised and hence two possible ways for the condition $\text{Q}_{\text{m}}(x)$ to be satisfied.

**1.4.2 Dual and plural**

From a count noun there can be formed a dual by adding the dual suffix -$\text{m}$/$\text{f}$ to the stem, after the feminine suffix if there is one. From many count nouns there can also be formed a sound plural by adding the plural suffix -$\text{m}$/$\text{f}$ (masculine) or -$\text{f}$ (feminine) to the stem.

The dual denotes two individuals (kinds, quantities); its use, however, is not obligatory unless emphasis must be placed on the number 2. The following examples from Cowell 1964, also quoted by Ojeda 1992, illustrate the distinction between the dual and the plural in those cases in which the number 2 must not be excluded.

(1.100) *Syrian Arabic*

a. (i) *manda ban$\text{a}$t b$\text{a}$s*<br> 'at him daughters-PL only'<br> 'He has only daughters.' (Not necessarily more than two; but no sons.)

(ii) *manda ban$\text{a}$b$\text{a}$m$b$*<br> 'at him daughters-DL only'<br> 'He has only two daughters.' (No more than two.)

b. (i) *imans$\text{m}$ do$\text{p}$pay*<br> 'and take<br> the coat tight at the shoulders-PL<br> 'The coat is tight in the shoulders.'

(ii) *imans$\text{m}$ do$\text{p}$pay*<br> 'and take<br> the coat tight at the shoulders-DL<br> 'The coat is tight in both shoulders.'

These examples show that the dual effectively packages the sum into a group of two components.

(1.101) $\text{dual}(\phi) = \lambda x \eta\phi(x) \land \|x\| = 2$

The group character of the dual is further confirmed by the fact that it can be used in a representational sense, denoting a conventional pair of which the thing named is the more prominent member (as determined by usage).

(1.102) *$\text{b}$b$\text{u}$ 'father' *$\text{b}$b$\text{u}$w$\text{a}$l$ $\text{b}$b$\text{u}$ 'father and mother'<br> *$\text{b}$b$\text{u}$ do$\text{b}$bro$\text{r}$ $\text{b}$b$\text{u}$b$\text{b}$ $\text{b}$b$\text{u}$ 'brother and sister'<br> *$\text{g}$mar$\text{m}$ 'moon' *$\text{g}$mar$\text{m}$ $\text{b}$ $\text{g}$mar$\text{m}$ 'moon and sun'<br> *$\text{m}$f$\text{r}$ 'East' *$\text{m}$f$\text{r}$ $\text{m}$f$\text{r}$ $\text{m}$f$\text{r}$ 'East and West'<

The plural is unmarked with respect to number in its general meaning, although it has the specific meaning of a number greater than two when contrasted to the singular and the dual (Ojeda 1992).
Accordingly, the dualisation and the sound pluralisation of a *nomina vocis* express double or multiple occurrence of the event.

As for the formal representation of the sound plural, the proper pluralisation of the predicate corresponding to the singulative yields the same representation as in the case of the Russian or Welsh pluralised singulatives.\(^24\)

\[(\text{1.103}) \quad \Phi_2 \omega (\phi) = \lnot \lambda (\text{\textit{\textalpha}} \phi \omega) \lambda \Omega_1 (\chi)\]

Howell 1900 notes that for many singulatives there is also a corresponding broken plural (occasionally more than one), formed by changing the vowel pattern of the word (*skên* 'hills, mounds'; *šêšm* 'tents, booths').\(^25\) He doesn't dwell on the semantic difference between the broken plural (where it exists) and the name of class 36, beyond the fact that a plural, such as *right* 'men' (plural of *našīm* 'man'), has to denote at least three individuals, whereas in the case of a class noun there is no such restriction, and one or two dates are already *sašar 'dates', apart from *tamašār* '(a) date' or *tamarašāt/nas* '/2 dates'.

With respect to the distinction between broken and sound plurals (for those nouns from which both are formed), Caspari 1896 says:

> As regards their meaning, the plurales fracti [broken plurals—\(L. D.\)] differ entirely from the sound plurals; for the latter denote several distinct individuals of a genus, the former a number of individuals viewed collectively, the idea of individuality being wholly suppressed. […] The plurales fracti are consequently, strictly speaking, singulars with a collective signification, and often approach in their nature to abstract nouns.

Where a sound plural coexists with one or more broken ones, it tends to be used as a plural of paucity, in view of the collective character of the broken plural and in line with the fact that practical countability decreases as numbers increase. (Cf. Croft 1991's statement to that effect: 'The individuals that make up the whole are more salient in smaller quantities, simply because there are fewer of them and more attention can be focussed on each.')

For Maltese Borg 1983 presents two explicit examples of nouns which have both a class form and a broken plural:

\[(\text{1.104}) \quad \text{class form:} \quad \text{našīm} \quad \text{'trumpet',} \quad \text{našī} \quad \text{'thread'} \quad \text{qa} \quad \text{qamānī} \quad \text{'}wheat'} \quad \text{'}

\text{singular (singulative)} \quad \text{našī} \quad \text{‘piece of thread’} \quad \text{qa} \quad \text{mānī} \quad \text{‘gram of wheat’}

\text{determinate (sound) plural} \quad \text{našīt} \quad \text{‘pieces of thread’} \quad \text{qa} \quad \text{mānīt} \quad \text{‘grains of wheat’}

\text{indeterminate (broken) plural} \quad \text{našīt} \quad \text{‘lengths of thread’} \quad \text{qa} \quad \text{mānīt} \quad \text{‘varieties of wheat’}

The glosses show that the broken plural is essentially a plural of the class noun. This is in fact predictable from its derivation, which does not go by the way of the singulative, unlike the

\[^{24}\text{This formula translates the semi-specific meaning of the Arabic plural (‘two or more …’), in which the dual is included, although the singular is not. The specific meaning (‘three or more …’) can be captured by including a constraint which excludes the domain of the dual, much as the specific reading of the English plural excludes the domain of the singular.}\]

\[^{25}\text{The formation of broken plurals is one of the most idiosyncratic areas of Arabic morphology. There are at least 180 instances of broken plurals, 4 of which are marked as plurals of paucity, specifically referring to a number up to ten and obligatorily used with numerals in that range, the rest are plurals of multitude, referring by default to a number greater than ten.}\]

\[^{26}\text{The term traditionally used in Arabic grammar for a class noun is collective, but I shall reserve it here for formal confusion with another subclass of nouns denoting compound entities, which are different from class nouns in that they form no singulatives.}\]

1.4. Number in Arabic

By derivation of the sound plural. Consequently, the conversion processes follow the diagram in Figure 1.7, strictly parallel to the one proposed for Russian in Figure 1.3 and for Welsh in Figure 1.4.

![Diagram](image)

**Figure 1.7: Packaging and pluralisation in Maltese.**

*Some examples brought up by Ojeda 1992 show that the same distribution is found in the modern Arabic vernaculars.\(^{106}\)*

\[(\text{1.105}) \quad \text{class form:} \quad \text{Sa'ād Arabic} \quad \text{ṣaquir} \quad \text{‘trees’,} \quad \text{ṣaquir} \quad \text{‘tree’,} \quad \text{ṣaquir} \quad \text{‘trees’,} \quad \text{ṣaquir} \quad \text{‘kinds of trees’,} \quad \text{ṣaquir} \quad \text{‘kinds of fish’}

\text{Syrian Arabic} \quad \text{sawak} \quad \text{‘fish’,} \quad \text{sawak} \quad \text{‘a fish’,} \quad \text{sawak} \quad \text{‘fish’,} \quad \text{sawak} \quad \text{‘kinds of fish’,} \quad \text{sawak} \quad \text{‘kinds of fish’}

1.4.3 Dual and plural of the plural

In Classical Arabic from a broken plural it is often possible to form a dual, a sound plural and/or further broken plurals. This amounts to treating (that is, reinterpreting diachronically) the broken plural as a singular noun. The semantic effect is either increasing the minimal number of individuals denoted by the form or extending the meaning of the pluralisation to entities of a higher type (that is, to groups or kinds).

The first option, according to Howell 1900, is in action in the case of the collective "Našīm (‘cattle’ or other grazing livestock, e.g., cattle, sheep, goats’), which presumably refers to 3 or more camels.\(^{27}\) This noun, he reports (referring to works by the Arabic grammarians Al-Ghazālī and Ibn Yāsīn), pluralises to "Našīn (‘9 camels or more’ (‘3 or more našīm’), which in turn can be pluralised to "Našīn (‘27 camels or more’ (‘3 or more našīm’). This interpretation, which is on a literal understanding of the specific meaning of the plural, seems to be taking numerical ranges more seriously than actual usage in. In any case, no commitment to the range 9 to 26 is apparent in the use of "Našīn in "Sūrā 7. ‘Anām (‘Cattle Chapter’), the 6th chapter of the Qur'ān. Rather, the word is employed here in the context of a discussion of different species of livestock.\(^{28}\) Here are the relevant verses:

\[(\text{1.106}) \quad \text{našīm (a) l- 9 Našīn Naşāq (an) dā-farāsān (n)}

\text{and from the cattle-\(\text{a}-\)buiden-\(\text{a}-\)ACC and spread-\(\text{a}-\)ACC}

\text{And of the cattle [Allah has created] some for burden and some for slaughter}.’ (6:143)

\[^{27}\text{Traditional grammar calls našīn a quasi-plural, not a genuine plural, because there is no singular corresponding to it, but not a genuine collective either, because no constraints are imposed on the organisation of the group.}\]

\[^{28}\text{I thank Hussein Bishnag for bringing this fact to my attention.}\]
1.5 Summary

The purpose of this chapter was the development of an account of nominal reference based on the theory of plurality of Landman 1989, a theory which relies on a consistent distinction between sums and groups and on a classification of all expressions into types according to the level of grouping, with the possibility of lowering the type of a term by lifting the predicate whose argument it is.

I argued for a formal representation of mass terms which reflects their similarity to plural count terms. The mass and the count subdomain of the domain of material entities can thus be united into a monolithic system such as the one presented in the diagram in Figure 1.6.

I discussed the classes of count and mass terms, singular and plural terms, singularities, collectives and representative plurals and the processes of conversion between them and showed how they can be represented by means of the operations defined in the theory, viz. group formation, ungrouping, ordinary and proper pluralisation and atomisation. The correspondence between the major categories recognised in natural languages and the formal concepts and tools of the theory is summarised in Table 1.1.

In the subsequent chapters we shall see how the present theory is applied to the domain of eventualities.
2.1 The Structure of Time

Since eventualities exist in time, a word on the assumptions concerning the mero- and the topological structure of the temporal domain is due at this point.

The universe in the temporal domain is built upon a set of moments (temporal atoms, points in time). No definite assumptions need be made regarding the cardinality of this set. In board games time is discrete, the eventualities in them are states obtaining in an integer number of successive positions and events happening in an integer number of moves, each of which leads from one position to another. This may or may not be an adequate model of time in the 'real world'. It is certainly possible to think of time as a finite or countably infinite series of units with non-zero duration, although that would necessitate the reformulation of some concepts (such as the notion of an open-fronted interval in §8). Nevertheless, the underlying assumption throughout the present discussion shall be that it is a continuum, or at least a dense set, of infinitely brief moments. For this reason I shall not discuss any worlds in which time is obviously discrete.

Most questions pertaining to temporal precedence belong, strictly speaking, to the domain of tense. For a discussion of aspect it is usually considered sufficient to assume that, unlike space, time possesses an at least partial ordering relation, called a relation of precedence, which has the property backwards linearity: each moment has a unique past, although not necessarily a unique future.

\[(2.1)\]
\[t1 \leq t2 \land t2 \leq t3 \rightarrow t1 \leq t3\]

\[(2.2)\]
\[t1 \leq t3 \land t3 \leq t1 \rightarrow t1 < t2 \lor t1 = t2 \lor t1 > t2\]

This can accommodate both linear time (where the ordering is also forward linear) and branching time as developed by Dowty 1977.

An interval is a continuous group of moments. The condition on its integrity can be formulated either topologically (as integrality would be defined in the spatial domain) or by means of the relation of precedence (if two moments belong to an interval, then so does any moment which precedes one of them and is preceded by the other). In (2.3) is a sum of moments.

\[(2.3)\]
\[\text{interval } [c] = \{t1,t2,t3 | t1 < t2 \land t2 < t3 \land t1 = t2 \lor t1 > t2 \}\]

An interval which is a material part of another is called a subinterval of the latter.

The predicates defined in the temporal domain operate on times in the broadest sense. The notation \(\phi(t)\) shall stand for 'the eventuality \(\phi\) happens at time \(t\)' (\(t\) is a time of the eventuality \(\phi\)), where \(t\) is a moment, an interval or a series of moments or intervals. The

\[\text{I assume time to have an atomic structure for theoretical convenience. This is a convention which is perfectly compatible with a view that moments, like the spatial atoms of Subsection 2.1.1, are abstract entities with no actual existence and all run times are intervals with a measurable, albeit possibly very short duration. For arguments in favour of a non-atomic time theory, where time points are constructed out of time intervals, and an exposition of such a theory of} \text{ L. R. Landman 1991.}\]
2.2. Aspectual Classes

The concept of aspectual class is due to the idea that it is possible to derive the aspectual properties of a verbal expression, or an eventuality denoted by one, from its belonging to one of a small number of classes, which are identified by means of semantic or semantically motivated criteria. Despite Vendryes 1989's observation that aspectual classes cannot obviate the need of referring to the criteria themselves, their use, in one form or the other, as a descriptive device is virtually universal practice.

2.2.1. Aspectual classifications

Numerous ways to divide eventualities, and the linguistic expressions denoting them, into classes according to their aspectual characteristics have been proposed in the literature. They differ in several points, namely:

- at what level the classification operates (ontological or linguistic, and in the latter case lexical, phrasal or sentential; some classifications refer to more than one level);
- how many classes are recognized, what names are given to them and what the relations between them are (the architecture of the system);
- what syntactic or/and semantic criteria are employed for assigning a verbal expression to a specific class (the most commonly cited ones being logical entailments and restrictions on cooccurring phase verbs and temporal adverbials, as well as a few based on, or related to, agentivity, e.g. causative semantics, formation of imperatives and cooccurrence with active adverbs of manner such as carefully, deliberately or vigorously or their counterparts in other languages);
- what other aspectual categories are considered (for example, in Holisky 1981 a Georgian verb pertaining to one of the four classes of Vendryes 1967 is further characterized as having linear or punctual aspect; Guiraud-Weber 1988's tripartition of Russian verbs is also orthogonal to imperfective or perfective aspect, in contrast, for Moës & Steedman 1988 the aspectual properties of a verbal expression are fully encoded by the class).

Finally, some authors, such as Mourelatos 1981, also consider a number of intermediate levels of classification, which makes possible the concise formulation of generalizations across aspectual classes.

The result of this proliferation of classifications is a certain degree of terminology mismatch (in particular, an overloading of the term event), as can be seen from the table in Table 2.1, which presents a comparison of a number of systems. It must be remembered that, due to the differences mentioned above, the correspondence between the individual classes recognized in the different classifications is at best approximate. It is not being claimed, for example, that everyone who uses one of the terms activity, energia or process means the same thing, although the terms share a column in the table.

In his fundamental work Vendryes 1967 offers the English verbal expressions in Table 2.2 to illustrate the four aspectual classes distinguished in his theory. It is noteworthy that he persistently refers to his enterprise as designing a classification of verbs, yet his examples are in fact verb phrases, and the presence of the minimal pairs write, wrote a letter and run, ran a mile among them certainly indicates that he can not be said to be unaware of the impact of constituents such as the object or a measure adverbial on the aspectuality of the clause; nevertheless, he does not comment on it. It has been observed subsequently (viz. also, by Dowty 1979, Vlach 1981 and Vendryes 1972 and 1989) that other constituents, including the subject, can have a similar impact, and from this it follows that aspectuality should be regarded as a property of the clause as a whole, rather than being restricted to the verb or the verb phrase. The mechanism of aspectual composition, by which I mean the interaction between the aspectual properties of the verb and the nominal and adverbal constituents towards the formation of the aspectuality of the clause, shall be explored in detail in Chapter 3.

It seems justified to say that most authors working on aspectuality have made use of Vendryes's quadripartition to one extent or the other (or at least have referred to it), but, as I observed above, this does not mean that it has always been interpreted in the same way. Four ways to organise a system of aspectual classes are compared in the summary offered in Vendryes 1989, who draws attention to the crucial importance of the relations between the classes for their interpretation. I present them in Figure 2.1, using Vendryes's terminology everywhere I can avoid confusion. The architectures can be generalised in a straightforward way for systems with fewer or more than four classes.

The architecture of the system embodies the relations which are assumed to exist between the aspectual classes. For example, in the cross-classification in Figure 2.1, which appears to
2.2. Aspectual Classes

have been Vendler’s original intended interpretation of his system, states and achievements (the left column of the table) are counterposed to activities and accomplishments (the right column) on the basis of the ability of the former and the inability of the latter to be evaluated in a single moment, a distinction manifested, inter alia, in their respective inability and ability to be overtly progressivized (that is, to form continuous tenses) in English. The examples and the judgements are Vendler’s own.

(2.4) a. She is loving him.
    (state)
b. She was recognising him.
    (achievement)

By contrast, in the other three architectures this affinity between states and achievements is disassembled as accidental, since they manifest the behaviour they seem to share on different grounds: the meaning of the former is already continuous in a simple tense, which makes overt progressivization redundant, whilst the meaning of the latter is incompatible with continuity, which rules out progressivization. Instead of being grouped with achievements, in those architectures states are counterposed to the three other categories, which don’t form a natural class in a cross-classification. On the other hand, the distinction between the aletic states and activities, which don’t pertain to a definite temporal entity, and the telic accomplishments and achievements, which do, is lost in a partial ordering, another highly popular architecture going back to Kenny 1963 and ultimately to Aristotle. The hinge ordering, the general type to which Verkuyl 1989’s classification belongs, is aimed at recovering this distinction (the horizontal division) whilst preserving the autonomy of states (the leftmost column). In a strict hierarchy, such as the one developed by ter Meulen 1983, each of the four Vendler-classes is defined by adding a semantic condition to the definition of the one immediately above it, so that achievements are effectively assumed to be a kind of accomplishments, which are a kind of activities, which are a kind of states.

In this study I shall assume the classification in Figure 2.2, a hinge ordering of aspectual classes distinguished by a characteristic eventuality contour1 (ignoring the correlation with agesitvity, the assumption of which underlies some of Vendler’s criteria), and shall combine the terminology chosen by Taylor 1977 with the one of Vendler 1967. Both the term activity and the term

---

1A variation of the term event contour, which is part of the terminology of Lojban. I believe it was introduced by John Colson.

---

2.2. Aspectual Classes

energeia will be used; I will treat them as synonyms, using the former in conjunction with the two terms accomplishment and achievement and the latter in conjunction with the more general term kinesis.

The following sentences illustrate the four aspecual classes:

(2.6) a. I was tired.
    (state)
b. I ran.
    (energeia)

(2.7) a. (t) I saw the picture.
    (kinéseia: achievement)
b. (t) I hung the picture.
    (kinéseia: accomplishment)

2.2.2 Aspectual Classes and Taylor’s postulates

In order to relate the discussion of aspectual classes to the formalism exposed in Chapter 1, I shall now turn to Taylor 1977, who formulates meaning postulates to represent the logical characteristics of each of the three aspectual classes distinguished by him.2

States

States, such as the one in (2.6), express the most primitive kind of eventuality—an internally unbounded continuous state of affairs with no temporal substructure. Taylor’s postulate for states is based on the intuitive observation that an interval t can count as a time within which a state holds only if, and indeed insofar as, every moment t’ within this interval counts as such a time.3

(2.8) state(o){ \( \text{Per}(t) \rightarrow (o(t) \leftrightarrow \forall t'(\text{Mom}(t') \land t' \sqsubset t \rightarrow o(t'))) \)}

Carson 1981 further distinguishes a static and a dynamic class, depending on whether the verbal expressions, which share the ability to cooccur with both momentaneous and duration adverbials, allow the formation of continuous tenses in English. The static class is illustrated in (2.9), the dynamic one in (2.10).

(2.9) a. At that point I remembered the rule.
    b. I remembered the rule for two days.
    c. At that point I was remembering the rule.

(2.10) a. At seven o’clock the caravan stood in its old place.
    b. The caravan stood in its old place for days.
    c. At seven o’clock the caravan was standing on its old place.

---

2Taylor’s postulates are presented here in his own notation, where Mom(t) stands for ‘t is a moment’, Per(t) for ‘t is a period (i.e., an interval)’, t \( \sqsubset t' \) for ‘t falls within t’ and t \( \sqsubset t' \) for ‘t falls properly (wholly) within t’.

3See fn 9, Chapter 1, on the generalization ‘every’.
2.2. Aspetual Classes

He proposes to account for this difference by postulating that a stative predicate can only be evaluated in moments, whereas a dynamic one can only be evaluated in either moments or extended intervals. The dynamic class is closely related in his classification to the class of achievements, which can also be evaluated either in what he calls the climactic moment (or climax) or in an interval which contains the climactic moment.

(2.11) a. At that point he closed the door.
   b. At that point he was closing the door.

The difference is that for dynamics any moment can function as a climax, whereas for achievements the climax is unique.

Carston 1997 and Bulygina 1983 argue on the basis of English and Russian linguistic material, respectively, for another, cross-linguistically relevant, division of this class into individual-level predicates (qualities, properties), which are not localised in time, and stage-level predicates (stative phenomena, stative episodes), which are. The latter, but not the former, admit frequency adverbs such as always or often.

(2.12) a. He is a drunkard.
   b. He is (often) drunk.

As regards their structure, however, both qualities and stative phenomena are equally well covered by Taylor’s definition.

Energetics

Energetics, exemplified in (2.7a), have much in common with states, but they differ from them in two important ways.

The first distinction, which is of central relevance in particular within Discourse Representation Theory (Rapp & Reyle 1993), is made on the basis of the fact that an event (including an energic) introduces a new discourse referent, while a state under most circumstances merely contributes a new condition involving an existing discourse referent (the reference point). In this context Tommola 1991 discusses the category of ‘narrative aspecktivity’ (as opposed to ‘resultative aspecktivity’) as a means for structuring the discourse.

The second difference, is that energetics are dynamic, i.e., they express a continuous change of state, but this change either has no natural boundary or in any case is not required to reach it. This is the difference with which we are concerned here, since it is the one which affects the eventuality contour.

Taylor’s postulate for energetics captures the difference between the ways in which energetics and states take time. By virtue of its dynamics an energetic can’t happen in a moment (it constitutes a change of state over time, hence the need of registering the state in more than one moment); it fills an interval, by whose size (which determines the duration of the event) it is characterised.

(2.13) \[ \text{energetic}(c) \leftrightarrow (c(t) \rightarrow \text{Per}(t) \land \forall t' \exists t \land \text{Per}(t') \rightarrow c(t')) \]

Indeed, as Vlasch 1981 notes, states are compatible with momentaneous adverbials, whereas energetics are not, except possibly under an inchoative reading.

(2.14) a. Max was here at 8:30.
    b. Mary ran at 8:30.

Thus both states and energetics are atelic (have no set terminal point), but they differ in their relation to atomic time intervals (i.e., to moments); both are cumulative, but energetics are of limited distributivity.

The two types of atelic eventualities shall be expressed as plural predicates of type O (defined for moments and sums of moments), lifted before being applied to intervals (groups of moments, hence entities of type I). The distinction between ordinary plural and proper plural predicates provides a straightforward way to express the difference between states and energetics in the formalisation, as well as to allow for it to be glossed over for those languages, and for those contexts, in which it is not realised.

(2.15) State: \( \forall t \cdot (\text{Per}(t) \rightarrow c(t)) \)
    cf. (2.6)

(2.16) Energetic: \( \forall t \cdot c(t) \rightarrow \text{Per}(t) \)
    cf. (2.7a)

Kineesics

Kineesics, illustrated in (2.7b), are closed events, which delimit the time they take, not happening in any of its proper subintervals, otherwise speaking, they are quantised relative to the run time. Taylor’s postulate for kineesics reflects this property.

(2.17) \[ \text{kineesic}(c) \leftrightarrow (c(t) \rightarrow \text{Per}(t) \land \forall t' \exists t \land \text{Per}(t') \rightarrow \neg c(t')) \]

Taylor’s view is that ‘mere moments do not suffice as times of application’ of kineesics, any more than they do for energetics, as confirmed by the condition ‘\( \neg \text{Per}(t') \)’ in the postulate (2.17).

From this it appears that he does not, strictly speaking, consider instantaneous kineesics to be eventualities at all. If this condition is removed, however, the postulate will trivially apply to them as well (that is, they do not happen in any proper subinterval of their application times, since moments have no proper subintervals).

In his original theory Vendler 1967 introduces two separate classes of closed events, which he calls achievements and accomplishments. The former are punctual phase transitions, whereas the latter are linear processes bringing forth a phase transition, i.e., activities culminating in achievements.

Venkyu 1989 argues that the distinction between the classes of achievements and accomplishments is not well grounded and should be left out of consideration. He draws attention to the fact that whether an event takes a moment or an interval of time is more of an accidental circumstance than an inherent property which would be relevant to language, and that in any case the length of the event in question does not seem to be of importance at all if the event is conceived of as taking time. This is to say that an event which would normally be classified as

1The quantification treatment of this class of adverbials shall not be discussed in detail here; some considerations on their properties, in particular on their interaction with expressions of temporal measure, are presented in Mußmann 1991.

2The postulate in (2.13) is actually restricted to homogeneous energetics, that is, such for which it is strictly true that they happen in every subinterval of an application time of theirs: every part of an interval filled by a failing event, however brief, is itself filled by failing (that is, by motion driven by gravity). It needs to be qualified further before it can apply to heterogeneous energetics, which contain subphases within which they don’t apply: an interval filled by a walking or a falling event contains subintervals whose brevity does not permit the process contained in them to be identified as walking or falling. They are therefore treated as consisting of recurring stages, each of which is essentially a miniature kineesic.
an achievement or an accomplishment can be 'stretched' or 'squeezed' into the other aspektual class under the influence of modern technology or in some other way, and the linguistic criteria will bear witness to the conversion. Consider the examples:

(2.18) a. John typed the letter 'p' at noon sharp.
   b. John typed that business letter at noon sharp.

Example (2.18a) is usually thought of as being perfectly acceptable, while (2.18b) is judged odd; but if John's word processor took three minutes to display the letter 'p' on the screen after John pressed the [P] key, and on the other hand the hitting of a single key instantly produced a copy of a standard business letter, the judgements may well be reversed. A similar argument could be made for the case of example (0.1b), repeated here in (2.19b),

(2.19) a. John saw seven zebras in an hour.
   b. John saw a zebra in an hour.

which would be acceptable if JOHN is a pattern recognition system of low efficiency, whose designers and users think of the 'seeing' as happening over the interval between the moment in which JOHN receives its visual input and the moment in which it reaches the conclusion that a zebra is present in it. 10

In many cases it doesn't take any modern technology to stretch an achievement over an interval by including the prologue (the preparatory stage), or at least a part of it, into the time occupied by the event.

(2.20) a. I spent all last night realizing how easily I could slip.
   b. The old man was dying.
   c. The taxi was arriving.

In the view of Carlson 1981, the extending of an achievement over an interval containing the moment in which it holds need not be restricted to supplying a preparatory stage, and accordingly be distinguished between initial, internal and final climactic moments, depending on their position within the internals.

(2.21) a. The dog attacked me at once.  (initial climax)
   b. At that point the plane took off from the ground.  (internal climax)
   c. He lost the tournament when he missed that ball.  (final climax)

Some languages provide morphosyntactic evidence which further supports the view that the two classes of kinesis must be considered jointly, at least for some purposes. As I shall show in Section 2.4, Bulgarian sets achievements and accomplishments (expressed by verbs of the perfective aspect) formally apart from activities and states (expressed by verbs of the imperfective aspect and distinguished from one another by tense). Furthermore, the derivational process known as secondary imperfectivisation, which relates, for example, the imperfective verb in (2.22b) to the perfective one in (2.22b), allows for nearly any achievement to be stretched over a time longer than a moment.

(2.22) [Bulgarian]

a. Мякото увре.
   the milk boil-3SG
   'The milk was boiling.'

b. Мякото зазвъна.
   the milk boil-IPFV-3SG
   'The milk began to boil.'

c. Мякото звъняше.
   the milk (noN) boil-IPFV-3SG
   'The milk was beginning to boil.'

An essentially identical strategy of combining aspect and tense for the purposes of identifying a verb form as expressing a state, energy or kinesis is found in Georgian, whose tense system is characterised by the same oppositions as the Bulgarian one. Georgian differs from the Slavic languages in that it has no productive secondary imperfectivisation, but compensates for it by possessing multiple ways of deriving stative predicates from one another. In particular, the derivation of inchoatives, marked by the suffix -d-, goes through a stage at which the verb is imperfective, and although it nearly always proceeds to the acquisition of a perfectivising preverb, such as a- in (2.26c), in some cases it does not. This means that the initialisation of the corresponding activity is formally treated as a process taking time, which culminates in the actual initiation of the process denoted by the stem.

(2.23) [Georgian]

a. რჩა დაღ-დ.
   milk-IPFV-3SG
   'The milk was boiling.'

b. რჩა დაღ-ჰოდ.
   milk-IPFV-3SG
   'The milk was beginning to boil.'

c. რჩა ადაღ-დ.
   milk-IPFV-3SG
   'The milk began to boil.'

In Mandarin, whose aspect system shall be discussed in Section 2.5, the classes of achievements and accomplishments are also united under the morphologically motivated category of resultative verbs (Tai 1994, Qiu 1992). 11

The appeal to crosslinguistic evidence brings forth the question how anglocentric Verkuyl's argument is, in other words, to what extent it is dependent on the possibility to build continuous tense forms from any English verb. The argument works reasonably well for Bulgarian, with its nearly unadulterated secondary imperfectivisation and the option to read almost any imperfective verb as denoting an ongoing process. Its application to languages which fail to provide the necessary...

10 This is in itself a heterogeneous category, composed of inchoative verbs, typically occurring with the aspect marker -d 'become' (e.g., დაღ 'understand'), and resultative verb compounds, of which the first component indicates a process and the second a state occurring after the phase transition (ახან 'kill' ('kill-die'), ზუსხა 'burn' ('study-know')). The latter structure parallels elegantly the analysis of an accomplishment as an activity culminating in an achievement (here represented by the ensuing state). However, it must be noted that this subcategory also includes verbs whose English counterparts Vendler 1967 classifies as achievements (შეხვედრა 'find' ('seek-reach'), ქარგა 'see' ('look-meet')).
2.2. Aspectual Classes

grammatical means for 'stretching' an instantaneous event over an interval is somewhat less straightforward. One such language is Russian, in which there is a large class of perfective tantum (chiefly semelfactives\(^{12}\), delimitatives or inchoatives, e.g., moryat’ 'blink (once)', zlynut’ 'gush, spout', popolyat’ 'take a walk', poleot’ 'fly forth'), as well as a large class of aspectual pairs which are functionally (though not morphologically) defective, in that the imperfective member has only an iterative meaning. Events denoted by classes headed by such verbs can not be extended over intervals. Some examples of the latter are offered in (2.24–2.25).

(2.24) [Russian]

a. On priddles.
   he-NOM come-P-VB/PST-SG.M
   'He came.'

b. On prosvodit.
   he-NOM come-L-VB/PRS-3SG
   'He comes (habitually).' ("He's coming.")

(2.25) [Russian]

a. Oto slučilos’?
   what-NOM occur-P-VB/PST-SG.N
   'What happened?'

b. Oto slučestaja?
   what-NOM occur-L-VB/PRS-3SG
   'What happens (regularly, under such and such circumstances)?'
   ("What is going on?")

Guiraud-Weber 1988 groups the class of morphologically defective and the class of functionally defective verbs together under the category of *verbes dynamiques à effet immediat* and attributes their failure to imperfectivise to semantic reasons. This argument, for all its intuitive appeal, leaves without an explanation the existence of obviously idiomatic restrictions, which can hardly be explained on the basis of the lexical meaning of the verbs. For example, the verb sūpul’ja ‘fall in love’ can be imperfectivised to sūpul’jaa ‘be in the process of falling in love; fall in love (repeatedly)’, while the semantically parallel verb vovenuvaat’ ‘come to hate, conceive a hatred for’ doesn’t undergo secondary imperfectivisation. Similarly, umerei’s ‘die’ has an imperfective counterpart, namely umerei ‘be in the process of dying; die (repeatedly)’, whereas the euphemism svodčatsja ‘pass away’ has none. Compare also the verbs in examples (2.24–2.26) to the closely related (in terms of other derivation, semantics or both) or even synonymous verbs in examples (2.26–2.27), which form regular aspectual pairs and by virtue of this are categorised as *verbes dynamiques à effet progressif*.

(2.26) [Russian]

a. On včel.
   he-NOM go-away-P-VB/PST-SG.M
   'He went away.'

b. On včelit.
   he-NOM go-away-L-VB/PRS-3SG
   'He goes away.' ("He’s going away.")

(2.27) [Russian]

a. Čto prososcdilo?
   what-NOM happen-P-VB/PST-SG.N
   'What happened?'

b. Čto prosvodit?
   what-NOM happen-P-VB/PRS-3SG
   'What is going on (at the present moment)？'

If the existence of an imperfective counterpart of a perfective verb and the semantic relation between the two is determined by the duration of the event denoted by the latter (instantaneous or continuous), then the perfective verbs in examples (2.24–2.25) and (2.26–2.27) must correspond to predicates evaluated respectively in moments and intervals, possibly differing only in the perspective of what is in reality the same event.

The -te iru construction of Japanese provides another example of a phenomenon for which the traditional explanation, which depends on a distinction between continuous and instantaneous events, turns out to be flawed. As Jacobsen 1984 points out, the common assumption that whether this construction has a progressive or a resultative interpretation is determined by the duration of the event, which is what examples (2.28) and many similar ones seem to indicate.

(2.28) [Japanese]

a. Kodomo wa asonde iru.
   child TOP play-3SG be
   'The child is playing.'

b. Kare wa shinde iru.
   he TOP die-3SG be
   'He has died/is dead.' ("He is dying.")

is proven incorrect by a significant number of counterexamples, including pairs of a transitive and an intransitive verb, in which the former typically has a progressive and the latter a resultative meaning.

(2.29) [Japanese]

a. A to wo akete iru.
   door ADD open (TR)-3SG be
   'I am/She is... opening the door.'

b. A to ga ate iru.
   door NOM open (TR)-3SG be
   'The door is open.'

In actual fact, as he shows, the verbs for which the -te iru construction has a progressive interpretation are the ones expressing change (though not necessarily a momentary change) in the referent of the subject. That is to say that -te iru strives to select an interval during which the subject is in some marked state (the progressive state for the agent, who is engaged in the action while it lasts, the consequent state for the patient, of which it is predicated).

Still, while it is true that the expressed event is open to interpretation as being punctual or durative, an implication to this effect is clearly present in each particular case, and indeed I did
appeal to the aspeclual distinction between achievements and accomplishments to explain the difference in the acceptability of (0.1a) and (0.1b) under normal circumstances.

In my view the solution of the contradiction lies in the recognition that the aspeclual properties of kinesis are determined primarily by the fact that the predicates are quantised and to a lesser extent by the type of the run time (0 for an achievement and 1 or higher for an accomplishment). The observed difference with respect to cocurrence with temporal adverbials amounts to the fact that, unlike moments, temporal structures of type 1 or higher have a non-zero duration, which can be measured and by which the event is caracterised.

(2.30) Achievement: \( \psi^1(t^1) \)  
(2.31) Accomplishment: \( \psi^1(t^1) \)  

cf. (2.7b i)  

cf. (2.7b ii)

In order to account for iterativity, application times in general shall be regarded as entities of type 2 (groups of intervals, which in turn constitute groups of moments), and the possibility of iterative interpretation shall be expressed by an additional pluralisation operator on the eventualty predicate.

2.3 Conversion of Aspecual Classes

The relation of the aspecual class of the eventualty expressed by a clause to the lexical properties of the verb is frequently obscured by the possibility of the eventualty being converted to a different class. The conversion may be implicit (triggered by the nominal or adverbial constituents of the clause, by another associated conversion or by the context), or it may be indicated explicitly by derivation or by verbal or nominal inflexion, in a necessarily language-specific manner. In the latter case it may be signalled by the mode of action, aspect and/or tense of the verb or (as in Finnish and Estonian and to a certain extent the Germanic languages) the syntactic marking of the object of the sentence.

The possibility of applying any operation of aspeclual class conversion to a predicate may depend on the derivation of that predicate. In this sense I agree with Holisky's 1981 statement, made within a discussion of the morphology of aspect in Georgian, that

the caracterisation of aspect types must be made with reference to the verbal root of Georgian, and not merely to a particular surface verb form. [..] Each verb root in Georgian must be marked for aspect, each root will be in one of Vendler's four classes.

My approach differs from hers in that I don't share her assumption that all forms traditionally grouped within the paradigm of a single verb must necessarily be considered to belong to the same aspeclual class (and consequently to be distinguished where necessary by the value of another, orthogonal aspeclual category). For example, I regard the Georgian pair [s̩]eše 'he writes/ai writing/it will be writing' and daceš 's̩e he will write' as a state and a kinesis, respectively, rather than a linear and a punctual aspect form of the same accomplishment verb.

2.3.1 Organisation of Moens & Steedman's network

The transition network in Figure 2.3 is introduced by Moens & Steedman 1988 to define the ontology by which the conversion of aspeclual types is driven. For ease of reference I use Vendler 1967's terms activity, accomplishment and achievement instead of Moens & Steedman's process, culminated process and culmination.

![Figure 2.3: The aspeclual network of Moens & Steedman 1988.](image)

The underlying interpretation of the individual types of eventualties is based on a generic eventualty structure called a tripartite nucleus, shown in Figure 2.4. The relation between the eventualty, preparatory process and culminated eventualty is shown in Figure 2.4. The tripartite nucleus.

![Figure 2.4: The tripartite nucleus.](image)

The three components of the nucleus are set in terms of contingency (the culmination is brought about by the preparatory process and in turn brings about the consequent eventualty), and their relative allocation in time (the preparatory process precedes, and the consequent eventualty follows, the culmination) is a side effect of that. The choice of aspeclual class in each particular case determines which parts of the nucleus are considered relevant, without necessarily excluding the existence of the others. For example, an accomplishment is composed of a preparatory process and a culmination, while an activity is just the former and an achievement just the latter.

In the diagram in Figure 2.4 the dashed box in the centre sets events (inside) apart from states (outside). The allocation of the four classes of eventualties reflects the underlying architecture, a cross-classification of eventualties, the two criteria in which are the atomicity of the eventualty and the existence of an associated consequent eventualty. In this context an eventualty is considered to be atomic if it has no substructure or its substructure is disregarded, and to be extended otherwise. (See Table 2.3.)

<table>
<thead>
<tr>
<th>atomic</th>
<th>extended</th>
</tr>
</thead>
<tbody>
<tr>
<td>consequence</td>
<td>achievement</td>
</tr>
<tr>
<td>consequence</td>
<td>point</td>
</tr>
</tbody>
</table>

Table 2.3: The cross-classification of eventualties.
latter condition is that points, unlike achievements, sound odd in the perfect tenses, which select the consequent state of the event:

(2.32)  a. # Harry has hiccupped.  (point)
          b. Harry has reached the top.  (achievement)

An unlabelled edge in most cases indicates a conversion which amounts to a mere change in the speaker’s perspective on the reported event, while a labelled edge indicates the inclusion of a stage (preparatory process, culmination or consequent state) into, or its exclusion from, the eventuality contour.

The dynamic part of the network, that is, the part in the dashed box in the centre of Figure 2.3, which includes events and transitions between them, excluding states and transitions to and from them, is in fact equivalent to the triangular scheme in Figure 2.5, which in turn is parallel to the one in Figure 1.8.

![Figure 2.5: The triangular nucleus which underlies the dynamic part of the aspectual network.](image)

As in the case of conversion of types of nominal reference, a transition is possible from every node of the nucleus to either of the two others. The implicit transitions between points and achievements, which don’t affect the eventuality contour, are carried out in this diagram within the node shared by the two classes. The arrows marked with x and y correspond to the unlabelled edges leading from the Activ and the Accom node to the Point node.

### 2.3.2 Aspectual modifiers in English

For English Moens & Steedman recognise five types of overt aspectual modifiers, which are associated with nodes or edges in the network.

#### Habitual states

The simple present and the simple past tense under habitual interpretation cause a transition of the edge Point → S(hbt).

(2.33) Pido banks (often).

The eventuality is converted into a point if it is not one already, so that the entire path may have the form Activ → Point → S(hbt), Accom → Point → S(hbt) or Achie → Point → S(hbt).

(2.34) He drank wine (often).  

Activ → Point → S(hbt)

Closely related is the class of dispositional states, which Moens & Steedman do not discuss. Dispositional states are also morphologically unmarked in English.

(2.35) *He drank wine. (He was not a teetotaller.*)

but they differ from the habitual ones, and are similar to the subclass of qualities illustrated in (2.12a), in that they do not admit modifiers such as often or regularly. Unlike a habit, a disposition does not require even the occasional occurrence of the event, as Bullygin 1983 observes, (2.36) is a plausible interchange between a hostess and her guest.

(2.36) — Do you eat olives?

— I don’t know. I’ve never had any.

The habitual reading of the question in these circumstances would have compelled the guest to reply in the negative.

### Progressive states

The continuous tenses cause transition along the edge Activ → S(reg).

(2.37) The president is speaking.

The treatment of the progressive as a kind of state is in line with Vlach 1981’s proposal known as ‘progressive as a stativiser’, based on the observation that progressives and states have the same aspectual properties (if they hold in a given interval, they also hold in any of its subintervals, atomic or not), that many natural languages have progressive constructions which are syntactically parallel to locatives, as illustrated below (the locative adpositions are set in boldface).

#### Gaelic

- a. Tha *mi aig an t-sheir.

be-PRS I at the fire

‘I am at the fire.’

- b. Tha *mi ag obair.

be-PRS I at working

‘I am working.’

#### Georgian

- a. Erwts war.

yard-in be-PRS-1SG

‘I am in the yard.’

- b. Cerulis gadapeta ts war.

letter-ONI copy-P-PN/IMP-in be-PRS-1SG

‘I am copying the letter.’

#### Turkish

- a. Odun ocaîtard.

wood fireplace-LOC-3SG

‘The wood is in the fireplace.’

- b. Odun ocaita gırmakta’dard.

wood fireplace-LOC-3SG burn-IMP-LOC-3SG

‘The wood is burning in the fireplace.’
(2.44) Chinese

(2.44)  

a. 女生正在听讲。
   We (be) at classroom
   'We are in the classroom.'

b. 女生正在听讲。
   We (be) at bold class
   'We are having a class.'

and that, again in many languages, the distinction between progressive and non-progressive aspect fails to show up for stative verbs (e.g., in Standard English stative verbs generally appear in the simple but not in the continuous tenses — hence the absence of an edge from S(1s) to S(prg), while at least some varieties of Scottish and Indian English feature the reverse situation, in Japanese stative verbs either always appear in the progressive construction formed with -te iru or never do).

The operation of progressivisation can be expressed conveniently by means of the atomisation operator defined in Section 1.3. Given that an energy is formally represented as $\Psi$ (a proper plural predicate), $\Psi(t)$ is true for any moment $t$ belonging to an interval within which the event takes place, and the corresponding ordinary plural

(2.42) \[ \neg^+(\Psi) = \Psi \]

(conversion to a state) holds for all subintervals, atomic or not.

Progressives are closely related to habitual and dispositional states in that they predicate of all moments of a given interval, a feature derived from an event by which that interval is characterised; the three differ in the degree to which they require the interval to be covered by occurrences of the event.

Since activities are astatic, as are states, the imperfective paradox — the problem of an event being brought up without its occurrence being asserted — doesn’t arise at this stage. However, as Oghara 1990 observes, this doesn’t necessarily mean that it is solved. It is merely shifted to the edge $\text{Accom} \rightarrow \text{Activ}$, where accomplishments are to have their calumnations removed.

The question is, then, how the activity is identified as the accomplishment’s preparatory process. Its discussion in further detail lies outside the scope of this work.

(2.43)  

a. John was hanging the picture.
   Accomp $\rightarrow$ Activ $\rightarrow$ S(prg)

b. Harry was reaching the top.
   Activ $\rightarrow$ Accomp $\rightarrow$ Activ $\rightarrow$ S(prg)

c. $\#$ Harry was hiccupping.
   Point $\rightarrow$ Activ $\rightarrow$ Accomp $\rightarrow$ Activ $\rightarrow$ S(prg)

The operation accompanying the implicit transition of the edge $\text{Accom} \rightarrow \text{Activ}$, which yields a predicate denoting an incomplete action bounded by a real or hypothetical event, could be referred to as participativisation. It is also conveniently expressed by means of the atomisation operator, or more precisely by means of the operation of grading defined in its terms. If $\Psi(p)$ is true for an interval $p$, then $\Psi(t)$ is true for any moment $t$ within $p$, hence the paritive

(2.44) \[ \text{GRAD}(\Psi) = \neg^+(\Psi) \]

(conversion to an energy) holds for all subintervals of $p$ longer than a moment.

In examples (2.43b–2.43c) the achievement is implicitly extended over an interval by having a preparatory process leading to it included in the eventuality contour. This conversion can be compared to the formation of representative plurals, also discussed in Section 1.3, and represented accordingly as in (2.45),

(2.45) \[ \text{NAMEs}(\psi) = \lambda x. \exists ! t (\exists p [x \in t \cup \text{Activ} \wedge \Psi(t) \wedge \neg^+(\Psi(t_1)) \cup \text{Activ}]) \]

where the activity $\psi_{(t)}$ is the process accompanying the achievement $\Psi$ happening in the moment $t$. This doesn’t, in fact, require that the process be a preparatory one, thus accommodating Culicover 1981’s trick of turning initial, internal and final clausal moments, illustrated in (2.21).

An alternative way for an eventuality to be converted into an activity for the purposes of progressivisation is by way of the iterative edge $\text{Point} \rightarrow \text{Activ}$.

(2.46)  

a. Harry is hiccupping.
   Point $\rightarrow$ Activ $\rightarrow$ S(prg)

b. Roger was running a mile.
   Accomp $\rightarrow$ Point $\rightarrow$ Activ $\rightarrow$ S(prg)

c. $\#$ Harry was reaching the top.
   Accomp $\rightarrow$ Point $\rightarrow$ Activ $\rightarrow$ S(prg)

As already noted, iteration amounts to pluralisation.

(2.47) \[ \text{ITRsl}(\psi) = \psi \]

In some languages itertives are also grammaticalised as plural entities, cf. the parallel treatment of plural nouns and itertives in Quileute, where $\rightarrow$ with reduplication of the preceding vowel is a pluralisation marker for both nouns and verbs (O’Leary 1969), or the optional use of reduplication for marking distributive plurality of the eventuality or of any argument in Straits Salish (Jelinek 1991).

(2.48)  

[a. (i) a-et-bt ‘chief’
   (ii) a-er-tət-bt ‘chiefs’

b. (i) f-e-a-xatl ‘I leave him’
   (ii) f-e-e-a-xatl ‘I leave him often’

(2.49)  

[a. (i) s-ha-li ‘she is a’ woman’
   (ii) s-ha-li ‘they are’ women’

b. (i) s-eq-g ‘he dives’
   (ii) s-eq-s-eq ‘he dives repeatedly; they dive [repeatedly]’

Expressions of duration

An expression of duration, such as a for-adverbial or an equivalent, causes transition along the edge Activ $\rightarrow$ Accomp.

(2.50)  

a. Mary played the piano for thirty minutes.

b. Mary spent thirty minutes playing the piano.
The transition is caused by the fact that the expression for thirty minutes sets for the entire interval a condition which, unlike play the piano itself, does not distribute to its subintervals. Thus 
\[ \psi \] is quantised to the form in (2.51),
\[
P_{\phi, \psi}(p) = \lambda \lambda \psi'(p) \land Q_3(p)
\]
where \( Q_3(p) \) stands for the fact that the interval \( p \) has the duration \( d \), formulated by reference to a metric or to another extended or recurrent event. If the eventuality is not an activity and even if it is, as in (2.52a), it can be converted to a point and then iterated.

(2.52) a. Mary played the piano for three years. 
    Activ \rightarrow \text{Point} \rightarrow \text{Activ} \rightarrow \text{Accom}

b. Mary arrived late for several days. 
    Activ \rightarrow \text{Point} \rightarrow \text{Activ} \rightarrow \text{Accom}

The inclusion of a durative adverbial affects the temporal constitution of the predicate: hang pictures is cumulative while hang pictures for three minutes is quantised. The inclusion of a measure phrase into an unspecific plural of mass term has a parallel effect: water is cumulative while two litres of water is quantised. This enables Krifka 1993 to group for three minutes and two litres (of) water under the category of extensive measure functions.

None the less, an imperfective verb is used in Slavic and Georgian, and a monomorphic verb (werbe unitoire for Cartier 1972) in Mandarin. This is not surprising, considering that perfectivisation in these languages is associated with a change of the mode of action, which is not affected here, since the quantisation is restricted to the duration of the event, without a terminal point being set or reached.

Expression of time span

An expression of time span, such as an in-adverbial or an equivalent, causes no transition on its own, but requires an accomplishment,

(2.53) a. The boys carried the piano upstairs in five minutes.
    b. It took the boys five minutes to carry the piano upstairs.

The obtaining of which may cause some other conversion.

(2.54) a. John reached the top in two hours. 
    Achie \rightarrow \text{Accom}

b. I found the keys in ten minutes. 
    Achie \rightarrow \text{Accom}

c. I ran in three minutes.
   1. '3 minutes passed from some earlier time referred to in the discourse to the time of my running.' 
      Activ \rightarrow \text{Point} \rightarrow \text{Achie} \rightarrow \text{Accom}

   2. '3 minutes passed from the beginning of my running (of a specified distance) to its end.' 
      Activ \rightarrow \text{Accom}

The impact of the modifier is to convert \( \phi' \) into the likewise quantised form in (2.55),
\[
\lambda \psi'(p) \land Q_3(p)
\]
where \( Q_3(p) \) has the same interpretation as in the case of a durative adverbial.

In fact the classes of in- and for-adverbials differ in their pragmatic effects. To wit, the time indicated by the former is implicitly allowed to be an underestimate, whereas the one introduced by the latter is more likely to be an overestimate, as shown by the possible continuations of (2.50a) and (2.53a):

2.3. Further considerations

In the previous subsection some simple aspectual modifiers found in English were discussed. More complex paths are also possible, and are regarded as compositions of the fundamental ones. Here is an example, accompanied by a diagram (in Figure 2.6) showing the continuations and a formal representation, in which \( P \) translates the minute Waltz and \( Q_2a, Q_2b, Q_2c \) and \( Q_3 \) the translate the three expressions of temporal measure in the order in which they occur in the sentence:

(2.56) a. Mary played the piano for 30 minutes—eventually for 40 minutes.
    b. The boys carried the piano upstairs in 5 minutes—actually in 4 minutes.

This difference, which is due to the context in the type of reference (cumulative vs. quantised) of the predicative predicate which translates the verbal expression cooccurring with the adverbial, is not reflected by the representation of the adverbials in the formulae in (2.51) and (2.55).

Consequent states

A perfect tense causes transition along the edge Achie \rightarrow S(cm), that is, it converts a culmination to an appropriate consequent state (its formation selects the final nucleus of the predicate referred to by the predicate).

(2.57) a. Harry has reached the top. 
    Achie \rightarrow S(cm)

b. The star has waned. 
    Point \rightarrow \text{Achie} \rightarrow S(cm)

c. If I have worked in the garden. 
    Activ \rightarrow \text{Point} \rightarrow \text{Achie} \rightarrow S(cm)

d. The mountainer has climbed Mt Everest. 
    Activ \rightarrow \text{Point} \rightarrow \text{Achie} \rightarrow S(cm)

On the subject of the acceptability of these sentences, I quote Moens & Steedman 1988:

'The most obvious of these consequences for [(2.57a)] is that Harry still be at the top, although as usual there are other possibilities. Informal evidence that this indeed is the function of the perfect can be obtained by noticing that perfects are infelicitous if the salient consequences are not in force.

To support this statement, they observe that uttering

(2.58) I have spilled my coffee.

would be infelicitous if the observable result of the event, namely the puddle of split coffee on the table or the floor, is no longer present. The outcome of the formation of the perfect is also less than fully felicitous if no recognisable consequences could be associated with the event in the first place, as in the case in (2.57b-2.57c), where a culmination and a consequent state are formally attributed to the event for the purposes of the transition of this arch.

The previous paragraph describes the resultative perfect, found in English and in many other languages. Closely related is the experiential perfect, which is also of very wide distribution and in some languages coexists with a resultative perfect. For the purposes of the experiential perfect the consequent state is defined as 'the state of a Ψ-eventuality having taken place',

(2.59) '\( \exists t \in \mathbb{R} \cdot (\psi(t') \land t' < t) \)'

which trivially holds for all moments later than the time of \( \psi \), unless some idiosyncratic restrictions are in force. The existence of such a state does not depend on the existence of a 'natural' culmination, and consequently it is not required that \( \psi \) be a telic predicate.
2.3. Conversion of Aspectual Classes

(2.60) It took me two days to play the Minute Waltz in less than sixty seconds for more than an hour.

\[ \lambda p. \left( \left( \lambda \alpha. \left( \lambda \beta. \left( p \wedge \alpha \wedge \beta \right) \right) \wedge \left( \lambda \delta. \left( \wedge \delta \wedge \alpha \wedge \beta \right) \right) \right) \right) \]

It took me two days to

\[
\begin{array}{c}
\text{[play \ active the Minute Waltz]}
\end{array}
\]

in less than sixty seconds for more than an hour.

Figure 2.6: A very complex aspectual conversion.

It must be noted that transition along some of the edges is only permitted if certain syntactic, semantic or pragmatic conditions (universal or language-dependent) are met. In particular,

(2.61) a. a move along the edge Point \rightarrow Activ is only possible if the semantics of the event identifies it as repeatable,

b. a move along the edge Activ \rightarrow Accom is permitted only if the context allows a culmination point to be associated with the process,

c. a move along the edge Point \rightarrow Achieve requires the availability of associated relevant consequences of the event,

d. a move along the edge Achieve \rightarrow Accom is dependent on the existence of a preparatory process,

e. a move along the edge Accom \rightarrow Activ in English needs to be licensed by the presence of continuous tense, which means that it must be part of a route to the edge Activ \rightarrow S(eng).

The last restriction entails that all verbal expressions which Vendler 1967 would classify as accomplishments, but which can cooccur with a for-adverbial (play the sonata, read a book, climb Ben Nevis), are really activities, but are coerced along the edge Activ \rightarrow Accom unless protected by a continuous tense or a for-adverbial (since the default interpretation is the terminative one). As in the case in which a dative adverbial is present, the transition of this edge is accompanied by the conversion of the activity \"it\" into (2.62),

(2.62) \[ \text{PASS}_{\alpha}(\phi) = \lambda p. \left( \lambda \psi. \left( \psi \wedge \alpha \right) \wedge \left( \psi \wedge \psi \wedge \psi \right) \right) \]

where \[ \text{PASS}_{\alpha}(\phi) \] stands for the fact that the natural boundary of the activity is reached in the interval \[ p \]. As such, the verbal expressions under consideration differ from the ones which enter the network already as accomplishments (build a shed) and can't normally receive a participial interpretation.

(2.63) ??John built a shed for several days.

In the terminology of Dahl 1984, the T-property (existence of a terminal point) is set to a positive value for both sets of verbal expressions, but the value of the P-property (actual reaching of the terminal point) is initially negative for the former and positive for the latter set. In the absence of any morphosyntactic indications in English, however, it is far from obvious what in the nature of the processes or our knowledge of the world causes this difference.

One should note that the modifier causing a conversion may also influence, in terms of both quantity and quality, the side effects of the conversion. In all examples in (2.64-2.65) a lexical achievement is stretched to an accomplishment, but while the preparatory process added to the reaching of the top in (2.64a), which repeats (2.54a), may include the whole climbing, the one in (2.64b), which repeats (2.43b), includes only its very last stage (Glasbey 1985), and in the case of the finding of the keys the very possibility of stretching the event depends on the modifier, as shown by the comparison of (2.65b) and (2.65a), which repeats (2.54b):

(2.64) a. John reached the top in two hours.

b. John was reaching the top.

(2.65) a. I found the keys in ten minutes.

b. I was finding the keys.

It seems that the stretching of an achievement to an accomplishment in these cases involves the inclusion of a preparatory process which is normally expressed by a different lexical item. Thus, the preparatory process associated with find is the activity denoted by look for (search, seek), reach the top can be stretched over the stage immediately preceding the culmination, but otherwise it is supplemented by climb. The result of this is that time-span expression can be applied, but progressiveivation fails, as it requires 'looking into' a process which must remain unmarked.

There are some other problems with employing the network as defined for analyzing English aspectual phenomena. For example, lexical and habitual states can cooccur with expressions of duration,

(2.66) a. For how long did you love her? For three years.

b. How long did you believe in the stark? Till I was seven.

and in many cases so can progressive states,\footnote{Cf. Vendler's remark: 'Accordingly, the question, For how long did he push the cart?' is a significant one [. . .]. And, of course, the corresponding answer will be He was pushing it for half an hour.' It is interesting that he doesn't comment upon the fact that his respondent switches from the past simple to the past continuous tense, though he certainly can't fail to realize it.} although that appears to depend strongly on their derivation in ways which shall not be explored here.

(2.67) a. The milk was boiling for ten minutes.

b. The milk was beginning to boil for ten minutes.

There is, however, no path from any of the statical nodes to the Activ \rightarrow Accom edge.

The lack of any connexion between the node S(eng) and the rest of the network also leaves open the problem of the handling of the inchoative reading of lexical states, which is not shared by progressive states. Quoting Ogihara 1990,

We can say that a lexical state sometimes appears to move narrative time forward because it allows the possibility that when it is asserted to be true at a certain interval, it is the maximal interval at which it is true.
This reading can be triggered by connectives such as when:

(2.68) a. I owned the yacht when Uncle Herbert died.

b. Macbeth believed in ghosts when he saw Banquo.

According to the analysis of Moens & Steedman, the when-clause allocates the event which is the referent of the main clause somewhere in the preparatory process of its own referent or in its consequent state. If the main clause denotes a lexical state, it should be possible for it to be converted into an event expression.

Another problem is posed by the restrictions on the aspectual class of a stative until-clause:

(2.69) a. "He held a great part of incapacity for maidsens to drink wine until they are married."

b. He kept the window open until she was shivering from cold.

c. "He was unhappy until she was building him a house."

Finally, there is no path from the stative nodes to the Activ $\to S(cq)$ edge, which leaves open the question how their perfect tenses are to be treated. This includes the perfect continuous tenses of all verbs which have them. The only available path goes to the Activ node, via Accom $\to$ Activ if necessary, and from there to $S(cq)$ along the subpath Activ $\to$ Point $\to$ Activ $\to S(cq)$.

2.4 Aspect in Bulgarian

In this section I shall examine the aspect system of Modern Bulgarian, a language in which regular overt aspect marking obviates the need of a specific context for certain conversions, while its absence inhibits others, even in contexts which would be sufficient to enable them in English.

2.4.1 An overview of the aspect system

The most pervasive feature of the verb system of Bulgarian, shared with all other Slavic languages, is the division of all verbs into two aspects, known as imperfective and perfective. All but about 50 of the primary verbs, and therefore also of the verb roots, in the language are imperfective. There is also a recently formed class of bispecular verbs, which can be interpreted as belonging to either aspect. The vast majority of them contain the loan suffix -ero (cf. German -ero). An imperfective verb can be perfectivised by the addition of a preverb (of a choice of 18) or the inchoative/semelfactive/alternative suffix -u. (Only in a small number of cases the addition

A preverb can be added to a perfective verb, affecting the lexical meaning, but not the aspect, the event is still bounded, but the boundary is further specified. While the impact of the first (perfectivising) preverb is often idiosyncratic, the interpretation of any further preverbs is strictly compositional: p-, for example, is attenuative, do- is completive.

(2.72) a. poprep $\to$ 'drink somewhat more (u) than one's fill, overdrink slightly'

b. dopre $\to$ 'get drunk, completely drink up'

c. Topre $\to$ 'to have a swallow/draught of y' (drink off')

d. topre $\to$ 'drink a little y'

e. (i) Topre $\to$ 'squander y on drink, dissipate y, drink y away'

f. podpre $\to$ 'drink more than y could spare one, sponge on y for drink'

g. padpre $\to$ 'drink more than y, overdrink y'

A preverb can also be added to a perfective verb, affecting the lexical meaning, but not the aspect, the event is still bounded, but the boundary is further specified. While the impact of the first (perfectivising) preverb is often idiosyncratic, the interpretation of any further preverbs is strictly compositional: p-, for example, is attenuative, do- is completive.

(2.72) a. poprep $\to$ 'drink somewhat more (u) than one's fill, overdrink slightly'

b. dopre $\to$ 'get drunk, completely drink up'

c. Topre $\to$ 'to have a swallow/draught of y' (drink off')

d. topre $\to$ 'drink a little y'

e. (i) Topre $\to$ 'squander y on drink, dissipate y, drink y away'

f. podpre $\to$ 'drink more than y could spare one, sponge on y for drink'

g. padpre $\to$ 'drink more than y, overdrink y'

e. (i) zaps se- $\to$ 'go on the gumble'

f. propre se- $\to$ 'take to drink, become a drunkard'

g. nadpre se- $\to$ 'compete in drinking'

h. propre se- $\to$ 'get drunk, become intoxicated'

i. Topre se- $\to$ 'drink one's fill, get drunk'

A preverb can also be added to a perfective verb, affecting the lexical meaning, but not the aspect, the event is still bounded, but the boundary is further specified. While the impact of the first (perfectivising) preverb is often idiosyncratic, the interpretation of any further preverbs is strictly compositional: p-, for example, is attenuative, do- is completive.
2.4. Aspect in Bulgarian

The secondary imperfective verb expresses the process of moving towards the boundary or the recurrence of its reaching.

The process of imperfective verbalization is productive and can be undergone by all verbs except those whose derivation perfectivization follows upon secondary imperfectivization, such as "zazdora" (begin to look at (from all sides, carefully)) derived from "zazdro" (look at). Such verbs, however, not typical for the language; in addition, they can often be used as biaxial, thus undergoing implicit tertiary imperfectivization.

Apart from the genuine biaxial verbs, there also exists a class of pairs of homonymous verbs which belong to different aspects by virtue of their derivation, such as "zazdora" or "zastava" (each of which, as shown in Figure 2.7, is the final point of two derivational paths. The vertical arrows indicate derivations which don’t affect the aspect.

<table>
<thead>
<tr>
<th>Imperfective</th>
<th>Perfective</th>
<th>Imperfective</th>
<th>Perfective</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;zazdora&quot;</td>
<td>&quot;zastava&quot;</td>
<td>&quot;zazdora&quot;</td>
<td>&quot;zastava&quot;</td>
</tr>
<tr>
<td>‘throw, hurl, cast’</td>
<td>‘start to throw’</td>
<td>‘throw away, cast aside’</td>
<td></td>
</tr>
<tr>
<td>↓</td>
<td></td>
<td>↓</td>
<td></td>
</tr>
<tr>
<td>&quot;zastava&quot;</td>
<td>&quot;zazdora&quot;</td>
<td>&quot;zazdora&quot;</td>
<td>&quot;zastava&quot;</td>
</tr>
<tr>
<td>‘stand’</td>
<td>‘stand up, become’</td>
<td>‘stand up (coll.)’</td>
<td>‘come, begin, fall (for an age or season)’</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 2.7: The derivation of homonymous pairs of verbs of different aspect in Bulgarian.

2.4. Aspects classes and Bulgarian aspect

One of the most frequently cited criteria for distinguishing between verbal expressions denoting the two classes of dynamic eventualities is the P1 criterion (so named by Verkuyl 1989; the name comes from the initials of the three ‘keywords’ from, in, take). This criterion is based on the ability of the expressions to combine with certain constructions of temporal measure: energiai (activities) do not take time-span adverbials (en-phrases or their equivalents), but they take durative adverbials (for-phrases or their equivalents), whereas kineis (accomplishments) take time-span adverbials but not durative adverbials (the ones which seem to be able to are actually energiai, according to the argument of Moens & Steedman).

(2.73) a. I hung pictures for three minutes.
    b. I hung pictures in three minutes.
    c. It took me three minutes to hang pictures.

(2.74) a. I hung the picture for three minutes.
    b. I hung the picture in three minutes.
    c. It took me three minutes to hang the picture.

In Bulgarian the distribution of expressions of temporal measure is correlated with the aspect of the verb. The correlation finds its most consistent realisation in the two synthetic past tenses, the aorist and the imperfect. Of these the aorist, the principal narrative tense, locates an event in a moment or interval in the past, the imperfect is a scene-setting tense, which states that an ongoing or recurring eventuality is taking place in a moment or interval. The imperfect of a perfective verb may not appear as the head of a main clause.

In a clause headed by a verb in the aorist the imperfective or perfective aspect of the verb determines whether the clause may contain a durative adverbial (in Bulgarian a bare noun phrase, corresponding to a for-phase in English) or a time-span adverbial (a phrase introduced by the preposition za, which corresponds to the English for in benefactives and in expressions of purpose and of price, but to in expressions of temporal measure). I shall use ‘za’ in the glosses, since using either for or in would be misleading. A clause headed by a verb in the imperfect tense (the paradigmatic counterpart of the operation of progressivisation) can take neither a durative nor a time-span adverbial.

(2.75) a. (i) Piek + vino.
    drink-L-VB/INF=1SG wine
    ‘I was drinking wine.’

    (ii) Piek + vino, kogato Irina slave.
    drink-L-VB/INF=1SG wine when enter-P-VB/AOR-3SG
    ‘I was drinking wine when Irina came in.’

    (iii) Piek + vino, dokato Irina pleše.
    drink-L-VB/INF=1SG wine whilst kniž-L-VB/INF-3SG
    ‘I was drinking wine whilst Irina was knitting.’

b. Piek + vino (tridestet minutas).
    drink-L-VB/AOR-1SG wine 30 minutes
    ‘I drank wine (for 30 minutes).’

c. Ispis + vino (za tridestet minutas).
    drink (up)-P-VB/AOR-1SG the wine za 30 minutes
    ‘I drank the wine (in 30 minutes).’

Note the obligatory use of the definite article, the existence of which is a feature which sets Bulgarian apart from the rest of the Slavic branch, on the object in (2.75c), vino - the wine. The existence of a definite article, along with the correlation between aspect and temporal adverbials, allows the aspectual class of each individual occurrence of a biaspectual verb (and consequently also its aspect) to be derived from the context, essentially the same way as it is done for all verbs in languages such as English (Kabakchiev 1992):

1In the future and the futures in the past the distinction between the two types of atomic eventualities is neutralized.
2A certain semantic parallel can be perceived between the use of za in expressions of price and expressions of time span. Compare:
   * Kogoza? + vino za tridestet lit. ‘I bought the wine for 30 pounds.’
   * Ispis + vino za tridestet minutas. ‘I drank the wine in 30 minutes.’

   (‘Buying the wine cost me 30 pounds.’)
   (‘Drinking the wine took me 30 minutes.’)
Thus the dichotomy of the two aspects parallels the distinction between energetic and kinesis (including accomplishments, achievements and points). It follows that the conversions between the various types of kinesis are implicit in Bulgarian, as they also are in English, but a conversion of an energetic into a kinesis (except for one realised by a duration expression) necessarily materialises as perfectivisation, and a conversion of a kinesis into an energetic materialises as imperfectivisation.

The first of these processes, perfectivisation, carries with itself a shift in lexical meaning. It is essentially a change of the mode of action, by which a spatial orientation, a specific intensity, a degree of involvement of the arguments in the event or such circumstantial features as completion or recurrence can be specified, setting conditions which are to be met by the event as a whole (i.e., as a group). The variety of morphological means by which the conversion can be realised reflects the multitude of ways in which a terminal point can be set. The mode of action of each of the derived perfective verbs is associated with a certain (though possibly vaguely determined) quantity of the process (in the terminology of Dahl 1984, the setting of the T-property to a positive value). In general it can be said that the energetic expressed by the imperfective verb, represented as \( \phi \), is thereby packaged to the form in (2.80). The condition symbolised by \( \Theta \) is contributed by the change of mode of action.

(2.80) \[ \text{PAKE}_Q(\phi) = Q \Theta \]

The conversion of the verb to the perfective aspect, associated with this condition, signifies the requirement for the terminal point to be actually reached (the simultaneous setting of the P-property to a positive value).

By contrast, in accordance with the fact that a kinesis has a unique culmination, and therefore there is a unique energetic which results from its elimination, Bulgarian morphology provides a single means for expressing the conversion. Imperfectivisation is limited to aspect, which is to say that it is not associated with a change of the mode of action; the terminal point is still set in the same way, but the requirement for its reaching is waived (the P-property is reset to a negative value).

(2.81) a. \( \text{Vtiera toj dosprova edna baraka.} \)
yesterday he-nom build-p/vb/aor-3sg one-sg p cabin
\( \text{Yesterday he completed the building of a cabin (which he or someone else had started earlier).} \)

b. \( \text{Vtiera toj dosprotvuvva edna baraka.} \)
yesterday he-nom build-p/vb/aor-3sg one-sg p cabin
\( \text{Yesterday he spent some time completing the building of a cabin. } \) (It doesn't matter whether he actually did complete it.)

The derivational processes are sufficient conditions for conversion; in particular, a transition along the edge Accom → Activ does not require progressiveivisation or the presence of an expression of duration. The sentence in (2.81b), the Bulgarian counterpart of (2.74a), is well-formed, and it conveys the meaning that the speaker has spent three minutes hanging the picture, without any commitment as to the outcome of the effort.

(2.82) a. \( \text{Zabava: kartetnata za tri minuti.} \)
\( \text{Hang-p/vb/aor-3sg the picture 3 minutes} \)

b. \( \text{Zabava: kartetnata za tri minuti.} \)
\( \text{Hang-p/vb/aor-3sg the picture 3 minutes} \)
On the other hand, the derivational processes are also necessary conditions for transition, and pragmatics alone doesn’t have the power to set a culmination point to an event expressed by a clause headed by an imperfective verb. The inclusion of a time-span expression into such a clause yields an ungrammatical sentence:

(2.83)° žagaz ñe nykökë munëtu. cf. (2.54c:ii)
run-vb/aor-1sg 2a several minutes

This immediately leads to the question of the fate of the unlabelled edge Aktiv → Point, since its transition would require perfectivisation with preservation of the mode of action. This edge was mentioned in the context of the following four paths:

Aktiv → Point → S(hit): Aktiv → Point → Achieve → S(on);
Aktiv → Point → Aktiv → Accom; Aktiv → Point → Achieve → Accom.

The fourth of these conversions has no counterpart in Bulgarian, whereas (2.54c-i) can only be translated using a prepositional phrase headed by sëd ‘after’, not a za-phrase. The counterparts of the others involve no perfectivisation, so they must be considered to be following different routes.

(2.84) a. Šaro lae (često). cf. (2.33)
barz-vb/pres-3sg often
b. Rabotëti sëd v gradinata. cf. (2.57c)
work-vb/pres-3sg in the garden

Let us first consider example (2.52a/2.84c), the most plausible reading of which is the iterative one. It indicates the recurrence of the event of Mary playing the piano, that is, the existence of a series (a group) of intervals, over each of which an event of that type takes place. The entire event can be adequately represented as a plural temporal entity. Ignoring the duration adverbials, (2.50a) is represented as ‘P’(t) and (2.52a) as ‘P’(t’), considering that the superposition of two pluralisation operators would be redundant. The predicate P, which belongs to type 0, is lifted once in (2.50a) and twice in (2.52a). Indeed, example (2.85), the Bulgarian counterpart of (2.50a), features the same imperfective verb as (2.84c).

(2.85) Marija svari na piano vred svetët munëtu.
play-vb/aor-3sg on piano 30 minutes

On the other hand, if the recurrent event is a kinesis, its conversion to an energy is reflected in the perfectivisation of the verb.

(2.86) a. Šačadži as pafe zë na pirona. Achieve
hang-vb/aor-1sg repl-dat the coat on the nail
’I hung my coat on the nail.’

b. Šačadži as pafe zë na pirona tri godini. Achieve → Aktiv
hang-vb/aor-1sg repl-dat the coat on the nail 3 years
’I hung my coat on the nail for three years.’

With all this having been said, the question of the content of the class of points deserves serious consideration. In Bulgarian semelfactive verbs (e.g. mopsa ‘blink (once)’, sospsa ‘back (once)’) are morphologically complex, being derived by perfectivisation of the corresponding verbs which denote an undetermined quantity of the action (mopsa ‘blink’, sospsa ‘back’). The associated derivational process could be regarded as a more along a qualified edge Aktiv → Point, but morphologically it is no different from the formation of an inchoative or a terminative verb (Aktiv → Achieve or Aktiv → Accom). The treatment of semelfactics as achievements is also justified by the fact that the perfect tense is much more readily formed from any verb in Bulgarian than it is in English; in other words, there is always a consequent state (be it the experience of any of the participants of the event, indirect evidence or hearsay). In terms of the network as presented in Moens & Steedman 1988 this could mean that Achieve → S(on) unconditionally invokes Point → Achieve. However, the need of the recognition of points as a separate aspectual class in Bulgarian is seriously undermined.

The network thus assumes the form in Figure 2.8. Two dashed boxes set events (the domain of the aspect) and states apart from one another in the diagram; within the class of events another dashed box groups the two classes of kinesis together, and the edge to and from it are shared by both. The edge corresponding to the addition of a preparatory process to an achievement, Achieve → Accom, is the only labelled edge whose transition is not reflected in the morphology.

2.5 Aspect in Chinese

In this section I shall look briefly at the aspect system of Mandarin Chinese, a language in which overt aspect marking is syntactically optional in many contexts, but which none the less possesses a highly complex system of aspectual categories, realised by both derivational and inflectional strategies.

OCF: the loss of the aspect and the imperfect as a result of their gradual replacement by the perfect in most other Slavic languages, or the severe restriction of the use of the tense corresponding to the action (passé simple, partitivo remoto) in most spoken forms of French and Italian.
2.5. Aspect in Chinese

Figure 2.8: The aspectual network for Bulgarian.

2.5.1 Aspectual derivation

According to the structure of the stem, the verbs of Mandarin Chinese can be divided into primary verbs (mostly monomorphemic ones) and resultative verb compounds, which consist of a primary verb and a resultative verb complement. As shown by the examples in Table 2.4, the resultative verb complement can be a subordinate verb or adjectival characterising the culmination or the consequent state of the event or an adverb indicating, possibly metaphorically, the direction of the process denoted by the primary verb.

A resultative complement can be adequately compared to a perfectivising preverb in languages such as Bulgarian. As Tsai (1994) observes,

Accomplishment verbs in English, when in past or perfect tenses, necessarily imply an attainment of the goal. Their supposed equivalents in Chinese do not contain such an implication as an inherent part of the meaning, even though the implication in question can sometimes emerge from the composite meaning of the whole predicate or the context explicitly or implicitly provided. To ensure the attainment of the goal, Chinese resorts to resultative verb compounds [...] .

In my view Tsai’s accomplishment verbs are lexical activities, which are converted into accomplishments by the formation of a resultative compound.

Table 2.4: Perfectivisation in Chinese.

<table>
<thead>
<tr>
<th>primary verb</th>
<th>resultative complement</th>
<th>resultative compound</th>
</tr>
</thead>
<tbody>
<tr>
<td>hàm ‘look’</td>
<td>mìngbà ‘understand’</td>
<td>hàm mìngbà ‘read and understand’</td>
</tr>
<tr>
<td>zǒu ‘walk’</td>
<td>kāi ‘open’</td>
<td>zǒu kāi ‘walk away’</td>
</tr>
<tr>
<td>hē ‘drink’</td>
<td>zuì ‘(be) drunk’</td>
<td>hē zuì ‘drunk’</td>
</tr>
<tr>
<td>shǎ ‘be hungry’</td>
<td>sī ‘die’</td>
<td>shǎ sī ‘starve to death’</td>
</tr>
<tr>
<td>zì ‘write’</td>
<td>hào ‘(be) good’</td>
<td>zì hào ‘write properly’</td>
</tr>
</tbody>
</table>

2.5.2 Aspectual inflection

Apart from the stem, a verb form in Mandarin Chinese may contain an aspect marker, which can be one of the three suffixes -le, -yu or -she and the preverbal particles zài (zhèng, zhènglái), which may cooccur with -she. An unmarked primary verb may have the semantics of a state, an energeia or a momentary kinesis (point or achievement). Both the semantics of the stem and the aspect marker, if one is present, contribute towards the formation of the aspectuality of the inflected verb form.

Examples (2.88) present the Chinese counterparts of (2.75):

(2.88) a. (i) Wǒ zài hē yuè.  
I be at drink wine  
‘I was drinking (the) wine.’

(ii) Ālǐng yǐnluò shí wǒ zhènglái hē yū.  
enter-com the time I just be at drink wine  
‘I was drinking (the) wine when Irene came in.’

(iii) Ālǐng zài bǐnǎnhǎi, wǒ tōngyuǎn hē yū.  
be train at the time then be at drink wine  
‘I was drinking (the) wine whilst Irene was knitting.’

b. Wǒ hào. (zànshǐ fēn de) yuè.  
I drink-AOR 30 minute’s wine  
‘I drank wine (for 30 minutes).’

c. Wǒ (zài zànshǐ fēn nǐ) hēdiǎole yuè.  
I at 30 minute within drink-consume-AOR wine  
‘I drank the wine (in 30 minutes).’

In examples (2.88a) the auxiliary verb zài ‘be at’, preceded or not by the adverb zhèng ‘just’, identifies the eventuality as a progressive state. This marker may cooccur or (usually in a subordinate clause) alternate with the stative suffix -she, which indicates a resultative consequent state (specifically a reversible physically observable one) when used on its own.

(2.89) a.  
Tā kěle mèn.  
Activ-le  
(she) open-AOR door  
‘(S)he opened the door.’

b. Mèn kāishé.  
Activ • S(=es)  
door open-RBS  
‘The door is opened.’

The progressive construction is not formed from lexical achievements and resultative verb compounds.

(2.90) Tā zài sī.  
(she) be at die  
(‘(S)he is dying.’)
2.5. Aspect in Chinese

(2.91) a. Wǒ zài xué zhōnɡwén.
I be at study Chinese.
Activ → S(org)
'I am studying Chinese.'

b. Wǒ zài xuéwèi zhōnɡwén.
I be at study-know Chinese.
Activ → S(org)
'I am learning Chinese.'

(2.92) a. Wǒ zài shā tà.
I be at kill (s)he 'I am killing him/her.'
Activ → S(org)

b. Wǒ zài shā sǐ tà.
I be at kill die (s)he
Activ → S(org)

There are a few exceptions, presented by Carter 1972, who notes that the suffix -she is still incompatible with the verbs in question. Some of her examples follow.

(2.93) Ni zài dǎ duōng ma.
Activ ě occurs S(org)
thou be at lose thing still 'Thou art [in the process of] losing something.'

(2.94) Tā zhēngqǐ bīng shēnqì wúqī yì fā diào chīhuān. (s)he just now at use stone kill 1 strip caterpillar
[‘S]he is killing a caterpillar with a stone.'

b. Tā zhēngqǐ pàogǔguā. (s)he just now at run-come
[‘S]he is coming running.

In (2.98b–2.98c) the perfective marker -le labels the eventuality as a single event (as opposed to a state) taking place prior to the reference time.90 My glossing of -le as -AOR is based on the fact that this function is shared by the Bulgarian aspect, as we saw in Section 2.4.

The suffix -le also serves to indicate the conversion of a lexical state into an energia, in particular for the purpose of its further conversion to a kinesis by the addition of a durative adverbial, as in (2.98b). Such adverbials may not cooccur with states, including consitutive states, as shown by the ungrammaticality of (2.98b); (2.98c) could be paraphrased as ‘[Since the doors] were closed, several days passed'.

(2.95) a. Tā zhú zài cūnlái. (s)he live at village
[‘S]he lives in the countryside.

b. Wǒ zài nǎi zhǎo rén céng yě yué. Activ ě occurs S(lex)
I there live-AOR 2 item month
'I lived there for two months.'

(2.96) a. Míngtiān wǒ hén guānzhāi. Activ → S(res)
temple door still close
'The temple doors are still closed.'

Since Chinese lacks tense, the position of the reference time relative to the utterance time is not overtly expressed.

(2.97) Wǒ hǎnmó yǐ le. Activ → S(lex)
'I drink-TFX wine already
'I have drunk wine. (I have had the experience of drinking wine.)'

b. Wǒ kānjiànle nǐ wèi lābōwù. Activ → Acc-le
I look-perceive-AOR that person old man
'I saw that old man.'

b. Nǐ wèi lābōwù nǐ kānjiànle wǒ ma? Activ → Acc-le
that person old man thou look-perceive-TFX
'Has thou (ever) seen that old man?'

In the absence of any of these overt markers the aspectual class is determined on the basis of the semantics of the stem and the context. Quoting Smith 1997, who uses the term viewpoint (aspect) for the semantic correlate of the morphologically marked category in Chinese.

Viewpoint morphemes are syntactically optional; as a result the neutral viewpoint is in principle always available. The choice of an explicit viewpoint morpheme thus carries a certain emphasis not available in languages in which viewpoint is syntactically obligatory.

Overt aspect marking is incompatible with a narrow class of static verbs (cúnzǎi 'exist', zhān 'stand') and, for all other verbs, with certain syntactic environments (e.g., subordination). Null marking is also the only available option for events in the future time of reference and for habitual states.

(2.99) a. Méiyě rén huí fā 'le. Activ ě occurs S(lex)
every item man can die
'Every man is mortal.'

b. fāshēng 'le. Activ ě occurs S(lex)
be determined correct these fault error
'be determined to correct these faults and errors'

(2.100) a. Tā mèn fēng zǐ. Activ-le
(s)he write-AOR 1 sheet letter
'The letter was written.'

b. Tā fēng zǐ. Activ → S(hab)
(s)he every day write 1 sheet letter
'The letter was written every day.'

Lexical points can be iterated implicitly; the fact of the conversion does not become evident until it is followed by another conversion particular to energiai, such as progresivisation.
Thus the only conversions within the class of events are the implicit iteration of points and the perfectivisation of stative realisation as the formation of resultative compounds or accompanying the addition of an expression of duration.

### 2.5.3 Negation: a durativiser?

It has been stated by several authors that negation should be treated as a kind of stativer—a modifier which converts an eventuality of any aspetual class into a negative state. This consideration is based on the observation that negative clauses show durative aspetual behaviour, for example with respect to cooccurrence with expressions of duration, even when their affirmative counterparts do not. This implies that (2.104a) and (2.104b) are both well-formed, while (2.104c) is not, because not wake up shares the atelicity of sleep, parting ways with the telic wake up.

(2.104)

- a. She slept for fourteen hours.
- b. She didn’t wake up for fourteen hours.
- c. She wake up for fourteen hours.

This approach is formally correct, but hardly intuitive. The statement actually made by a negative clause is not that there is a \&-eventuality (whatever that might be) obtaining in the relevant interval, but that there isn’t any \&-eventuality obtaining anywhere within it. A spatial analogy might serve to illustrate the conceptual difference between the two logically equivalent statements. Consider examples (2.105–2.106):

(2.105)

- a. The box is full of gold.
- b. The box is full of a ring.

(2.106)

- a. There is no gold in the box.
- b. There is no ring in the box.

All of these examples attempt to make a statement with respect to the entire volume of the box, and three of them actually succeed in doing so. The reason for the failure of the fourth is that a ring, as a singular count term, denotes a substance of fixed size, which can’t fill an arbitrary volume, unlike the stuff denoted by gold. One can see, however, that there is no such distinction between the absence of a stuff and the absence of a substance. Now, as pointed out by Taylor 1977 (Subsection 2.2.2), atelic eventualities fill time in a way similar to the one in which stuff fills space, while telic eventualities and substances delimit, instead of filling, temporal or spatial areas of fixed size. Saying that a negated telic eventuality becomes atelic is akin to saying that no ring is a mass term and example (2.106b) describes the box as full of a particular stuff, namely “no-ring,” “ringlessness” or whatever one might choose to call it. One shouldn’t have to make such a counterintuitive assertion in order to be able to say that no part of the volume of the box contains a ring. In the same way it should be possible to say that no part of an interval is a time of a \&-eventuality, without committing oneself to the view that the whole interval is thereby the time of a \&-eventuality. Negation need not be a durativiser, any more than it is an amannifiser.

Note also that negated predicates are formally not durative; they are not cumulative, which durative predicates always are. The inference

\[
\forall t_1 \forall t_2 [\Phi(t_1) \land \Phi(t_2) \rightarrow \Phi([t_1,T \cup t_2])]\]
does not hold if φ is the negation of a telic eventuality. Indeed, if I hung a picture in a certain interval, not hung a picture is something I did in either half of that interval (this is part of what it means for the accomplishment to be quantised), but the same can not be said of the whole. In the same way the predicate no-apple holds for each of the two halves of an apple, but not for the entity composed of them, since the whole apple is not a no-apple.

Chinese is a language which presents tangible evidence against the treatment of negation as a durativiser. Consider the examples:

(2.108) a. Tā tíle hángge zhēngguī de gīn. 

play-AOR 2 item week 's lute 'I played the lute for two weeks.'

b. Méi tā tíle hángge zhēngguī de gīn, zhī tā tíle sān tiān. 

haven't play 2 item week 's lute only play-AOR 3 day 'I didn't play the lute for two weeks, (I) only played for three days.'

c. Língge zhēngguī méi tā tíle. 

2 item week haven't play lute 'For two weeks, (I) didn't play the lute.'

In (2.108b) méi negates tā tíle hángge zhēngguī de gīn 'play the lute for two weeks'. The sentence has no interpretation which would attribute the duration expression hángge zhēngguī 'two weeks' to méi tā tíle 'didn't play the lute', which shows that this latter is not, in fact, an atelic predicate. This doesn't, however, prevent one from saying that no event of tā tíle 'playing the lute' occurred within a period of hángge zhēngguī 'two weeks', which is what happens in (2.108c).

The Chinese counterpart of (2.104a–2.104b) show the same characteristic variation in the constituent order: the time adverbial is in postverbal position in the affirmative sentence and in preverbal position in the negative one.

(2.109) a. Tā shěng chū xià shíge zhōngxiāo. 

(sleep-AOR 14 item hour 'sleep 14 item hour')

b. Tā shěng chū xià shíge zhōngxiāo méi zēngqī. 

(sleep 14 item hour haven't wake-up 'don't wake-up')

It is of particular interest to observe that the position of the duration expression in (2.108c) and (2.109b) is the same as it occupies in sentences containing a frequency adverbial.

(2.110) a. Suǒqǐ tā wǒ dālǐ sān cì kēwén. 

yesterday I read-AOR 3 time(s) text 'Yesterday I read the text three times.'

b. Shānggōu wǒ wǒ jiāngguō tā sān cì. 

up month I perceive-EXP him/her 3 time(s) 'Last month I saw him/her three times.'

This suggests that, rather than a durativiser, at least in Chinese negation is a kind of frequency specifier, indicating, as it were, 0 occurrences of the negated eventuality.

2.6 Summary

The purpose of this chapter was to explore the application of the theory of plurality to the domain of eventualitys.
Chapter 3

Aspectual Composition

Consider the following sentences:

(3.1) John shot a zebra (*for*/in an hour).
(3.2) a. John shot zebras.  
    b. John carried a zebra.
(3.3) a. John shot seven zebras.  
    b. John brought a zebra.

The sentences in examples (3.2a) and (3.3a) are headed by the same verb as the one in (3.1), the lexical achievement *shoot*, while the ones in (3.2b) and (3.3b) share with (3.1) the object a zebra. The aspectual criteria discussed in Chapter 2 (such as cooccurrence with temporal adverbials), however, identify (3.1) as an achievement, (3.2a–3.2b) as activities and (3.3a–3.3b) as accomplishments, showing that the temporal constitution of the eventuality which constitutes the semantic content of a clause is derived from the interaction of the reference properties of all of its constituents, in the process of what Verkuyl 1989 calls *aspectual composition*. This interaction is not a random one; the transitions of the formal representations of the aspectual class of the eventuality between (3.1), (3.2a) and (3.3a) within the diagram in Figure 2.4 replicate the corresponding transitions for the reference type of the object within the analogous diagram in Figure 1.6.

<table>
<thead>
<tr>
<th>type</th>
<th>type</th>
<th>(3.3a): accomplishment</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>seven zebras</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>a zebra</td>
<td>(3.1): achievement</td>
</tr>
<tr>
<td></td>
<td>zebras</td>
<td>(3.2a): activity</td>
</tr>
</tbody>
</table>

Figure 3.1: Transfer of reference types for the object of see.

The relevance of the aspectual properties of a nominal constituent to the aspectuality of the clause is determined by the way in which the entity denoted by it participates in, or is related to, the eventuality expressed by the clause in which it occurs, that is, by the properties of what is commonly referred to as its thematic role (thematic relation, semantic relation).

In this chapter I shall discuss the application of the formal tools presented in Chapters 1 and 2 for the development of an account for aspectual composition which makes use of the parallelism in the representation of reference properties in the two domains.

3.1 Eventualities and Thematic Roles

The status and interpretation of the fundamental concepts of eventuality and thematic role and the relations between them will be in the focus of my attention in the first section of the exposition. The subsequent sections shall be devoted to the use of thematic roles specifically for analysing the composition of aspectual properties.

3.1.1 Ordered argument systems

In an ordered argument system a verb denotes a relation of fixed arity, following the standard mechanism of formal predicate logic.

(3.4) \(\Phi'(x_1, \ldots, x_n)\)

Here \(\Phi'\) is the n-place predicate to which the system maps an expression of natural language. For example, the sentence in (3.4a) is assigned the representation in (3.4b).

a. Jones buttered the toast with a knife in the bathroom at midnight.

b. butter'([l, k, b, m, i])

The order by which the arguments of the predicate 'butter' are identified is chosen arbitrarily when the predicate is defined.

A specific (individual) thematic role \(\theta_i\) of an n-ary predicate \(\Phi'\), where \(0 < i \leq n\), is the set of all properties which can be entailed from (3.4) regarding the ith argument of \(\Phi'\).

(3.5) \(\theta_i^{\Phi} = \{ \alpha | (\exists x_1 \exists x_2 \cdots \exists x_n \Phi'(x_1, x_2, \ldots, x_n) \rightarrow \alpha(x_1))\}\)

For example, it is possible to define a specific thematic role called 'butteree', consisting of everything that can be concluded about something on the basis of the knowledge that it appears in the first argument position of the predicate 'butter' encountered in (3.4b), i.e., the knowledge of the fact that someone butters it with something, somewhere and at some time.

(3.6) \(\theta_1^{\Phi} = \{ \alpha | (\exists z \exists x \exists y \exists z_1 \exists z_2 \exists z_3 \exists z_4 \exists z_5 \exists z_6 \exists z_7 \exists z_8 \exists z_9 \exists z_10 \Phi'(z_1, z_2, z_3, z_4, z_5, z_6, z_7, z_8, z_9, z_{10}) \rightarrow \alpha(z_1))\}\)

If the ith position of the predicate \(\Phi'\) has been assigned the thematic role \(\theta_i^{\Phi}\), an expression in the ith argument position of \(\Phi'\) is referred to as the bearer of \(\theta_i^{\Phi}\). In example (3.4a) the toast is the bearer of the butteree role.

A thematic role (type) is then defined as the intersection of a number of specific thematic roles. In the following formula \(\Sigma\) is a set of ordered pairs of predicates and positions in their argument frames and \(\theta_i\) is a thematic role type based on \(\Sigma\).

(3.7) \(\theta_i \subseteq \bigcap_{\Phi', i \in \text{index}} \theta_{i}^{\Phi'}\)

The set \(\Sigma\) should be chosen so that \(\theta_i\) contains at least one property other than the trivial \(\lambda x \exists y \exists z \exists i \in \Sigma \wedge \Phi'(x, y, z, i)\) with \(x\) in the ith position of \(\Phi'\). This means, for example,
that a hypothetical thematic role based on the specific roles borne by the subjects of the two verbs ishe and please, call them $\theta_0'$ and $\theta_0''$, would be useless for all practical purposes, because almost nothing could be guaranteed about its bearer apart from the trivial fact that, by virtue of the definition of the role, it either likes something or pleases someone.

There are two further conditions, derived from the way in which thematic roles are employed in linguistic descriptions, which should be met by a system of thematic role types:

(3.9) Completeness: Every specific thematic role is accounted for by some thematic role type.

(3.9) Distinctness: Every argument position of every predicate is assigned a thematic role type.

The latter of these, incidentally, provides an additional reason for the unsatisfiability of the hypothetical role $\theta_0[1,2,3,4,5,6]$. Since the verbs ishe and please are near synonyms, but the subject of each corresponds to the object of the other, the same role could equally well be assigned to the two objects, and consequently it would be of no use for the purpose of distinguishing between the predicates of the predicates.

### 3.1.2 Event-based systems

In an event-based system (also called a neo-Davidsonian thematic roles system), as an acknowledgement of the fundamental contributions of Davidson 1967, a verb is a monadic predicate of eventuality, which are given the status of autonomous semantic units, and thematic roles are relations between eventuality and entities.

$$\exists \phi'' \forall x \left( \phi''(x) \land \bigwedge_{i=1}^{n} \theta_i(x), \forall i \in [1, \ldots, n] \to \theta_i \in \Theta(\phi) \right)$$

Here $\phi''$ is a monadic predicate to which an expression of natural language is mapped, which expresses the fact that the entity $x_i$ is related to the eventuality $e$ by the thematic role $\theta_i$, and $\Theta(\phi')$ is the set of all thematic roles associated with the predicate $\phi$, that is, all thematic roles for which it makes sense to be predicated of an eventuality of the kind denoted by $\phi$.

Thus the following are possible representations of (3.4a), the first from Dowty 1989 and the second from Schütz 1990 (both slightly modified).

$$\exists e \left( \text{butter}''(e) \land \text{Th}(e, t) \land \text{Ag}(e, j) \land \left( \begin{array}{l} \text{with a knife}''(e) \\ \text{in the bathroom}''(e) \\ \text{at midnight}''(e) \end{array} \right) \right)$$

By using the functional notation $\theta_i(e) = x_i$ instead of the relational $\theta_i(x)$ in the formalizations a requirement of uniqueness of the thematic role bearer is enforced, according to which two distinct entities may bear the same thematic role in the same eventuality.

$$\forall e \forall y [\forall x (\forall y \forall z \exists \theta_i(e, x) \land \theta_i(y, z) \to y = z)]$$

The formal representations of a predicate $\phi'$ in the two theories are related by the regularity in (3.14), assuming that the set of thematic roles from which $\theta_1, \ldots, \theta_n$ are chosen covers all argument positions of all predicates of the language. The latter condition, strictly speaking, is not to be taken for granted, since the only way to ensure that a given set meets this condition is to test it empirically against all predicates in the lexicon.

$$\phi'' = \lambda x \ldots \lambda x_n \exists \phi''(e) \land \theta_1(e, x_1) \land \ldots \land \theta_n(e, x_n)$$

I shall not engage in comparing the adequacy of the two described systems or commit myself to one of them here. For the sake of brevity, I shall use both notations as a shortcut and a full-form of one another, leaving out the single and double primes identifying the translation of predicates as pertaining to an ordered arguments or an event-based system.

### 3.1.3 Run times

The positions in the argument frame of $\phi'$ in (3.4) and the thematic roles associated with $\phi''$ in (3.10) intended to establish the relations between the eventuality and the denotata of the noun and adverbial constituents of the clause.

Since eventuality happen in time, their relation to their run times is of particular importance for a discussion of aspectuality. Krifka 1991 introduces a temporal trace function $\tau$, which maps the domain of eventuality onto the domain of times.

In order to obtain more direct access to the run time, I will include it into the argument frame of the predicate as an additional argument bearing a special thematic role. This leads to the notations in (3.15a) as an alternative to (3.15b).

$$\exists t \left( \phi'(t, x_1, \ldots, x_n) \land \phi''(e) \land \tau(e) = t \right)$$

In the preceding chapter the notation $\phi(t)$ was used for the statement "a $\phi$-eventuality happens at time $t$" (it is the time of a $\phi$-eventuality), without subjecting the predicate $\phi$ to any further analysis. That notation was therefore equivalent to $\exists e \phi''(e) \land \tau(e) = t$ in an event-based system. The one in (3.15a) is merely an extension of $\tau$, in which the arguments $x_1, \ldots, x_n$ have also been included. I shall hereafter make a point of listing the run time in $\tau$ position in the shortcut notation, a convention I didn’t adhere to in (1.59). In the full notation thematic roles are of course accessed by name, not number, and I shall use $\phi''(c)$ (a stylized image of the face of a clock) for the run time.

It appears expedient to rule out the possibility of having distinct eventuality with identical predicates and argument sets, that is, to require the validity of (3.16).

$$\forall e \forall y (\phi' \land e' \in \phi \land \forall x \forall y \exists e (\phi(x, y) \leftrightarrow \phi'(e', x) \to e = e'))$$

Krifka 1991 does allow for this possibility, but if run times are included in the argument frames of predicates, it is no longer required by actual linguistic evidence. It is ruled out if (3.17), proposed by Gennaro Chierchia and reworded here as in Dowty 1989, is adopted as definition of the concept of eventuality.

(3.17) An **eventuality** is an $(n+1)$-tuple $(\phi, x_1, \ldots, x_n)$, where $\phi$ is an $n$-place property and $x_1, \ldots, x_n$ are individuals.
3.2. Properties of Thematic Roles

This formulation is intended for an ordered argument system. Within a neo-Davidsonian thematic role system it can assume the following form:

(3.18) An eventuality is a pair \( \langle \phi, \langle (\theta_1, x_1), \ldots, (\theta_n, x_n) \rangle \rangle \), where \( \phi \) and \( x_1, \ldots, x_n \) have the same meaning as in (3.17) and \( \langle \theta_1, \ldots, \theta_n \rangle = \Theta(\phi) \) is the set of all thematic roles of the predicate \( \phi \).

A consequence from this definition of eventuality is that (3.13), the requirement for uniqueness of the thematic role bearer, is trivially met.

It should be noted that under (3.18) eventualities become syntactic objects, which can be constructed at will, and therefore it is necessary to speak of their occurrence rather than their existence in contexts such as (3.10).

3.2 Properties of Thematic Roles

In this section I shall look at the set of properties of thematic relations examined by Krifka 1991, but using directly the run time instead of the eventuality and applying the treatment of plurality outlined so far. The impact of the properties of thematic relations on aspectual composition will be discussed in Section 3.3.

3.2.1 Uniqueness of events and identification sets

The property uniqueness of events indicates that there is only one eventuality of the relevant kind related to the entity by the thematic relation \( \theta_1 \); for example, for a specific glass of wine there can be only one drinking event in which it appears as patient. This property accounts for the distinction between affected and consumed objects (patients), on the one hand, and stimuli or affected objects (themes), on the other.

(3.19) \[ \forall \phi \forall \psi \forall \theta \forall c : \langle \theta, c, \phi \rangle \land \langle \theta^*, c^*, \psi \rangle \rightarrow c = c^* \]

Uniqueness of events entails uniqueness of run times, since there is only one eventuality, there is also a single run time associated with it.

This property is used, inter alia, to inhibit undesired iterative readings, guaranteeing the quantised reference of the predicate applied to the eventuality. With some predicates, however, iteration is excluded even though none of the thematic relations has on its own the property uniqueness of events. An example is discover, a lexical achievement represented as the predicate \( D^{\alpha, \alpha}(\theta, Th, Ag) \). Despite (3.21a) and (3.21b) and the ensuing acceptability of (3.20a) and (3.20b), the iterative reading of (3.20c), which would be enforced by the duration adverbial, is inhibited by (3.21c):}

(3.20) a. Tourists discovered that quaint little village all summer.
 b. I discovered new quaint little villages all summer.
 c. I discovered that quaint little village (*all summer*)

(3.21) a. \( \neg UNI^{\alpha, \alpha}( TH ) \) (a theme may be discovered many times by different agents);
 b. \( \neg UNI^{\alpha, \alpha}( AG ) \) (an agent can make many discoveries);
 c. a given agent can discover a certain theme at most once.\(^2\)

\(^2\)This presupposes the use of discover in the sense of: become aware of the existence of,... obtain sight or knowledge of (something) previously unknown for the first time, not any of the metaphoric senses based thereon, which allow for an iterative reading.

Therefore it appears expedient that the uniqueness property be predicated of sets of thematic relations rather than individual roles. I shall use the notation \( \phi ! \Phi \) for "these can be at most one way to satisfy \( \psi \) or \( \psi \), if the values of the roles in the set \( \Phi \) are fixed"; and shall call \( \Phi \) an identification set of the predicate \( \phi \).

(3.22) \[ \phi ! \Phi \rightarrow \left( \psi \land \left( \phi \land \psi \right) \land \psi \right) \rightarrow \forall \psi \left( \forall \theta \left( \psi \land \psi \right) \rightarrow \psi \right) \]

Obviously any superset of an identification set of a predicate is also an identification set of it, and since it was assumed that, as per (3.16), eventualities with the same predicate have to differ in the values of at least one thematic role in order to be distinct, the set \( \Theta(\phi) \) of all thematic roles which can be had by a predicate \( \phi \) is trivially an identification set.

(3.23) \[ \forall \psi \left( \phi ! \Psi \land \psi \right) \]

The following rule (3.24) is a generalisation of (1.33) for predicatives whose arity is greater than one. A predicative can't be properly pluralised relative to a termset if it has an identification set which doesn't include any of the roles in that termset:

(3.24) \[ \exists \phi \left( \phi ! \Phi \land \exists \theta \left( \psi \land \psi \right) \rightarrow \psi \land \psi \right) \]

3.2.2 Considerations on identification sets

I shall now discuss the properties of several kinds of identification sets and their relation to the properties of thematic relations.

To begin with the simplest case, if a predicate has an empty identification set, it obviously has either an empty or a singleton extension. The latter subcase corresponds to the property singular reference,

(3.25) \[ \forall \phi \left( \neg UNI^{\alpha, \alpha} \land \exists \theta \left( \psi \land \psi \right) \rightarrow x = y \right) \]

which is had, inter alia, by predicatives translating definite noun phrases (such as the letter) and is used for eliminating undesirable iterative readings. This shall be discussed in more detail in Section 3.3.

The case of a singleton identification set generalises Krifka's uniqueness of events, contributing the possibility for the single identifying role to be the run time itself. In this case simultaneous eventualities of the corresponding kind are excluded. For example, if \( K \left( 1, \theta, Th \right) \) is the predicate king of England, then \( K \left( 1, \psi \right) \) expresses the fact that at any time there is at most one king of England, so that (3.26) has to express a pair of non-overlapping eventualities.

(3.26) Edward and George were kings of England.

Similarly, if \( M^{\alpha, \alpha}(\theta, Th, So, Go) \) in the predicate move Th from So to Go in chess, then \( M \left( 1, \psi \right) \) (only one move is made at a time); if \( S^{\alpha, \alpha}(\theta, Lo) \) in the shoot at Lo in the battleships game, then \( S \left( 1, \psi \right) \) (only one shot is made at a time) as well as \( S \left( 1, \psi \right) \) (at most one shot can be performed at every field).

The predicate \( D \) for discover presents an example of a doubleton identification set. We can rewrite the statements in (3.21) as (3.27):

(3.27) a. \( \neg D \left( \theta, Ag \right) \);
 b. \( \neg D \left( \theta, Th \right) \);
 c. \( D \left( \theta, Ag, Th \right) \).
3.2. Properties of Thematic Roles

Doubleton identification sets involving the time of application as one of the roles indicate the commitment (engagement) of that role for the run time. For example, \( \phi ! (c, A, g_1) \) holds if \( \phi \) is a predicate such as read or drink, whose agent can be involved in at most one eventuality of the designated type at a time. Also, if \( \phi \equiv \lambda (c, A, g_1), \) the translation of a relational noun or the head of a possessive construction, \( \lambda (c, A, g_1) \) is interpreted as \( \lambda (c, A, g_1) \) at time \( \phi! (c, A, g_1) \) then \( \phi \equiv (c, A, g_1) \) if a theme can be related to no more than one collocate and \( \phi \equiv (c, A, g_1) \) if no more than one theme can be related to any individual collocate.

Since eventualities are identified unambiguously by their predicates and argument frames, identification sets containing all thematic roles but one, that is, having the form \( \Theta(\phi) \{ x \} \), correspond to Kövecses’ property uniqueness of objects, which expresses the fact that an eventuality is related to a specific object, for example, a drinking of a glass of wine is related via the patient role to nothing but this glass of wine.

\[
\forall \phi \{ (\text{read} \circ (c, A) \land \text{wine}(x)) \} \rightarrow x = x'
\]

Regarding this property, Kövecses notes the following:

Obviously, it does not hold for the stimulus relation, as e.g. I can see a zebra and, with the same event of seeing, see the mane of the zebra as well. And it does not obtain with affected objects, as e.g. I can touch a shoulder and a person with the same event of touching.

By virtue of (3.13), the requirement for uniqueness of the thematic role bearers, the eventualities shall only be required to be ceteris paribus, while remaining distinct, and the connexion between the seeing of the mane and the seeing of the zebra, or the touching of the shoulder and the touching of the person, can be established by meaning postulates capitalizing respectively on the fact that the mane is a material part of the zebra (as in \( \exists r \{ x \subseteq z \} \)) and that the shoulder is a material part of the person.

In some cases uniqueness of events may or may not obtain depending on whether the predicate is given a type-oriented or a token-oriented reading. For example, the predicate is something which can only be done once to the particular physical copy of the letter, but any number of times to the text. Since the latter reading can be paraphrased as ‘type’ (in the token-oriented sense) a copy of the letter”, it can be said that the type-oriented predicate performs a kind of implicit type conversion. In the formula in (3.20) \( \phi \) is the token-oriented version of the predicate \( \phi \) and \( \forall (x) \) stands for ‘\( x \) is an instance of \( x \).

Thus only the patient role of the predicate has the property uniqueness of events, because different choices of \( z \) can make for different \( \phi \)-eventualities which share the same \( x \).

The object-event homomorphism is brought forth by two mapping properties. A thematic relation, \( \phi \rightarrow \text{mapping to objects} \) if every part of the eventuality corresponds to a part of the object,

\[
\forall \phi \{ (\text{map} \circ \text{object}) \} \rightarrow \forall \phi \{ (\text{object}) \} \land \text{event} \subseteq \text{object} \land \forall \phi \{ (\text{object}) \}
\]

and it has the property \( \text{mapping to events} \) if every part of the object corresponds to a part of the eventuality.

\[
\forall \phi \{ (\text{map} \circ \text{event}) \} \rightarrow \forall \phi \{ (\text{event}) \} \land \text{object} \subseteq \text{event} \land \forall \phi \{ (\text{event}) \}
\]

Kövecses observes that these properties seem to be sound assumptions for gradual patient relations. Take as an example the reading of a book; every part of the book corresponds to a part of the reading and vice versa. With other thematic relations, these properties normally do not obtain; for example, there is no correspondence between parts of the person that is reading and the reading event. But note that as we can have sum individuals, it is possible that mapping to events and mapping to objects (as well as uniqueness of objects) apply to other thematic relations in similar circumstances as well. As an example, consider see seven zebras. Even if a single experience is involved, this predicate can be applied to events with different temporal structure, for example to events where seven zebras are seen simultaneously, or to the sum of seven consecutive events, in each of which a single zebra was seen. Now, in the second case, it does make sense to speak of mapping to events and mapping to objects, as for every part of the complex seeing event (down to the observations of single zebras) there is a part of the sum individual of the zebras which is seen in this event.

In a theory such as the present one, in which a typifying mechanism is used to control the structure of the terms to which predicates apply, one can reformulate the quoted paragraph more concisely by saying that the mapping properties can always obtain (though they don’t necessarily have to) if the argument is of a type higher than the one expected by the predicate, which is then pluralized with respect to this argument (but not otherwise). This is a direct consequence of the need for the predicate to be lift and the resulting ungrowing of the argument with the possibility of distribution. Since mapping licensed by the thematic relations has the same effect on the aspectuality of the clause as mapping caused by the compound structure of the argument, it is my opinion that the introduction of types into the theory allows the capture of an important generalization.

In the example of see seven zebras the verb see is represented as \( S^{\text{ont}, \text{t}}(c, A, g_1) \). The theme seven zebras, however, is of type 2 (it ultimately corresponds to a structure such as \( \{ (c, A, g_1) \} \)). The predicate may be applied to it by being pluralised relative to it and distributed over its components, as in (3.32). Alternatively, the pluralisation and the subsequent distribution may affect the term of the run time and the theme, as in (3.33) in either case the distribution is preceded by ungrowing. In the formula in (3.32–3.33) \( x \) stands for the experience, a role with which we are not concerned here.

\[
S^{\text{ont}, \text{t}}(c, A, g_1) = \bigcup_{1 \leq i \leq n} S^{\text{ont}, \text{t}}(c, A, g_i)
\]

\[
S^{\text{ont}, \text{t}}(c, A, g_1) = \bigcup_{1 \leq i \leq n} S^{\text{ont}, \text{t}}(c, A, g_i)
\]

This means that while see a zebra is of type 0 relative to the run time (applying to moment), see seven zebras is of type 1 (applying to intervals). The same considerations hold for the case of see a/the soul of zebras, if the seeing takes place zebra by zebra.

\footnote{The expressions ‘see a/the soul of’ mean that the event of seeing is accomplished in a more general way, by focusing on the part of the event itself. In this case, the predicate is an event, and it expresses the fact that an eventual is related to a specific object, for example, a drinking of a glass of wine is related via the patient role to nothing but this glass of wine.}

\footnote{The expressions ‘see a/the soul of’ mean that the event of seeing is accomplished in a more general way, by focusing on the part of the event itself. In this case, the predicate is an event, and it expresses the fact that an eventual is related to a specific object, for example, a drinking of a glass of wine is related via the patient role to nothing but this glass of wine.}

\footnote{The expressions ‘see a/the soul of’ mean that the event of seeing is accomplished in a more general way, by focusing on the part of the event itself. In this case, the predicate is an event, and it expresses the fact that an eventual is related to a specific object, for example, a drinking of a glass of wine is related via the patient role to nothing but this glass of wine.}

\footnote{The expressions ‘see a/the soul of’ mean that the event of seeing is accomplished in a more general way, by focusing on the part of the event itself. In this case, the predicate is an event, and it expresses the fact that an eventual is related to a specific object, for example, a drinking of a glass of wine is related via the patient role to nothing but this glass of wine.}

\footnote{The expressions ‘see a/the soul of’ mean that the event of seeing is accomplished in a more general way, by focusing on the part of the event itself. In this case, the predicate is an event, and it expresses the fact that an eventual is related to a specific object, for example, a drinking of a glass of wine is related via the patient role to nothing but this glass of wine.}

\footnote{The expressions ‘see a/the soul of’ mean that the event of seeing is accomplished in a more general way, by focusing on the part of the event itself. In this case, the predicate is an event, and it expresses the fact that an eventual is related to a specific object, for example, a drinking of a glass of wine is related via the patient role to nothing but this glass of wine.}
3.2. Properties of Thematic Roles

In a similar way, while the theme of see is of type 1 (a single entity), the theme of see in an hour has to be of type 2 (a group), since the type of an hour is also higher than the one normally expected by $\theta$.

Thus the unsatisfactory of example (3.1b), repeated here as (3.34), is formally parallel to the unsatisfactory of examples (3.2b) and (3.3b), repeated here as (3.38–3.36).

(3.34) John saw a zebra in an hour.

(3.35) The horse gathes in the field.

(3.36) I counted the horse.

Kripke also considers some examples in which the two mapping properties apply with certain restrictions. By definition there is no mapping to events unless every part of the object corresponds to a part of the eventuality, but what counts as a part of the object may depend on the predicate, which has the option of selecting specific aspects of it. For example, eating the apple affects (and distributes over) its volume, while its peeling or washing affects its surface. Furthermore, if the apple has been cut in half and what is referred to as the apple is the group of the two halves, the cutting will have led to the creation of two new surface areas, which would have to be affected by washing the apple, but not by peeling the apple.$^8$

The predicate thus performs a kind of implicit type conversion, $\phi$ the apple part of $x$, where $\phi_0$ is a version of $\phi$ to which mapping to events applies without any reservation. In the general formula in (3.37), $\eta_0 (\text{Co}, \text{Th})$ stands for 'the apple part of Co'. As shown in (3.38), the case for eat, the conversion makes distribution over the territory of the run time and the object possible:

$$\phi^c(t, x) \rightarrow \exists \eta \exists \eta_0 (\text{Co}, \text{Th}) \wedge \eta(x, x)$$

$$E^c(t, x) \rightarrow \exists \eta \exists \eta_0 (\text{Co}, \text{Th}) \wedge \eta(x, x)$$

The case with mapping to objects is similar. The process of building a house is a gradual one, yet some subevents of the building (e.g., the erection of a scaffold and its subsequent disassembly) do not correspond to any part of the object. This indicates that, strictly speaking, mapping to objects characterizes the corresponding role of the principal subevent, the one which actually brings the house into being and of which the entire complex event is a representative plural. Here, too, the conversion makes distribution possible:

$$\phi = \text{NBR} \phi_0$$

$$\phi^c(t, x) \rightarrow \exists \eta \exists \eta_0 (\text{Co}, \text{Th}) \wedge \eta(x, x)$$

The two mapping properties, in conjunction with uniqueness of objects, characterize what Kripke calls gradual thematic relations—relations which transfer the reference properties of the argument to the eventuality. The requirement of uniqueness of objects appears superfluous if mapping is accounted for by type coordination, which is actually a stronger mechanism than the definitions in (3.30–3.31), since the mapping relations can trivially obtain in cases where intuitively it makes little sense to talk of object-event homomorphism; for example, the achievement see has mapping to objects, because the eventuality has no proper parts, and bring has mapping to events at any level, because every part of the object corresponds to a part of the event (though not necessarily a proper part), but in neither case is there any distribution involving the run time. For this reason I will reformulate graduality as a property of all thematic roles whose fillers are of a type higher than the one expected by the predicate.

3.3 Composition of Predicates

This section is devoted to discussing the formal details of the mechanism by which the verbal expression corresponding to the predicate $\alpha \cdot \eta (\text{Co}, \text{Th})$ is combined with the nominal expression corresponding to the predicate $\delta^m$ (Th). (I assume that theme is the thematic role universally assigned by nominal expressions to their referents.) No requirements are imposed in this section on the syntactic function of the nominal constituent translated by $\delta$ in the clause, nor is it implied that the predicate $\alpha$ need be a translation of what would be recognised as a constituent (such as a verb phrase) in any particular syntactic theory.

For the predicates $\alpha$ and $\delta$ to be composed means that they must share a thematic role filler; in this case the Th of $\alpha$ is the theme of $\delta$. The general schema for the composition of the $m$-place predicate $\phi$ and the $n$-place predicate $\psi$, where the $i$th argument of $\phi$ (the bearer of the role $\theta_i$) is the $j$th argument of $\psi$ (the bearer of the role $\theta_j$), is as follows:

$$\phi^\delta = \exists \eta \exists \eta_0 (\text{Co}, \text{Th}) \wedge \psi \wedge \eta \wedge \eta_0$$

The arties of the two predicates are established, and the arguments involved in the composition identified, on the basis of information provided by the syntax. This means that the syntax must have access to the structure of the argument frames.

The identification sets of the $(m + n - 1)$-place predicate $\phi^\delta \eta_1 \psi$, which is the result of the composition, are derived from the identification sets of the two components. If the sets $\Phi$ and $\Psi$ identify respectively a $\phi$- and a $\psi$-eventuality, then a $\phi^\delta \eta_1 \psi$-eventuality is identified by the union of $\Phi$ and $\Psi$, but excluding 0 and 0, unless they both participate in the identification,

$$(3.42) \Phi \wedge \Psi \wedge \neg \exists \theta \in \Phi \wedge \neg \exists \theta \in \Psi$$

In the latter case there can be multiple $(\phi^\delta \eta_1 \psi)$-eventualities which share all $x_0$ in $\Phi \setminus \{0\}$ and all $y_0$ in $\Psi \setminus \{0\}$, but differ in the choice of the entity $x$. This is the reason for which uniqueness of events does not obtain for type-oriented predicates even when it does for their token-oriented counterparts: adhering to the notation of (3.29), $\phi = \phi_0^\delta \eta_1 \psi \wedge \neg \exists \theta \in \Phi$ and $\phi_0^\delta \eta_1 \psi \wedge \neg \exists \theta \in \Psi$ does not follow from $\phi \wedge \neg \exists \theta \in \Phi$ and $\psi \wedge \neg \exists \theta \in \Psi$.

A prerequisite for the composition of $\alpha^m \cdot \eta (\text{Co}, \text{Th})$ and $\delta^m$ (Th) is the compatibility of the types of the two predicates relative to the shared argument. According to the conventions of Subsection 1.1.4, it is required that $m \leq m'$, so that sentences such as (3.30) and (3.36), in which that is not the case, are ruled out directly.

Depending on whether $m = m'$ or $m < m'$, as well as on the presence of pluralisation on $(\alpha^\delta \eta_1 \psi) \Theta$ and on its effect, several cases are to be distinguished. These will be considered in the rest of this section.

3.3.1 Direct composition

If $m = m'$ (the nominal expression is of the type expected by the predicate), the verbal expression is represented as a singular predicate relative to $\Theta$, since regular pluralisation relative
3.3. Composition of Predicates

To Θ, on its own or in a termset, would be discharged by distributivity, and proper pluralization is inapplicable. The composition of $\alpha_{m}^{n}(\varnothing, \Theta)$ and $\delta_{m}^{n}(\Theta)$ yields the form in (3.43),

$$\gamma^{n}(\emptyset) = (\alpha_{m}^{n}(\emptyset, \Theta)) = \exists x(\delta(x, t) \land \alpha_{m}^{n}(x, t))$$

and if the composite predicate is singular, the predicate translating the verbal expression is singular relative to the run time as well, and the reading obtained refers to a single event.

$$\gamma^{n}(t) \rightarrow \exists x(\delta^{n}(x) \land \alpha^{n}(x, t, x))$$

Under this reading, which is always available, regardless of the identification sets of the predicates $\alpha$ and $\delta$, example (3.3c), repeated here as (3.45), refers to the speaker’s determining the number of herds, without being concerned with the individual horses. In the formula below $C_{1,1}^{m,1}(\Theta, T h, A g)$, where $m \geq 2$, translates count, while $H_{1}^{1}(T h)$ translates (be) a herd of horses.

$$C_{1,1}^{m,1}(t, \emptyset) \exists x(\delta^{m}(x) \land \alpha_{m}^{n}(x, t, x))$$

(3.46) I counted the herds of horses.

Other examples of direct composition yielding a singular predicate are (3.1) and (3.2b), which are repeated below accompanied by their translations, where the predicate $S_{1,1}^{1,1}(\Theta, P t, A g)$ stands for shoot, $B_{1,1}^{1,1}(\Theta, P t, A g)$ for bring, $Z_{1}^{1}(T h)$ for (be) a zebra and $I_{1}$ for John.

(3.47) John shot a zebra.

$$\exists x(\delta(x) \land \alpha_{1}^{1}(x, t, i))$$

(3.48) John brought a zebra.

$$\exists x(\delta(x) \land \alpha_{1}^{1}(x, t, i))$$

The difference in the aspectual classes of the two verbs is reflected in the types of the corresponding predicates relative to the run time.

3.3.2 Lifting composition

If $m < n$ (the nominal expression is of a type higher than the one expected by the predicate) and the verbal expression is represented as a singular predicate relative to Θ (i.e., it has the form $\alpha_{m}^{n}$ or $\delta_{m}^{n}$), the lifting of the predicate lowers the type of the argument by flattening it, and it is treated as if it were of type $m-1$. Under this reading example (3.46) refers to determining the total number of horses in the herd.

$$C_{1,2}^{1,1}(t, \emptyset) \exists x(\delta^{1}(x) \land \alpha_{1}^{1}(x, t, i))$$

If the verbal expression is represented as a predicate pluralised relative to Θ or to a termset which contains it, the lifting causes the ungrouping of the argument $x_{1} \cup x_{2}$.

$$\gamma^{n}(t) \rightarrow \exists x_{1}(\delta^{n}(x_{1}) \land \alpha^{n}(x_{1}, t, x_{1}))$$

This case is illustrated by (3.32), where all zebras are mapped to a single moment in which the seeing event happens.

The latter reading is unavailable if $\alpha_{1}^{1}(\emptyset)$, that is, if Θ has the property uniqueness of objects. In that case the only option is for the predicate to be pluralised relative to the termset of Θ and the run time and to distribute over both. The reading obtained is the gradual one,

$$\gamma^{n}(t) \rightarrow \exists x(\delta^{n}(x) \land \alpha^{n}(x, t, x))$$

3.3. Composition of Predicates

in which the argument and the run time are mapped componentwise to one another and the reference properties of the argument are inherited by the composite predicate.

$$\gamma^{n}(t) \rightarrow \exists x(\delta^{n}(x) \land \alpha^{n}(x, t, x))$$

Since the predicate is pluralised, and in (3.3a) is also lifted, relative to the termset of the run time and the patient, so that the ungrouping and the distribution necessarily affect both, the run time is a sum or a group of moments if the patient is introduced as a sum or a group of zebras.

The gradual reading is always available, regardless of the identification sets of the predicates. It is illustrated by (3.3b), as well as by (3.2a) and (3.3a), which are repeated below.

(3.51) John shot zebras.

$$\exists x(\delta^{1}(x) \land \alpha_{1}^{1}(x, t, i))$$

(3.52) John shot seven zebras.

$$\exists x(\delta^{1}(x) \land \alpha_{1}^{1}(x, t, i))$$

It also yields the last interpretation of (3.45), which refers to determining the number of horses in each herd separately.

$$C_{1,1}^{1,1}(t, \emptyset) \exists x_{1}(\delta^{1}(x_{1}) \land \alpha_{1}(x_{1}, t, i))$$

The same regularity applies to distribution over the parts (that is, the atoms) of an individual entity or quantity of stuff.

(3.54) I drank the wine.

$$D_{1,1}^{1,1}(t, \emptyset) \exists x_{1}(\delta^{1}(x_{1}) \land \alpha_{1}(x_{1}, t, i))$$

Here $D_{1,1}^{1,1}(\Theta, P t, A g)$ translates drunk and $W_{1}^{1}(T h)$ (be a sum of wine atoms) translates (be) wine. The drinking maps 'wine atoms' to moments and thereby also maps the entire amount of wine to an interval containing all drinking moments.

The treatment of mass terms as plurals of a lower type thus provides a general insight into mapping conditioned by pluralisation, which is characteristic for gradual thematic relations.

3.3.3 Plural composition

If the composite predicate is pluralised, the reading obtained is durative or iterative.

$$\gamma^{n}(t) \rightarrow \exists x(\delta^{n}(x) \land \alpha^{n}(x, t, x))$$

This formula allows for the value of $n$ to vary. In a distinguished subcase this option is not exploited, and the choice of $n$ is the same for all times, with the effect that the pluralisation applies to the run time position of n alone.

$$\exists x(\delta^{n}(x) \land \alpha^{n}(x, t, x))$$

The formula is in fact a simplification of what it should be, as it makes the assumption that there is a unique counting time for each herd $t$, which, strictly speaking, is incorrect, in so far as the event can be iterated. The same is true for the analogous formula in the expression.

This view implies equality between the cardinalities of the set of atoms within the entity and the set of moments within the interval. This is indeed correct with respect to spatially and temporally discrete worlds, such as the world of battleships, for example, given that a cruiser occupies 4 fields, it takes 4 shots to sink, as does the group of 2 tankers or 4 submarines. In a continuous universe such as the 'real world', where measurements are made in real numbers, all cardinalities of sets of this kind are equal to $\aleph_{0}$.7
3.3. Composition of Predicates

The latter reading may be enforced or inhibited by the identification sets of α, which are determined in accordance with (3.42). If either α has singular reference or δ has singular reference and θ has the property uniqueness of events, then the empty set is an identification set of α, which rules out the iteration of the event.

(3.58) α ! θ \lor \delta ! θ \land α ! \theta(θ) \rightarrow (α^{\delta/\theta}θ)^{\alpha} ! θ

Since the predicate δ translates a nominal expression, it has singular reference if it is of the form ‘identity to α’ (where α is any given entity), a type of predicate for which Link 1083 introduces (though without discussion) the notation Iα.

(3.59) Iα = Λx[x = a]

(3.60) (α^{θ/\delta}Iα) = Λα(α, a)

From (3.42) it follows that the setting of an argument to a given value entails the exclusion of the corresponding thematic role from the identification sets in which it appears. All other identification sets of α are inherited with no alteration by (α^{θ/\delta}Iα).

For example, the sentence

(3.61) An orc slew Balin.

\lambda x(x(\alpha)(x) \land S^1(a,1)(b, x))

denotes an event which cannot be iterated. The predicate slain Balin has singular reference because (be) Balin does and the patient role of slain, whether regarded specifically as a ‘slayer’ or more generally as a destroyed patient, has the property uniqueness of events.

(3.62) Iα \land \theta ! \Lambda [Pr] \rightarrow (\delta^{\theta/\delta}Iα) ! \theta

Since the agent of slain does not appear in any identification set, its inclusion, whether it takes place before or after the introduction of the patient, makes no difference; the same result is obtained if the sentence is analysed as applying the predicate an orc slew (or the semantically equivalent was slain by an orc) to the argument Balin rather than the predicate slain Balin to the argument an orc. By contrast, the event expressed in the sentence

(3.63) Glims slew an orc.

\lambda x(x(\alpha)(x) \land S^1(a,1)(b, x))

can be iterated, provided a different orc is slain on each occasion.

Similarly, the single-event reading is the only available choice in (3.65a), where δ has singular reference, but is unavailable in (3.65b), where α ! \theta. For such a restriction that affects the fact no bullet can wound the same victim more than once,

(3.64) W ! [Pt, E] \rightarrow \forall x(W^{\delta/\theta}(x, E))[\forall x]

even though neither the patient nor the effecter of wound have the property uniqueness of events on their own. Example (3.65c), where neither restriction holds, leaves open the question whether the arrow was the same one on both occasions. The predicate W^{1}(\alpha, Pt, E) stands for wound, W^{\delta/\theta}(\alpha) for (be) a bullet, α^\delta for this arrow and m^\alpha for Miles.

(3.65) a. Miles was wounded by this arrow twice.

\lambda x(W^{(1)(x, m, a)} \land W^{(1, m, a)}) \rightarrow W^{(1, m, a)} \land W^{(1, m, a)}

3.4. Graduality and Degree of Affectedness

b. Miles was wounded by a bullet twice.

\lambda x(W^{(1)(x, m, a)} \land W^{(1, m, a)}) \rightarrow \exists x W^{(1)(x, m, a)} \land W^{(1, m, a)} \land \exists x W^{(1, m, a)}

c. Miles was wounded by an arrow twice.

Direct composition can also yield a plural predicate if α is already pluralised relative to the run time because of the lexical properties of the verb or the impact of another argument. An example is (3.2b), repeated below.

(3.66) John carried a zebra.

\exists x(Z^1(x) \land C^1,1(1, z, x))

C^1,1(1, z, x) translates carry, a predicate pluralised with respect to the run time because the verb it translates is in a lexically existential.

The same considerations apply in the case of lifting composition, where a durative or iterative reading is obtained by pluralisation relative to the run time,

(3.67) γ^\theta(t) \rightarrow \lambda \forall x[x(\alpha)(x) \land \alpha^\theta(\alpha)^{\gamma}(x, x)](t)

and in a distinguished subspace the choice of x is the same for all t, with the effect that the pluralisation applies to the run time position of α alone.

(3.68) \lambda \exists x[x(\alpha) \land \alpha^\theta]^[\gamma(t, x)]

The reading is unavailable if α ! \theta or α ! \theta.

3.4. Graduality and Degree of Affectedness

In this section I shall explore the mechanism of aspectual composition for gradual thematic roles, that is, roles characterised by the two mapping relations. As the name suggests, the volume of the bearer of such a thematic role is spanned gradually by the process as time progresses, and may be affected either partially or totally in the course of the entire event, depending on conditions which I shall discuss presently.

In the previous section we saw how the formal representations of (3.1), (3.2a) and (3.3a), repeated below, are obtained and how the aspectual properties of the patient are transferred to the eventuality as a result of the fact that the pluralisation and the type conversion affect the termset of that argument and the run time.

(3.69) a. John shot a zebra.

\exists x(Z^1(x) \land S^1,1(t, z, x))

b. John shot zebras.

\exists x[Z^1(x) \land S^1,1(1, z, x)]

c. John shot some zebras.

\exists x[Z^1(x) \land S^1,1(1, z, x)]

We also saw that the same considerations apply to mass terms, so that (3.70a) and (3.70b) are formally parallel to (3.2a) and (3.3a), respectively.

(3.70) a. I drank wine.

\exists x[\forall x(W^1(\alpha) \land S^1,1(1, x, w))] \land D^1,1(t, w, 1)]

b. I drank a litre of wine.

\exists x[\forall x[W^1(\alpha) \land S^1,1(1, x, w)] \land D^1,1(t, w, 1)]
The formula appears to indicate that *wone* and a *bire of wine* are modelled as distinct entities. In reality this is no more than an artifact of the convention according to which the corresponding predicates belong to different types: \( \exists v(\ldots [u v] \ldots) \) expresses the same thing as \( \exists \forall v(\ldots [w] \ldots) \), whereby the two are related by \( v = w \).

Sentences (3.70a) and (3.70b) can be visualised by the two space-time diagrams in Figure 3.2.

The curve in each diagram represents the drinking process, which maps every amount of wine to the time of its consumption by the speaker.

![Figure 3.2: Space-time diagrams for wine-drinking.](image)

The predicate which translates the verb, \( S^{0,1,1}(\sigma, \text{Th, Ag}) \) or \( D^{0,0,0,1}(\alpha, \text{Pt, Ag}) \), is pluralised with respect to the term on the role corresponding to the object and the run time and distributed over the two. (Polarisation with respect to the role alone is ruled out because in both cases \( \sigma, \text{Ag} \) is an identification set, hence the assumption that all zebras are not shot, and all the wine is not drunk, in a single moment.) As a result a seeing or drinking moment is counterposed to each of an unspecified number of zebras or wine atoms, and the run time \( t \) is equated to the sum of all of these moments.

The proposed translations of (3.3a) and (3.70a) are in fact equivalent to (3.71) and (3.72), where the singular counterpart of the predicate which translates the object is composed with the predicate which translates the verb, yielding respectively \( ST \text{p} \text{f}_1 \text{p} \text{w}_1 \) and \( D \text{p} \text{w}_1 \).

\[
(3.71)
\quad \forall \exists (W^0(t) \land D^{0,0,0,1}(1, i) \land t)
\]

\[
(3.72)
\quad \forall \exists (W^0(t) \land D^{0,0,0,1}(1, i) \land t)
\]

According to the latter formulation, the run time is a sum of moments in each of which a zebra is seen or a wine atom is drunk.

The eventuality, which in those two sentences is an activity, can be quantised by a duration adverbial, as in (3.73),

\[
(3.73) \quad I \text{ drank wine for half an hour.} \quad \exists \forall (W^0(t) \land D^{0,0,0,1}(1, i) \land t)
\]

to which the space-time diagram in Figure 3.3 corresponds. The run time has to be a group of moments, because it is the argument of a predicate of type 1, namely \( D^{0,0,0,1} \), which holds of intervals with a fixed duration.

Here, too, the pattern can be composed with the verb, yielding \( D \text{p} \text{f}_1 \text{p} \text{w}_1 \) as a translation of the verb phrase *drank wine*.

\[
(3.74) \quad D^{0,0,0,1}(1, i) \land D \text{p} \text{f}_1 \text{p} \text{w}_1 \land t
\]

In (3.3a) and (3.70b) the sentence attempts to supply to the predicate which translates the verb an argument belonging to a type higher than the one expected. The application is carried out by having the predicate which translates the verb lifted before being distributed over the termset. As a result the run time \( t \) is equated to the interval which is the group of all moments involved.

The object is totally affected by the event.

Not all arguments which can be totally affected need be, however, particularly when there is some variation in the choice of the argument which is to act as a measure of telicity by being totally or partially affected.

In their discussion of (3.75)

\[
(3.75)
\quad \text{a. Bill loaded the hay on the truck.}
\]
\[
\text{b. Bill loaded the truck with the hay.}
\]

Poley & Van Valin 1984 state that the two sentences have the same underlying logical structure, which is formulated as

\[
(3.76)
\quad \text{DO}([\text{do}(''x'')]) \text{ cause } \text{BECOME-at}(''y, z'')
\]

in their notation. On the basis of this structure the semantic relations (i.e., the thematic roles) borne by the constituents are determined: \( y \) (the hay) is a **theme** and \( z \) (the truck) is a **locative**, because they are respectively the first and the second argument of the abstract predicate **be-at**.

The **agent**, by virtue of being the first argument of the operator **DO**, whose second argument is a construct which in itself would have made \( x \) an **effector**. The syntactic contrast between the two examples is brought about by the different choice of the constituent to which the **undergoer** macrorole (a category mediating between syntax and semantics in Role and Reference Grammar) is assigned. In (3.76a) the undergoer is the theme the hay, in (3.76b) it is the locative the truck. Both theme and locative are relatively low in the hierarchy of semantic relations and therefore either one is a plausible choice for the undergoer macrorole, on the other hand, to agents, such as Bill in this example, it may not be assigned.

With respect to the aspectual behaviour of the nominal constituents of two sentences, one of which in either case is responsible for the telicity of the event, they say the following.

Notice that (3.76a) implies that all the hay was loaded but not that the truck was full, whereas (3.76b) implies that the truck was full but not that all of the hay was loaded.

Thus one can visualise (3.76a) by the diagram on the left and (3.76b) by the one on the right in Figure 3.4. The curve represents the loading process, which is further conceived of as being mapped to time, it maps the loaded part of the hay to the filled part of the body of the lorry.

Of course, although each sentence requires only the argument which delimits the process to be...
totally affected, neither explicitly precludes the other argument from being totally affected as well; in that case the curve would run to the upper right corner of the rectangle.) One should note the similarity between the diagrams for (3.75a) and (3.70b), on one hand, and the ones for (3.75b) and (3.73), on the other.

Figure 3.4: A pair of hay-lorry diagrams.

Poley & Van Valin continue:

This is a clear correlation between the occurrence of an argument as undergoer and a reading of total affectedness. This relates directly to the close link between undergoer and patient, since patients are arguments which suffer a change of state and are therefore thoroughly affected by the action of the verb, and since patients are prototypical undergoers. Affectedness is part of the inherent semantics of undergoer, and arguments other than patients occurring as an undergoer acquire this semantic flavouring in addition to the meaning of their own semantic relation.

Before we consider the treatment of these sentences in the present theory, let us look at two less complex examples, (3.77a) and (3.77b), which only differ from (3.75a) and (3.75b) in that the quantity of hay is not specified. The two are illustrated by the open-ended diagrams in Figure 3.5.

(3.77) a. Bill loaded hay on the truck.
   b. Bill loaded the truck with hay.

Figure 3.5: Two open-ended hay-lorry diagrams.

Since the theme, an indefinite mass term, is not quantised, the question of its referent being totally affected does not arise. In (3.77a) the location is not totally affected either; the sentence expresses an energia rather than a kinesia, which means that a proper plural predicate is applied to a sum of moments, as in (3.71) and (3.72). In each of those moments Bill loads an atomic amount \( i \) of hay into an atomic location (a point) \( k \) in the body of the lorry.

The verb load is translated as the predicate \( L^{(\cdot,\cdot,\cdot,\cdot,\cdot)}(\cdot, \cdot, \cdot, \cdot, \cdot) \). ‘Hay’ stands for be hay and \( l \) for the lorry (i.e., ‘the lorry’), and \( h \) and \( l \) are the total amount of hay and the part of the volume of the lorry which actually take part in the event, in the same way as \( w \) in (3.70a) was the total amount of wine.

(3.78) \[
\begin{align*}
\forall h, l, b, t & \rightarrow \exists (h, l, b) \land L^{(\cdot,\cdot,\cdot,\cdot,\cdot)}(\cdot, \cdot, \cdot, \cdot, \cdot)(t) \\
& \rightarrow \exists h, l, b \land (h, l, b) \land L^{(\cdot,\cdot,\cdot,\cdot,\cdot)}(\cdot, \cdot, \cdot, \cdot, \cdot)(t)
\end{align*}
\]

The predicate \( L_{h,l,b} \) is the outcome of the composition of \( l \) with the singular counterpart of the predicate translating the theme, the location, which is ground to points in accordance with the expected type, and the agent, which does not take part in the distribution, since its type matches the expected one from the outset.

(3.79) \[
L_{h,l,b} = (\forall h, l, b, t \rightarrow L^{(\cdot,\cdot,\cdot,\cdot,\cdot)}(\cdot, \cdot, \cdot, \cdot, \cdot)(t))
\]

The hay-lorry (that is, space-space) diagram for this example is as similar to the space-time diagram for (3.70a) as the formal representation in (3.78) is to the one in (3.72), and indeed one could think of (3.70a) as describing a process of ‘loading’ wine-drinking on time, intuitively parallel to loading hay on a lorry.

In (3.77b) the location is totally affected. The predicate is composed with the theme and pluralised with respect to the termset of the run time and the location,

(3.80) load with hay: \( (T^{(\cdot,\cdot,\cdot,\cdot,\cdot)} h, l, b, t) \rightarrow \exists h, l, b \land L^{(\cdot,\cdot,\cdot,\cdot,\cdot)}(\cdot, \cdot, \cdot, \cdot, \cdot)(t) \)

whose filler consequently is totally affected in the course of the event. Each location \( k \) in the lorry is mapped to a time \( t \) in which Bill loads an amount \( i \) of hay into \( k \), and the group of those times is the total run time, just as the group of the locations is the volume of the body of the lorry.

(3.81) \[
\begin{align*}
(T^{(\cdot,\cdot,\cdot,\cdot,\cdot)} h, l, b, t) & \rightarrow \forall h, l, b, t \rightarrow L^{(\cdot,\cdot,\cdot,\cdot,\cdot)}(\cdot, \cdot, \cdot, \cdot, \cdot)(t)
\end{align*}
\]

The hay-lorry diagram for this example matches exactly the space-time diagram constructed for example (3.73) (Figure 3.3), and the intuitive parallel between the loading of a lorry with hay and the filling of half an hour with wine-drinking has an analogy in the evident similarity between (3.74) and the left hand of (3.81).

Let us now return to (3.76), starting with (3.76b). It differs from (3.77b) in that the atomic entities loaded are not simply hay atoms, but atoms of the hay, selected by the predicate \( T_{h,l} \), where \( h = \{h, l\} \) stands for the hay, rather than \( h \). The predicate thus assumes the form in (3.82) or (3.83).

(3.82) load with hay: \( (T^{(\cdot,\cdot,\cdot,\cdot,\cdot)} h, l, b, t) \rightarrow \exists h, l, b \land L^{(\cdot,\cdot,\cdot,\cdot,\cdot)}(\cdot, \cdot, \cdot, \cdot, \cdot)(t) \)

The same reasoning can be applied to (3.75a), where the predicate assumes the form in (3.83) after being composed with the potential undergoer which does not become an actual one.
3.4 Graduability and Degree of Affectedness

\[(\mathcal{L}_{\text{Grad}} \cdot \mathcal{H}_{\text{Aff}})^{(\alpha, \beta, i, 1)}(\xi, \theta, \lambda, \alpha, \beta, i, 1)\]

Can we find a pair of sentences which are to (3.75) as (3.70a) and (3.73) are to (3.77), that is, of examples with a quantised 'filler' and a temporal 'container', which only differs in the presence or absence of a duration adverbial? The answer to this question is affirmative. Compare (3.75) to (3.84).

![Diagram of space-time for reading a book](image)

**Figure 3.6**: Space-time diagrams for reading a book.

3.5 Graduability and Mode of Action

In the previous section we saw how a quantised argument bearing a gradual thematic role may be prevented from being totally affected by the presence of another argument which can set a terminal point for the event: in (3.78a) the truck is not totally affected by the hay is, while in (3.75b) the opposite is the case. In many languages (such as Bulgarian, from which the examples in this section are drawn) the phenomenon observed in (3.75) is more pervasive than it is in English, and a quantised argument can be partially affected even though none of the referents of the other non-verbal constituents can act as a measure of felicity.

Let us contrast the English sentences (3.70a) and (3.54) with the Bulgarian sentences in (3.87).

Note that examples (3.87a) and (3.87c) replicate examples (2.75b) and (2.75c), and that the definite article in (3.87c-3.87d) is obligatory.

\[(\mathcal{L}_{\text{Grad}} \cdot \mathcal{H}_{\text{Aff}})^{(\alpha, \beta, i, 1)}(\xi, \theta, \lambda, \alpha, \beta, i, 1)\]

where the reading process either 'loads' the book on time or 'loads' three hours with the book, so that the book ends up being totally affected in (3.84a) and partially affected in (3.84b).

It was mentioned in Chapter 2 that read the book, along with play the sonata and climb Ben Nevis, belongs to a class of verbal expressions which behave as either kinesis or energency depending on the presence of a duration adverbial. Here we see that in (3.84b) the theme the book, like the hay in (3.75b), is ground to \(\gamma\) by and composed with the translation of read, the predicate \(\mathcal{R}^{(\alpha, \beta, i, 1)}(\xi, \theta, \lambda, \alpha, \beta, i, 1)\). This is not possible for the patient drunk, which must be included in a termset with the run time and act as the argument which sets the terminal point for the event.

\[(\mathcal{L}_{\text{Grad}} \cdot \mathcal{H}_{\text{Aff}})^{(\alpha, \beta, i, 1)}(\xi, \theta, \lambda, \alpha, \beta, i, 1)\]

So the English verb drunk is correctly translated as \(\mathcal{D}^{(\alpha, \beta, i, 1)}(\xi, \theta, \lambda, \alpha, \beta, i, 1)\), and this still rules in (3.70), (3.73) and (3.54) while ruling out (3.85b) as desired, though it is not necessarily the case for the counterparts of drunk in other languages.

To summarise what was said and demonstrated so far, the quantised argument \(x\) whose type is higher than the one expected (and whose thematic role consequently is a gradual one)

\[(\mathcal{L}_{\text{Grad}} \cdot \mathcal{H}_{\text{Aff}})^{(\alpha, \beta, i, 1)}(\xi, \theta, \lambda, \alpha, \beta, i, 1)\]

is partially affected if it is empty and directly composed with the predicate which translates the verbal expression, following (3.56), but with \(\delta = \gamma\); 1.

is totally affected if it is included into a termset with the run time, following (3.50) and with \(\delta = \gamma\).

3.7 A space–time diagram for a potentially bounded event.

\[(\mathcal{L}_{\text{Grad}} \cdot \mathcal{H}_{\text{Aff}})^{(\alpha, \beta, i, 1)}(\xi, \theta, \lambda, \alpha, \beta, i, 1)\]

the atomic entities consumed are not simply wove atoms, but atoms of the wove. Unlike the
situation in the English example (3.54), here it does not necessarily follow that a drinking moment is stated to exist for every one of them, that would make the eventuality quantised, conflicting with the aspect of the verb.

\[(90)\]
\[D_{w,1}^v = \left\{ (\mathbf{n}^v h_{w,1}^v)^{h_{w,1}^v} \mathbf{a} \right\} \mathbf{a} \mathbf{t}_{w,1}^v \mathbf{t} \mathbf{i} \]

\[(91)\]
\[\theta_{w,1}^v (t) \leftrightarrow \left( \lambda \mathbf{h} \mathbf{h}_{w,1}^v (t) \wedge \mathbf{a} \mathbf{t}_{w,1}^v \mathbf{t} \mathbf{i} \right) (t) \]

In example (3.87c) the head of the sentence, the perfective verbBg, belongs to the terminative\(^{17}\) mode of action, which expresses the carrying out of a process to its natural termination, as opposed to any other way of setting a terminal point to it. The sentence expresses an accomplishment derived from the activity in (3.87b) by adding to it the condition that it be carried out to its natural termination. In other words, the interval must be composed of a full set of moments \(v\) for which \(D_{w,1}^v (t)\) is true. Such a set contains a drinking moment for each wine atom.

\[(92)\]
\[\theta_{w,1}^v (t) \wedge \mathbf{a} \mathbf{t}_{w,1}^v (t) \rightarrow \forall t \left( \mathbf{a} \mathbf{t}_{w,1}^v (t) \rightarrow \exists \mathbf{t} (t \in \mathbf{a} \mathbf{t}_{w,1}^v (t) \wedge \mathbf{a} \mathbf{t}_{w,1}^v (t) \mathbf{i}) \right) \]

Since \(D_{w,1} = \lambda \mathbf{h} \mathbf{h}_{w,1} (t) \wedge \mathbf{a} \mathbf{t}_{w,1}^v (t)\), this formula is equivalent to (3.55), but the two differ in their derivation.

In example (3.87d) the head of the sentence, the imperfective verbBg, is obtained from the perfective verb in example (3.87c) by secondary imperfectivisation and also belongs to the terminative mode of action. The eventuality which the sentence expresses is an activity, as in (3.87a), but this activity is derived from the accomplishment in (3.87c) by gridding, so that its run time is stated to be composed of moments belonging to an actual or hypothetical interval in which the accomplishment occurs.

\[(93)\]
\[\exists t \left( \mathbf{a} \mathbf{t}_{w,1}^v (t) \wedge \mathbf{a} \mathbf{t}_{w,1}^v (t) \mathbf{i} \right) \]

The same conversion process is undergone by the English sentence (3.54) under progressivisation. It is compatible with the inclusion of the patient in a termset with the run time, which is obligatory in English, though not in Bulgarian.

The terminative mode of action refers to the natural termination of a process, which may be determined by the spanning of the full extent of a totally affected gradual argument. As such it is to be contrasted with the alternative mode of action,

\[(94)\]
\[a. \quad \text{P\\(\text{common}\)}
\[\text{drank (ATTH):} P \rightarrow V / A / O \rightarrow 150 \quad \text{wine}
\]['I drank some wine.'\]

b. \(\text{P\\(\text{organic}\)}
\[\text{drank (ATTH):} P \rightarrow V / A / O \rightarrow 150 \quad \text{glass wine}
\]['I drank a glass of wine (which is not a large amount).'\]

which characterises the amount of the process, and the referent of any gradually affected argument, as being small, though it is not required to be specified any further. Unlike all cases considered in Section 3.4, here the amount of the affected entity is set by the verb.

The relation between the alternative and the terminative mode of action is similar to the one between a specific indefinite and a definite term, as confirmed also by the use of the overt quantifier `some' in the English translation of (3.94a).

\(^{17}\)The term used by Maier 1966, from where the terminology in this section is generally drawn, is general resultative. I reserve it because of the possible clash with the term resultative, which refers to a particular kind of consequent state or one of a variety of corresponding categories existing in many natural languages.

3.5. Graduality and Mode of Action

Taken as a couple, these two modes of action are opposed to other couples in which the amount of the process is estimated in other ways. I shall mention two such couples briefly.

In examples (3.96–3.98) the process is measured by the time filled by it. The two modes of action which are distinguished here, namely the `specific indefinite' definitive (for a while); or for a brief time as explicitly indicated by an adverbial) and the `definite' transductive (throughout the duration of the object, which must be specified except in a few idiomatic cases), are essentially temporal counterparts of the attenuative and the terminative mode of action, since they use time rather than matter (or space) as a measure of telicity.

\[(95)\]
\[\text{Pospax: (polovin časa)}
\[\text{sleep (ELMT):} P \rightarrow V / A / O \rightarrow 150 \quad \text{half hour}
\]['I slept for a while/for half an hour.'\]

\[(96)\]
\[a. \quad \text{Prespax:}
\[\text{sleep (ELMT):} P \rightarrow V / A / O \rightarrow 150 \quad \text{half an hour}
\]['I slept for a while/for half an hour.'\]

b. \(\text{Prespax:}
\[\text{films:}
\[\text{sleep (ELMT):} P \rightarrow V / A / O \rightarrow 150 \quad \text{the film}
\]['I slept through the film.'\]

In (3.97–3.98) the process is presented as being resumed from an intermediate stage rather than initiated. (The implied preceding stage of the process is represented by the dotted curve in the diagrams in Figure 3.8.) The completive and the definitive mode of action, which are not always distinguished lexically, differ in that the former merely adds a further amount of the process to that stage, whereas the latter carries it to its natural termination, which may be determined by the full spanning of a gradual argument.

\[(97)\]
\[\text{Doljan: (malo) vino (v čaša)}
\[\text{pour (IMPL):} P \rightarrow V / A / O \rightarrow 150 \quad \text{a little wine in the glass}
\]['I poured some more wine (into the glass).'

\[(98)\]
\[a. \quad \text{Doljan:}
\[\text{vino (v čaša)}
\[\text{pour (IMPL):} P \rightarrow V / A / O \rightarrow 150 \quad \text{the wine in the glass}
\]['I poured the rest of the wine (into the glass).'

b. \(\text{Doljan:}
\[\text{čaša (v vino)}
\[\text{pour (IMPL):} P \rightarrow V / A / O \rightarrow 150 \quad \text{the glass with wine}
\]['I filled up the glass (with wine).'

Figure 3.8: The definitive mode of action in wine-glass diagrams.
3.6. Summary

To summarize, this brief survey of some modes of action shows that the degree of affectedness of a gradual argument depends both on its being introduced by a cumulative or a quantised expression and on the mode of action of the verb, as shown in Table 3.1. The elegant generalizations obtained as a result of the treatment of time as a gradual argument in all cases support the idea of including the run time into the argument frame of the predicate as a bearer of a special thematic role.

<table>
<thead>
<tr>
<th>mode of action</th>
<th>evolutive</th>
<th>‘specific indefinite’</th>
<th>‘definite’</th>
</tr>
</thead>
<tbody>
<tr>
<td>cumulative expression</td>
<td>never quantised</td>
<td>quantised by the verb</td>
<td>—</td>
</tr>
<tr>
<td>quantised expression</td>
<td>partially affected</td>
<td>totally affected</td>
<td>—</td>
</tr>
</tbody>
</table>

Table 3.1. The degree of affectedness of a gradual argument

3.6 Summary

The purpose of this chapter was to develop an account of the formation of the aspectuality of the clause on the basis of the aspectual properties of the non-verbal constituents and the lexical properties of the verb. I argued that aspectual composition is a process of direct transfer of aspectual properties, in other words, instead of assuming that in examples (3.1), (3.3a) and (3.5a) the aspectual class of the eventuality is affected in some way by the number and the quantification of the object, while remaining an inherently different category (as in the left-hand table in Figure 3.9), I contend that the eventuality has the same reference type as the object, modulo a constant offset determined by the definition of the predicate (as in the right-hand table). This is only possible because aspectuality is not one thing in the spatial and another in the temporal domain, it is a single category, and the individual ‘nominal’ and ‘verbal’ categories, which I examined, are its manifestations.

This view is the basis of the treatment of the run time as one of the arguments of the predicate, represented in its type signature, possibly present in its identification sets and available for inclusion in terms sets along with the ‘spatial’ arguments. Some additional benefits of this treatment, of descriptive nature, were discussed in the course of my survey of Bulgarian modes of action.

The identification sets of a predicate may enforce or inhibit the coordination of the reference types of two or more arguments, brought about by forming a termset of the arguments. Aspectual composition, then, amounts to the coordination of reference where one of the arguments happens to be the run time.

<table>
<thead>
<tr>
<th>example</th>
<th>class</th>
<th>example</th>
<th>type</th>
</tr>
</thead>
<tbody>
<tr>
<td>(3.1)</td>
<td>object</td>
<td>(3.1)</td>
<td>object</td>
</tr>
<tr>
<td>(3.2a)</td>
<td>singular</td>
<td>(3.2a)</td>
<td>singular</td>
</tr>
<tr>
<td>(3.3a)</td>
<td>bare plural</td>
<td>(3.3a)</td>
<td>bare plural</td>
</tr>
<tr>
<td></td>
<td>activity</td>
<td></td>
<td>activity</td>
</tr>
<tr>
<td></td>
<td>accomplishment</td>
<td></td>
<td>accomplishment</td>
</tr>
</tbody>
</table>

Figure 3.9: Two views on aspectual composition.

Conclusion

Review of the Thesis

The purpose of this work was the development of a theory of aspectuality as a generic category, based on the theory of plurality of Landman 1989 and the theory of properties of thematic relations of Krifka 1991. Let me state once again, in what I hope is an observable form, the main characteristics and premises of the account presented here.

- Two kinds of compound entities, sums and groups, are distinguished in both the spatial and the temporal domain, and operations which convert one into the other (summation, group formation and ungrouping) are defined.
- Predicates can be subjected to ordinary or proper pluralisation relative to a single argument or a termset of two or more arguments. As a rule, collective predication is brought about by the application of singular (quantised) predicates to groups, while distributive predication is brought about by the application of plural (cumulative) predicates to sums.
- A type, corresponding to the level of grouping, is assigned to each term and to each argument position of every predicate. A predicate can be applied directly to an argument of the type for which it is defined. If the argument belongs to a higher type, the predicate is lifted relative to the relevant argument position, which results in the lowering of the type of the term.
- An entity of the lowest type in the system is an atom, a point in space or time, and the operation of atomisation of predicates selects the atomic entities enclosed within members of the extension of a given predicate. Both mass terms and atelic eventualities (states and processes) are treated formally as plurals.

The concepts mentioned so far are formal counterparts of a number of nominal and verbal aspectual categories recognised in natural languages. Those categories include classes of expressions or entities (at a linguistic or an ontological level, respectively) as well as explicit or implicit processes of conversion between them. The correspondence between the formal concepts and their manifestations is summarised in Tables 1.1 and 2.5.

- The run time is included as a special thematic role in the argument frame of a predicate which translates a verbal expression, and in the signature of the predicate it is assigned a type, which reflects the aspectual class of the expression.
- A predicate is characterised by one or more identification sets, which constitute a generalisation of the feature uniqueness of events (Krifka 1991). An identification set consists of thematic roles whose fillers are jointly sufficient to identify the eventuality.
• Finally, aspectual composition, which is regarded as a process of coordination of reference, is a direct effect of the need for the types of the arguments, one of which is the run time, to meet the requirements imposed by the type signature and the identification sets of the predicate.

Directions for Future Work

In the interest of compatibility, the present theory does not make any definite assumptions about the general semantic framework in conjunction with which it is used. The implications of its incorporation into the major current semantic frameworks and its interaction with their premises should be addressed in detail in future research.

The ease of such incorporation depends on the modularity of the host framework and on the concepts and tools already provided by it for handling the kind of phenomena for which this theory is designed. For example, the interpretation of plurals adopted in Discourse Representation Theory (DRT) in its classical form (Kamp & Reyle 1993) is based on Link 1983's lattice-theoretic account, whose fundamental premises are shared by Landman 1989's set-theoretic account and hence also lie in the heart of the account presented here. For this reason the application of this theory for the treatment of plural and collective terms in DRT should be relatively straightforward; it would amount to little more than the following:

• assigning a type as well as a number (singular or plural) to each discourse referent;

• reformulating the two operations of DRT which form plural terms, summation (x ⊕ y) and abstraction (Dw:x), in terms of group formation;

• revising the language-sensitive rules governing the choice of singular or pluralaphones, taking into consideration the type as well as the number of the discourse referent.

On the other hand, the use of plurality for the treatment of mass terms and of diathetic eventualities has no counterpart in classical DRT, nor does the treatment of aspectual composition proposed here, and their introduction would require a lesser or greater amount of adjustment. Similar considerations apply in the case of any other general semantic framework.

It should be restated here that this theory is concerned with aspectuality as determined by the contour of the areas occupied by the elements which belong to the denotation of a predicate defined in a given spatial or temporal universe, in other words, by the type of nominal or temporal reference of the predicate. This means that the interpretation of some aspectual distinctions is left largely or entirely to the host framework. Among those are, for example, the distinction between states and events, which is less than fully captured by Taylor 1977’s postulates, and the distinctions between achievements and points and between progressive, habitual and generic states, for which the postulates do not account at all.

There are many other issues which I did not discuss here, but which I consider eminently worthy of being pursued in subsequent research. Among them I would mention the following:

• The details of the mechanism which govern the conversion of nominal and verbal aspectual classes in each language. Some problems with the employing of the network in Figure 2.3 for analysing English aspectual phenomena were pointed out at the end of Section 2.3. For the most part they involve edges whose transition may or may not be possible depending on the entire derivation. It may be possible to inhibit certain conversions by assigning a weight to every arc and a cost to every path in the transalional networks and setting a limit for the maximal permissible cost of each derivation. A more traditional strategy would involve introducing one or more other aspectual categories in addition to the system of types.

• The interface to syntax. By eschewing this question here I was able to avoid committing myself to any particular syntactic framework, which was expedient in particular in view of the cross-linguistic character of this study. This does not mean that I would dispute the relevance of the details of the conversion of linguistic expressions which bear aspectual meaning into formal representations. Of particular interest here are a number of issues related to determining the scope of aspectually relevant constituents and the order of their inclusion into the formalisations.

• The interaction between aspect and tense. These two categories are inherently different, since tense deals with linear order and aspect with type of reference in the temporal domain. Yet they are by no means orthogonal, since the expression of tense in natural languages tends to be highly correlated with the expression of aspect: aspectual distinctions which are made in some tenses may be neutralised in others (cf. in Bulgarian the opposition 'acting imperfect', which has no counterpart in the non-past tenses), and some categories may undergo a change of status (cf. the gradual 'temporalisation' of the perfect in many languages, a process in the course of which an aspectual category expressing the conversion of an event into a consequent state is transformed into a past tense).

• The applicability of the theory for the design of implementable grammars for handling aspectual phenomena in natural language processing and generation.

Finally, I devoted separate sections of this work to plurality in Arabic and to aspectuality in Bulgarian and Chinese, and throughout the rest of the discussion I drew support for the theory from these and a wide variety of other languages. Thus, I hope, has gone some way towards confirming the cross-linguistic relevance of the theory. However, the choice of languages was to some extent arbitrary, and the selection was not intended to be typologically exhaustive or even representative. In a further study the range of languages surveyed could be extended, with the purpose of obtaining and formulating (in the form of linguistic universals, preferably as considerations on parametric variation) useful generalisations regarding the systems of nominal and verbal aspectuality which exist in natural languages.
### Language Index

**Arabic** (Afro-Asiatic, Semitic, West, Central, Arabo-Canaanite)
- Cairene, 31
- Classical, 28–32
- Syrian, 29, 31

**Basque** (language isolate) 25, 27

**Bulgarian** (Indo-Hittite, Indo-European, Balto-Slavic, Slavic, South, East) 42, 43, 56–63, 91–93

**Chukchi** (Chukchi-Kamchatkan, Northern, Chukchi) 23, 24

**Danish** (Indo-Hittite, Indo-European, Germanic, North, East) 15

**Egyptian** (Afro-Asiatic, Ancient Egyptian) 15, 24

**English** (Indo-Hittite, Indo-European, Germanic, West, North Sea)
  - Australian Aboriginal, 26
  - Dorset dialect, 15
  - Hawaiian Pidgin, 26
  - Eskimo (Eskimo-Aleut, Eskimo) 24

**French** (Indo-Hittite, Indo-European,Italic, Latino-Paleo, Romance, Continental, Western, Gallo-Ibero-Romance, Gallo-Romance, North) 63

**Gaelic** (Indo-Hittite, Indo-European, Celtic, Insular, Goidelic) 49

**Georgian** (Caucasian, South) 43, 46, 49, 52

**German** (Indo-Hittite, Indo-European, Germanic, West, Continental, East) 1, 24

**Guridji** (Australian, Pama-Nyungan, South-West, Ngumbin) 26

**Italian** (Indo-Hittite, Indo-European, Italic, Latino-Paleo, Romance, Continental, Western, Italo-Romance) 63

**Japanese** (Altaic, Korean-Japanese, Japanese-Ryukyuan) 26, 45, 50

**Kanak** (Amerind, Northern A., Almoos-Keresienan, Almoosan, Moosan, Salish, S. Proper, Interior, Southern) 26

**Ladino** (Iberian, Romanesque, Sephardic, Spanish) 50–52

**Maltese** (Afro-Asiatic, Semitic, West, Central, Arabo-Canaanite) 28, 30

**Mandarin** (Sino-Tibetan, Sinitic, Chinese, Mandarin-Yue) 43, 50, 52, 63–70

**Quileute** (Amerind, Northern A., Almoos-Keresienan, Almoosan, Moosan, Chimakuan) 51

**Russian** (Indo-Hittite, Indo-European, Balto-Slavic, Slavic, East, North) 21, 34, 44–45, 56

**Sierra Popoluca** (Amerind, Northern, Penutian, Mexican, Mixe-Zoque) 25

**Straits Salish** (Amerind, Northern A., Almoos-Keresienan, Almoosan, Moosan, Salish, S. Proper, Coast, Central) 51

**Turkish** (Altaic, A. Proper, Turkic, Common T., Southern) 26, 49

**Welsh** (Indo-Hittite, Indo-European, Celtic, Insular, Brythonic) 20, 22–24

**Winnebago** (Amerind, Northern A., Almoos-Keresienan, Keresienan, Siouan-Yuchi, Siouan, S. Proper, Mississippi Valley, Chiwere-Winnebago) 25
References


Howell, Mortimer S (1900). A grammar of the classical Arabic language : tr. and comp. from the works of the most approved native or naturalized authorities. Allahabad: Printed at the North-Western Provinces and Oudh Government Press.


